

NTPC LIMITED

3x800 MW PATRATU STP

TECHNICAL SPECIFICATION


FOR

AGITATORS OF FGD SLURRY TANKS

SPECIFICATION NO.: PE-TS-434-571-18000-A003



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PROJECT ENGINEERING INSTITUTE BUILDING
SECTOR-16A, PLOT NO.-25, NOIDA, INDIA**

	3x800 MW PATRATU TPS	SPECIFICATION No: PE-TS-434-571- 18000-A003	
	AGITATORS OF FGD SLURRY TANKS TECHNICAL SPECIFICATION	SECTION	
		REV. 00	
		SHEET :	

CONTENTS**SECTION - I**

SUB- SECTIONS	TITLE	Page No.
Sub-Section-A	INTENT OF SPECIFICATION	3
Sub-Section-B	PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA	7
Sub-Section-C	TECHNICAL SPECIFICATIONS	
Sub Section-C1	SPECIFIC TECHNICAL REQUIREMENT– MECHANICAL	32
Sub Section-C2	CUSTOMER SPECIFICATION	
C2 - A	TECHNICAL REQUIREMENT	58
C2 - B	PROJECT SPECIFIC GENERAL REQUIREMENTS INCLUDING:	
	GENERAL TECHNICAL REQUIREMENT	62
	QUALITY ASSURANCE	139
	FUNCTIONAL GUARANTEES	150
C2 - C	PAINTING SPECIFICATION	179
Sub Section-C3	TECHNICAL SPECIFICATION (ELECTRICAL PORTION)	218
Sub Section-D	ANNEXURE-I LIST OF MAKES OF SUB-VENDOR ITEMS	255
	ANNEXURE-II MANDATORY SPARE LIST	265
	ANNEXURE-III INPUT DRAWINGS (GAD OF TANKS)	269
	ANNEXURE-IV MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	278
	ANNEXURE-V SEA-WORTHY PACKING	283

SECTION – II

SUB SECTIONS	TITLE	Page No.
Annexure-1	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	295
Annexure-2	COMPLIANCE CUM CONFIRMATION CERTIFICATE	296
Annexure-3	PRE BID CLARIFICATION SCHEDULE	298
Annexure-4	DEVIATION SHEET (COST OF WITHDRAWAL)	299
Annexure-5	ELECTRICAL LOAD DATA	300
Annexure-6	LIST OF MAKES OF SUB VENDOR ITEMS	301
Annexure-7	LIST OF TOOLS & TACKLES	302
Annexure-8	AGITATOR SCHEDULE	303
Annexure-9	LIST OF COMMISSIONING SPARES	305
Annexure-10	ATTACHMENT-3K	306
Annexure-11	GUARANTEED POWER CONSUMPTION FORMAT	331



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATIONS FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-A

REV. 00

DATE: DEC 2021


SHEET : 1 OF 1

INTENT OF SPECIFICATION

	TITLE:	SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE		
	TECHNICAL SPECIFICATIONS FOR		
	AGITATORS OF FGD SLURRY TANKS		
	REV. 00	DATE: DEC 2021	
	SHEET : 1 OF 3		

1.0 SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION

- 1.1 The specification covers Supply part, Services part and Mandatory spares comprising of design (i.e. Preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles, fill of lubricants & consumables till handing over, mandatory spares along with spares for erection, start-up and commissioning, forwarding, proper packing, shipment and delivery at site, assembly AND services part covers supervision services for erection & commissioning, trial run at site and carrying out Performance guarantee tests at site, training of customer/ client O&M staff covering all aspects of the Agitator including Operation & Maintenance, Troubleshooting etc., training of customer at manufacturer's works & handover in flawless condition of the package to the customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order for Flue Gas Desulphurization (FGD) plant of 3x800 MW Patratu TPS, Ramgarh, Jharkhand of M/s Patratu Vidyut Utpadan Nigam Limited (PVUNL), a Joint Venture amongst Govt. of Jharkhand, JUVNL, JBVNL and NTPC Ltd. The following points may be noted.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of **Agitators**.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation.
- 1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments

	TITLE: PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-434-571-18000-A003	
		SECTION-I, SUB-SECTION-A	
		REV. 00	DATE: DEC 2021
		SHEET : 2 OF 3	
<p>referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.</p> <p>1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.</p> <p>1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Section -III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/it's customer.</p> <p>1.9 In the event of any conflict between the requirements of two clauses of this specification & requirements of different codes/standards and between respective clauses of sub-section C & sub-section D, more stringent clause as per the interpretation of the owner shall apply.</p> <p>1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.</p> <p>1.11 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.</p> <p>1.12 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.</p> <p>1.13 Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.</p> <p>1.14 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.</p>			

	TITLE: PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-434-571-18000-A003	
		SECTION-I, SUB-SECTION-A	
		REV. 00	DATE: DEC 2021
		SHEET : 3 OF 3	

- 1.15 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-B

REV. 00

DATE: DEC 2021

SHEET : 1 OF 1

**PROJECT INFORMATION WITH WIND AND
SEISMIC DESIGN CRITERIA**





SUB-SECTION-I-B


PROJECT INFORMATION


**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.	PROJECT INFORMATION																	
<p>1.00.00</p> <p>2.00.00</p> <p>3.00.00</p> <p>4.00.00</p> <p>4.01.00</p> <p>4.02.00</p> <p>4.03.00</p>	<p style="text-align: center;">PATRATU STPS EXPANSION PHASE-I (3X800 MW)</p> <p>BACKGROUND</p> <p>A Memorandum of Agreement (MOA) has been entered on 29.07.2015 amongst Govt. of Jharkhand (GoJ), Jharkhand Urja Vikash Nigam Limited (JUVNL), Jharkhand UrjaUtpadan Nigam Limited (JUUNL), Jharkhand BijliVitaran Nigam Limited (JBVNL) and NTPC Limited to form a Joint Venture Company of NTPC Limited & JBVNL for transfer of Patratu Thermal Power Station (PTPS) located in Ramgarh District of Jharkhand State to the proposed JV Company for Performance Improvement of existing capacity & 4000 MW Capacity expansion of PTPS.</p> <p>Further to signing of JV agreement on 29.07.2015, a Joint Venture Company namely Patratu Vidyut Utpadan Nigam Limited (PVUNL) has been incorporated amongst GoJ, JUVNL, JBVNL and NTPC Ltd. on 15.10.2015. The Performance Improvement of existing capacity and 4000 MW Capacity expansion of Patratu STPS will be implemented by the JV Company (JVC). The configuration of expansion of 4000 MW shall consist of 5 units of 800 MW to be implemented in two phases; Phase-I: 3x800 MW and Phase-II: 2x800 MW.</p> <p>The present proposal is for Patratu STPS Phase-I (3x800 MW). The project is envisaged to be commissioned during XIII Plan period.</p> <p>CAPACITY</p> <p>Patratu STPS Phase-I: 3x800 MW - Present proposal</p> <p>MODE OF OPERATION</p> <p>Base Load</p> <p>LOCATION AND APPROACH</p> <p>Patratu Thermal Power station (PTPS) is located just outside the coal belt of South Karanpura in Ramgarh District of Jharkhand State. The nearest Railway Station is Patratu which is at a distance of about 4 km on Barkakhana-Barwadih Railway line.</p> <p>The latitudes and longitudes of the site are as follows:</p> <table border="1"> <thead> <tr> <th>Corner name</th> <th>Latitude</th> <th>Longitude</th> </tr> </thead> <tbody> <tr> <td>Top Corner</td> <td>23° 38 ' 60'' N</td> <td>85° 17' 51.5" E</td> </tr> <tr> <td>Bottom Corner</td> <td>23° 38 ' 12.5'' N</td> <td>85° 17' 27" E</td> </tr> <tr> <td>Left Corner</td> <td>23° 38 ' 22.5'' N</td> <td>85° 17' 10.6'' E</td> </tr> <tr> <td>Right Corner</td> <td>23° 38 ' 40'' N</td> <td>85° 17' 57'' E</td> </tr> </tbody> </table> <p>Airport</p> <p>The nearest commercial airport is Ranchi at about 45 km by road.</p>	Corner name	Latitude	Longitude	Top Corner	23° 38 ' 60'' N	85° 17' 51.5" E	Bottom Corner	23° 38 ' 12.5'' N	85° 17' 27" E	Left Corner	23° 38 ' 22.5'' N	85° 17' 10.6'' E	Right Corner	23° 38 ' 40'' N	85° 17' 57'' E		
Corner name	Latitude	Longitude																
Top Corner	23° 38 ' 60'' N	85° 17' 51.5" E																
Bottom Corner	23° 38 ' 12.5'' N	85° 17' 27" E																
Left Corner	23° 38 ' 22.5'' N	85° 17' 10.6'' E																
Right Corner	23° 38 ' 40'' N	85° 17' 57'' E																
<p style="text-align: center;">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p style="text-align: center;">SUB-SECTION-IB PROJECT INFORMATION</p>	<p style="text-align: center;">PAGE 1 OF 15</p>															


CLAUSE NO.	PROJECT INFORMATION			
<p>5.00.00</p> <p>LAND</p> <p>6.00.00</p> <p>WATER</p>	<p>A copy of Vicinity plan of the project site is placed at Annexure - I.</p> <p>The total land to be transferred to JV Company is 1859 acres. Out of 1859 acre, about 1234 acres of land has been envisaged for Plant, Ash pond and Land on railway track of the for Phase-I (3x800 MW). The balance 625 acre of land shall be transferred during commencement of Phase-II (2x800 MW).</p> <p>The make-up water for PSTPS is to be met from Patratu Dam on Nalkari River (capacity 99 MCM i.e. 110 Cusecs). About 52.34 Cusecs of water will be available at 90% dependable monsoon flow after considering evaporation loss.</p> <p>GoJ/JUVNL owns and controls water of Patratu Dam. GoJ/JUUNL supplies water to PTPS and to the other entities in the vicinity from this water reservoir. JUVNL had entered into agreements with these other entities for supply of water from water reservoir. JUVNL shall revisit these agreements to meet the requirement of water for expansion projects, if required.</p> <p>Make up water requirement of PSTPS, Phase-I (3x800 MW) would be about 27 Cusecs with "Air Cooled Condenser" based power plant. GoJ shall provide the required water from the existing reservoir to the JV Company.</p> <p>The JVC shall be responsible for the water supply arrangement starting at the downstream of intake chamber from where water supply commences for the Station. Ownership of the entire water supply system and related plant and equipment, including the water treatment plant, shall be that of the JVC and after the asset transfer, the JVC shall maintain, take care and use the same. The additional facility including addition of plant, equipment etc. for enhanced requirement (if any) and drawl of water shall be the responsibility of JVC and to be arranged by the JVC at their own cost.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p>SUB-SECTION-IB PROJECT INFORMATION</p>	<p>PAGE 2 OF 15</p>	


CLAUSE NO.	PROJECT INFORMATION		
<p>7.00.00 7.01.00 7.02.00 7.03.00 7.04.00</p>	<p>COAL</p> <p>Coal Requirement, Availability and Linkage</p> <p>About 12 MTPA of coal will be required to meet coal requirement of the Phase-I (3x800 MW) of the project.</p> <p>The Banhardih captive coal block at a distance of about 155 km from plant is allocated to JUVNL for end use of Patratu expansion. The coal from Banhardih captive coal block shall be transferred to the JVC for the usage of PSTPS with the approval of Ministry of Coal, GOI. MOC (11.09.15) has accorded in-principle approval of the Central Govt. to assign Banhardih Coal Block allocated to JUVNL to the JV Company.</p> <p>Coal Transportation</p> <p>The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways through BOBR / BOX- N wagons.</p> <p>Coal Quality</p> <p>The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in Annexure-IV-2 and imported coal parameters are indicated in Annexure-IV-4 are to be considered for steam generator design.</p> <p>Fuel Oil</p> <p>The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Heavy Fuel Oils having the characteristics given at Annexure-IV-3 and Light Diesel Oil having the characteristics given at Annexure-IV-1.</p>		
8.00.00	NOT USED		
9.00.00	<p>STEAM GENERATOR TECHNOLOGY</p> <p>The steam generators shall be super critical once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.</p>		
10.00.00	<p>FLUE GAS DESULPHURIZATION SYSTEM (FGD) & SCR:</p> <p>The project is envisaged with Flue Gas Desulfurization (FGD) system and SCR meeting Ministry of Environment, Forest & Climate Change notification dated 07.12.2015. Limestone to be used for design of FGD system shall be as per the characteristic given at Annexure-IV-5.</p>		
11.00.00	<p>POWER EVACUATION SYSTEM</p> <p>85% of power from the project is envisaged to be allocated to Jharkhand State subject to approval of Ministry of Power, while balance 15% would be as unallocated portion and Project is envisaged as regional project. Since major power (85%) is proposed to be absorbed by Jharkhand, the issue of Associated Transmission</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p>SUB-SECTION-IB PROJECT INFORMATION</p>	<p>PAGE 3 OF 15</p>

CLAUSE NO.	PROJECT INFORMATION		
	<p>System for the project would be taken up with them for planning and execution of transmission system modalities as Inter-State System or ISTS System.</p> <p>Considering overall capacity of the project as 4000 MW, 765 kV step-up system has been envisaged. Two D/C 765 KV line, one each to New Ranchi (Bero) and Gaya has been envisaged. This would also form part of 765 kV transmission corridor connecting Ranchi to Gaya. These lines can be used to evacuate power to the Eastern Region ISTS as well as to Jharkhand State. In view of above, provision of four nos. of 765 kV outgoing Line bays has been kept in the new 765 kV generation switchyard.</p> <p>The issue of power evacuation of the proposed project shall be taken up with appropriate Transmission Utility (STU or CTU) as per regulatory provision, based on allocation of power.</p>		
12.00.00	<p>METEOROLOGICAL DATA</p> <p>The meteorological data from nearest observatory is placed at Annexure-II.</p>		
13.00.00	<p>PLANT WATER SCHEME</p> <p>The Plant water scheme is described below.</p>		
13.01.00	<p>Equipment Cooling Water (ECW) System (Unit Auxiliaries)</p> <p>The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from ACW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject system etc. shall also be cooled by Demineralized (DM) water in a closed circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.</p>		
13.02.00	<p>Not used</p>		
13.03.00	<p>Other Miscellaneous Water Systems</p> <p>(a) The drinking water requirement of the plant shall be provided from water treatment plant.</p> <p>(b) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from demineralizing plant.</p> <p>(c) The quality of Raw Water & DM Water is enclosed with this sub-section as Annexure-III.</p> <p>(d) Effluent from various areas in TG & SG system shall be collected in respective pits in their areas and pumped to a common terminal point as shown in plant water scheme.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p>SUB-SECTION-IB PROJECT INFORMATION</p>	<p>PAGE 4 OF 15</p>

CLAUSE NO.	PROJECT INFORMATION		
14.00.00	<p>CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</p> <p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section.</p>		
15.00.00	<p>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</p> <p>All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B of this section.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p>SUB-SECTION-IB PROJECT INFORMATION</p>	<p>PAGE 5 OF 15</p>

<p>CLAUSE NO.</p>	<p>PROJECT INFORMATION</p>			
	<p>ANNEXURE-I</p>			
				
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p>SUB-SECTION-IB PROJECT INFORMATION</p>	<p>PAGE 6 OF 15</p>	


CLAUSE NO.	PROJECT INFORMATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
C	अलवापरी सारणी CLIMATOLOGICAL TABLE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	<p>753 ते 1960 पर्यंत के अवर्षा पर अवर्षा BASED ON OBSERVATIONS FROM 1953 TO 1960</p> <p>स्थान: अलवापरी STATION: Alwajhari</p> <p>उचाई: 100 मीटर ALTITUDE: 100 M</p> <p>देशांतर: 75° 30' E LONGITUDE: 75° 30' E</p> <p>रेखांतर: 23° 35' N LATITUDE: 23° 35' N</p> <p>वायु तापमान AIR TEMPERATURE</p> <p>वर्षा RAINFALL</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
<table border="1"> <thead> <tr> <th rowspan="2">MONTH</th> <th colspan="3">DAILY MEAN</th> <th colspan="2">EXTREMES</th> <th colspan="2">HUMIDITY</th> <th colspan="2">CLOUDY</th> <th colspan="2">WIND</th> <th colspan="2">TOTAL</th> <th rowspan="2">DATE</th> </tr> <tr> <th>WTF</th> <th>DAILY MAX</th> <th>DAILY MIN</th> <th>HIGHEST</th> <th>LOWEST</th> <th>RELATIVE HUMIDITY</th> <th>WIND VELOCITY</th> <th>RELATIVE HUMIDITY</th> <th>WIND VELOCITY</th> <th>WIND DIRECTION</th> <th>WIND VELOCITY</th> <th>WIND DIRECTION</th> <th>WIND VELOCITY</th> <th>WIND DIRECTION</th> </tr> <tr> <th></th> <th>mm</th> <th>°C</th> <th>°C</th> <th>°C</th> <th>°C</th> <th>%</th> <th>km/hr</th> <th>%</th> <th>km/hr</th> <th>dir</th> <th>km/hr</th> <th>dir</th> <th>mm</th> <th>dir</th> </tr> </thead> <tbody> <tr><td>JAN</td><td>14.5</td><td>18.5</td><td>34.5</td><td>82</td><td>28.5</td><td>37</td><td>33.1</td><td>31</td><td>1.5</td><td>1978</td><td>1.1</td><td>1978</td><td>58</td><td>11.8</td><td>1.2</td><td>9.8</td><td>0.8</td><td>42.9</td><td>01</td><td>10/66</td></tr> <tr><td>FEB</td><td>10.2</td><td>15.2</td><td>17.6</td><td>16.5</td><td>32.7</td><td>5.5</td><td>37.8</td><td>28</td><td>2.8</td><td>1978</td><td>1.0</td><td>1978</td><td>62</td><td>12.4</td><td>1.0</td><td>9.5</td><td>10.3</td><td>1.2</td><td>94.0</td><td>08</td><td>10/61</td></tr> <tr><td>MAR</td><td>12.5</td><td>16.4</td><td>13.0</td><td>15.1</td><td>32.3</td><td>10.4</td><td>41.1</td><td>29</td><td>7.4</td><td>1979</td><td>1.1</td><td>1979</td><td>50</td><td>14.8</td><td>1.3</td><td>9.4</td><td>11.4</td><td>1.2</td><td>36.4</td><td>00</td><td>31/2</td></tr> <tr><td>APR</td><td>19.5</td><td>17.2</td><td>15.0</td><td>16.1</td><td>32.3</td><td>10.4</td><td>41.1</td><td>29</td><td>7.4</td><td>1979</td><td>1.1</td><td>1979</td><td>50</td><td>14.8</td><td>1.3</td><td>9.4</td><td>11.4</td><td>1.2</td><td>36.4</td><td>00</td><td>31/2</td></tr> <tr><td>MAY</td><td>30.2</td><td>21.3</td><td>18.6</td><td>21.0</td><td>42.3</td><td>15.6</td><td>45.2</td><td>16</td><td>13.1</td><td>1987</td><td>1.2</td><td>1987</td><td>42</td><td>18.5</td><td>1.2</td><td>9.4</td><td>16.0</td><td>1.4</td><td>52.7</td><td>00</td><td>41/8</td></tr> <tr><td>JUN</td><td>34.5</td><td>22.1</td><td>16.8</td><td>24.5</td><td>44.8</td><td>20.0</td><td>46.9</td><td>11</td><td>17.1</td><td>1987</td><td>1.5</td><td>1987</td><td>47</td><td>23.2</td><td>1.5</td><td>9.5</td><td>23.7</td><td>2.3</td><td>156.6</td><td>00</td><td>78/4</td></tr> <tr><td>JUL</td><td>35.3</td><td>24.3</td><td>16.8</td><td>24.5</td><td>44.8</td><td>20.0</td><td>46.9</td><td>11</td><td>17.1</td><td>1987</td><td>1.5</td><td>1987</td><td>47</td><td>23.2</td><td>1.5</td><td>9.5</td><td>23.7</td><td>2.3</td><td>156.6</td><td>00</td><td>78/4</td></tr> <tr><td>AUG</td><td>30.9</td><td>25.5</td><td>17.5</td><td>23.5</td><td>43.2</td><td>21.7</td><td>47.8</td><td>12</td><td>19.1</td><td>1979</td><td>1.1</td><td>1979</td><td>62</td><td>20.3</td><td>1.2</td><td>9.4</td><td>125.4</td><td>7.4</td><td>339.4</td><td>13.4</td><td>140/8</td></tr> <tr><td>SEP</td><td>32.0</td><td>25.5</td><td>17.5</td><td>23.5</td><td>43.2</td><td>21.7</td><td>47.8</td><td>12</td><td>19.1</td><td>1979</td><td>1.1</td><td>1979</td><td>62</td><td>20.3</td><td>1.2</td><td>9.4</td><td>125.4</td><td>7.4</td><td>339.4</td><td>13.4</td><td>140/8</td></tr> <tr><td>OCT</td><td>28.1</td><td>25.8</td><td>22.3</td><td>24.3</td><td>17.3</td><td>22.1</td><td>48.5</td><td>1961</td><td>20.8</td><td>1974</td><td>1.1</td><td>1974</td><td>77</td><td>20.3</td><td>1.2</td><td>9.4</td><td>289.9</td><td>10.1</td><td>319.9</td><td>20.52</td><td>11</td><td>18/61</td></tr> <tr><td>NOV</td><td>24.9</td><td>25.7</td><td>24.1</td><td>15.3</td><td>22.1</td><td>22.1</td><td>38.0</td><td>08</td><td>18.2</td><td>1982</td><td>1.1</td><td>1982</td><td>76</td><td>20.3</td><td>1.2</td><td>9.4</td><td>289.9</td><td>10.1</td><td>319.9</td><td>20.52</td><td>11</td><td>18/61</td></tr> <tr><td>DEC</td><td>22.5</td><td>25.8</td><td>24.1</td><td>15.3</td><td>22.1</td><td>22.1</td><td>38.0</td><td>08</td><td>18.2</td><td>1982</td><td>1.1</td><td>1982</td><td>76</td><td>20.3</td><td>1.2</td><td>9.4</td><td>289.9</td><td>10.1</td><td>319.9</td><td>20.52</td><td>11</td><td>18/61</td></tr> <tr><td>TOTAL</td><td>272</td><td>24.8</td><td>23.6</td><td>23.6</td><td>15.0</td><td>21.5</td><td>38.0</td><td>05</td><td>18.9</td><td>1974</td><td>1.1</td><td>1974</td><td>61</td><td>20.3</td><td>1.2</td><td>9.4</td><td>289.9</td><td>10.1</td><td>319.9</td><td>20.52</td><td>11</td><td>18/61</td></tr> <tr><td>MEAN</td><td>24.9</td><td>22.1</td><td>21.4</td><td>15.1</td><td>14.4</td><td>14.4</td><td>38.0</td><td>02</td><td>10.5</td><td>1970</td><td>1.1</td><td>1970</td><td>74</td><td>25.7</td><td>2.8</td><td>1.6</td><td>91.7</td><td>4.2</td><td>383.7</td><td>2.6</td><td>134/4</td></tr> <tr><td>MAX</td><td>20.7</td><td>33.2</td><td>31.4</td><td>15.1</td><td>14.4</td><td>14.4</td><td>38.0</td><td>02</td><td>10.5</td><td>1970</td><td>1.1</td><td>1970</td><td>74</td><td>25.7</td><td>2.8</td><td>1.6</td><td>91.7</td><td>4.2</td><td>383.7</td><td>2.6</td><td>134/4</td></tr> <tr><td>MIN</td><td>16.6</td><td>16.3</td><td>28.3</td><td>11.4</td><td>91.5</td><td>8.2</td><td>35.1</td><td>01</td><td>5.4</td><td>1973</td><td>0.5</td><td>1973</td><td>86</td><td>15.5</td><td>0.9</td><td>0.2</td><td>7.0</td><td>0.5</td><td>77.5</td><td>0.0</td><td>34.2</td></tr> <tr><td>WIND</td><td>14.7</td><td>13.1</td><td>24.5</td><td>8.2</td><td>28.8</td><td>-4.0</td><td>32.0</td><td>01</td><td>06</td><td>1967</td><td>0.4</td><td>1967</td><td>68</td><td>12.0</td><td>0.9</td><td>0.4</td><td>3.7</td><td>0.2</td><td>54.4</td><td>0.0</td><td>56/1</td></tr> <tr><td>WIND</td><td>19.5</td><td>15.3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>TOTAL</td><td>24.3</td><td>19.8</td><td>21.8</td><td>13.6</td><td>64.9</td><td>3.0</td><td>48.0</td><td></td><td>06</td><td></td><td></td><td></td><td>65</td><td>27.0</td><td>2.4</td><td>1.4</td><td>1106.2</td><td>14.0</td><td>1460.1</td><td>196.7</td><td>2052</td></tr> <tr><td>MEAN</td><td>27.5</td><td>21.6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>56</td><td>21.5</td><td>2.6</td><td>1.7</td><td></td><td></td><td></td><td>1961</td><td>1955</td></tr> <tr><td>WIND</td><td>24</td><td>26</td><td>21</td><td>21</td><td>21</td><td>21</td><td>22</td><td></td><td>21</td><td></td><td></td><td></td><td>24</td><td>23</td><td>22</td><td>17</td><td>16</td><td>21</td><td>27</td><td>27</td><td>27</td></tr> <tr><td>WIND</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>			MONTH	DAILY MEAN			EXTREMES		HUMIDITY		CLOUDY		WIND		TOTAL		DATE	WTF	DAILY MAX	DAILY MIN	HIGHEST	LOWEST	RELATIVE HUMIDITY	WIND VELOCITY	RELATIVE HUMIDITY	WIND VELOCITY	WIND DIRECTION	WIND VELOCITY	WIND DIRECTION	WIND VELOCITY	WIND DIRECTION		mm	°C	°C	°C	°C	%	km/hr	%	km/hr	dir	km/hr	dir	mm	dir	JAN	14.5	18.5	34.5	82	28.5	37	33.1	31	1.5	1978	1.1	1978	58	11.8	1.2	9.8	0.8	42.9	01	10/66	FEB	10.2	15.2	17.6	16.5	32.7	5.5	37.8	28	2.8	1978	1.0	1978	62	12.4	1.0	9.5	10.3	1.2	94.0	08	10/61	MAR	12.5	16.4	13.0	15.1	32.3	10.4	41.1	29	7.4	1979	1.1	1979	50	14.8	1.3	9.4	11.4	1.2	36.4	00	31/2	APR	19.5	17.2	15.0	16.1	32.3	10.4	41.1	29	7.4	1979	1.1	1979	50	14.8	1.3	9.4	11.4	1.2	36.4	00	31/2	MAY	30.2	21.3	18.6	21.0	42.3	15.6	45.2	16	13.1	1987	1.2	1987	42	18.5	1.2	9.4	16.0	1.4	52.7	00	41/8	JUN	34.5	22.1	16.8	24.5	44.8	20.0	46.9	11	17.1	1987	1.5	1987	47	23.2	1.5	9.5	23.7	2.3	156.6	00	78/4	JUL	35.3	24.3	16.8	24.5	44.8	20.0	46.9	11	17.1	1987	1.5	1987	47	23.2	1.5	9.5	23.7	2.3	156.6	00	78/4	AUG	30.9	25.5	17.5	23.5	43.2	21.7	47.8	12	19.1	1979	1.1	1979	62	20.3	1.2	9.4	125.4	7.4	339.4	13.4	140/8	SEP	32.0	25.5	17.5	23.5	43.2	21.7	47.8	12	19.1	1979	1.1	1979	62	20.3	1.2	9.4	125.4	7.4	339.4	13.4	140/8	OCT	28.1	25.8	22.3	24.3	17.3	22.1	48.5	1961	20.8	1974	1.1	1974	77	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61	NOV	24.9	25.7	24.1	15.3	22.1	22.1	38.0	08	18.2	1982	1.1	1982	76	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61	DEC	22.5	25.8	24.1	15.3	22.1	22.1	38.0	08	18.2	1982	1.1	1982	76	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61	TOTAL	272	24.8	23.6	23.6	15.0	21.5	38.0	05	18.9	1974	1.1	1974	61	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61	MEAN	24.9	22.1	21.4	15.1	14.4	14.4	38.0	02	10.5	1970	1.1	1970	74	25.7	2.8	1.6	91.7	4.2	383.7	2.6	134/4	MAX	20.7	33.2	31.4	15.1	14.4	14.4	38.0	02	10.5	1970	1.1	1970	74	25.7	2.8	1.6	91.7	4.2	383.7	2.6	134/4	MIN	16.6	16.3	28.3	11.4	91.5	8.2	35.1	01	5.4	1973	0.5	1973	86	15.5	0.9	0.2	7.0	0.5	77.5	0.0	34.2	WIND	14.7	13.1	24.5	8.2	28.8	-4.0	32.0	01	06	1967	0.4	1967	68	12.0	0.9	0.4	3.7	0.2	54.4	0.0	56/1	WIND	19.5	15.3																					TOTAL	24.3	19.8	21.8	13.6	64.9	3.0	48.0		06				65	27.0	2.4	1.4	1106.2	14.0	1460.1	196.7	2052	MEAN	27.5	21.6											56	21.5	2.6	1.7				1961	1955	WIND	24	26	21	21	21	21	22		21				24	23	22	17	16	21	27	27	27	WIND																						
MONTH	DAILY MEAN			EXTREMES		HUMIDITY		CLOUDY		WIND		TOTAL		DATE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	WTF	DAILY MAX	DAILY MIN	HIGHEST	LOWEST	RELATIVE HUMIDITY	WIND VELOCITY	RELATIVE HUMIDITY	WIND VELOCITY	WIND DIRECTION	WIND VELOCITY	WIND DIRECTION	WIND VELOCITY		WIND DIRECTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
	mm	°C	°C	°C	°C	%	km/hr	%	km/hr	dir	km/hr	dir	mm	dir																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
JAN	14.5	18.5	34.5	82	28.5	37	33.1	31	1.5	1978	1.1	1978	58	11.8	1.2	9.8	0.8	42.9	01	10/66																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
FEB	10.2	15.2	17.6	16.5	32.7	5.5	37.8	28	2.8	1978	1.0	1978	62	12.4	1.0	9.5	10.3	1.2	94.0	08	10/61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
MAR	12.5	16.4	13.0	15.1	32.3	10.4	41.1	29	7.4	1979	1.1	1979	50	14.8	1.3	9.4	11.4	1.2	36.4	00	31/2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
APR	19.5	17.2	15.0	16.1	32.3	10.4	41.1	29	7.4	1979	1.1	1979	50	14.8	1.3	9.4	11.4	1.2	36.4	00	31/2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
MAY	30.2	21.3	18.6	21.0	42.3	15.6	45.2	16	13.1	1987	1.2	1987	42	18.5	1.2	9.4	16.0	1.4	52.7	00	41/8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
JUN	34.5	22.1	16.8	24.5	44.8	20.0	46.9	11	17.1	1987	1.5	1987	47	23.2	1.5	9.5	23.7	2.3	156.6	00	78/4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
JUL	35.3	24.3	16.8	24.5	44.8	20.0	46.9	11	17.1	1987	1.5	1987	47	23.2	1.5	9.5	23.7	2.3	156.6	00	78/4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
AUG	30.9	25.5	17.5	23.5	43.2	21.7	47.8	12	19.1	1979	1.1	1979	62	20.3	1.2	9.4	125.4	7.4	339.4	13.4	140/8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
SEP	32.0	25.5	17.5	23.5	43.2	21.7	47.8	12	19.1	1979	1.1	1979	62	20.3	1.2	9.4	125.4	7.4	339.4	13.4	140/8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
OCT	28.1	25.8	22.3	24.3	17.3	22.1	48.5	1961	20.8	1974	1.1	1974	77	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
NOV	24.9	25.7	24.1	15.3	22.1	22.1	38.0	08	18.2	1982	1.1	1982	76	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
DEC	22.5	25.8	24.1	15.3	22.1	22.1	38.0	08	18.2	1982	1.1	1982	76	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
TOTAL	272	24.8	23.6	23.6	15.0	21.5	38.0	05	18.9	1974	1.1	1974	61	20.3	1.2	9.4	289.9	10.1	319.9	20.52	11	18/61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
MEAN	24.9	22.1	21.4	15.1	14.4	14.4	38.0	02	10.5	1970	1.1	1970	74	25.7	2.8	1.6	91.7	4.2	383.7	2.6	134/4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
MAX	20.7	33.2	31.4	15.1	14.4	14.4	38.0	02	10.5	1970	1.1	1970	74	25.7	2.8	1.6	91.7	4.2	383.7	2.6	134/4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
MIN	16.6	16.3	28.3	11.4	91.5	8.2	35.1	01	5.4	1973	0.5	1973	86	15.5	0.9	0.2	7.0	0.5	77.5	0.0	34.2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
WIND	14.7	13.1	24.5	8.2	28.8	-4.0	32.0	01	06	1967	0.4	1967	68	12.0	0.9	0.4	3.7	0.2	54.4	0.0	56/1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
WIND	19.5	15.3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
TOTAL	24.3	19.8	21.8	13.6	64.9	3.0	48.0		06				65	27.0	2.4	1.4	1106.2	14.0	1460.1	196.7	2052																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
MEAN	27.5	21.6											56	21.5	2.6	1.7				1961	1955																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
WIND	24	26	21	21	21	21	22		21				24	23	22	17	16	21	27	27	27																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
WIND																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
635																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							


CLAUSE NO.	PROJECT INFORMATION			
ANNEXURE-III				
RAW WATER ANALYSIS				
S.No	Constituent	As	mg/l	
1	Calcium	CaCO ₃	105	
2	Magnesium	CaCO ₃	81	
3	Sodium	CaCO ₃	70	
4	Potassium	CaCO ₃	7	
	Total cations	CaCO ₃	263	
5	HCO ₃	CaCO ₃	180	
6	P- Alkalinity	CaCO ₃	0	
7	Chloride	CaCO ₃	60	
8	Sulphate	CaCO ₃	23	
	Total Anions	CaCO ₃	263	
9	Silica, Reactive	Si	3	
10	Iron (Total)	Fe	0.6	
11	pH	-	7.0-7.8	
12	Turbidity	NTU	100	
13	Total dissolved solids		230-300	
14	Temperature	Deg C	20-35	
15.	Organics (KMnO ₄)		2	


CLAUSE NO.	PROJECT INFORMATION		एनटीपीसी NTPC																		
	<p style="text-align: right;">ANNEXURE-III</p> <p style="text-align: center;">THE MINIMUM QUALITY OF DM WATER TO BE CONSIDERED FOR MAKE-UP WATER</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Sl.No.</th> <th style="text-align: left;">Characteristics</th> <th style="text-align: left;">Value</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Silica (Max.)</td> <td>0.02 ppm as SiO₂</td> </tr> <tr> <td>2.</td> <td>Iron as Fe</td> <td>Nil</td> </tr> <tr> <td>3.</td> <td>Total hardness</td> <td>Nil</td> </tr> <tr> <td>4.</td> <td>pH value</td> <td>6.8 -7.2</td> </tr> <tr> <td>5.</td> <td>Conductivity</td> <td>Not more than 0.1micro mho/cm excluding the effects of free CO₂</td> </tr> </tbody> </table>			Sl.No.	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as SiO ₂	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 -7.2	5.	Conductivity	Not more than 0.1micro mho/cm excluding the effects of free CO ₂
Sl.No.	Characteristics	Value																			
1.	Silica (Max.)	0.02 ppm as SiO ₂																			
2.	Iron as Fe	Nil																			
3.	Total hardness	Nil																			
4.	pH value	6.8 -7.2																			
5.	Conductivity	Not more than 0.1micro mho/cm excluding the effects of free CO ₂																			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 10 OF 15																		


CLAUSE NO.	PROJECT INFORMATION		एनडीपीसी NTPC																								
	<p>ANNEXURE-IV-1</p> <p><u>LIGHT DIESEL OIL CHARACTERISTICS</u></p> <p>AS PER IS 15770-2008</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Characteristics</th> <th style="text-align: left;">LDO</th> </tr> </thead> <tbody> <tr> <td>1. Pour Point (max)</td> <td>21 °C & 12°C for Summer and Winter respectively</td> </tr> <tr> <td>2. Kinematic viscosity in centistokes at 40 deg.C</td> <td>2.5 to 15.0</td> </tr> <tr> <td>3. Sediment percent by mass (max)</td> <td>0.10</td> </tr> <tr> <td>4. Total sulphur percent by mass (max)</td> <td>1.5</td> </tr> <tr> <td>5. Ash percentage by mass (max)</td> <td>0.02</td> </tr> <tr> <td>6. Carbon residue (Rams bottom) percent by pass (max.)</td> <td>1.50</td> </tr> <tr> <td>7. Acidity inorganic</td> <td>Nil</td> </tr> <tr> <td>8. Flash point (Min.) - Pensky Martens</td> <td>66 deg.C</td> </tr> <tr> <td>9. Copper strip corrosion for 3 hours at 100°C</td> <td>Not worse than No. 2</td> </tr> <tr> <td>10. Water content, % by volume (max)</td> <td>0.25</td> </tr> <tr> <td>11. GCV(kcal/kg)</td> <td>10,000</td> </tr> </tbody> </table>		Characteristics	LDO	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0	3. Sediment percent by mass (max)	0.10	4. Total sulphur percent by mass (max)	1.5	5. Ash percentage by mass (max)	0.02	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50	7. Acidity inorganic	Nil	8. Flash point (Min.) - Pensky Martens	66 deg.C	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	10. Water content, % by volume (max)	0.25	11. GCV(kcal/kg)	10,000	
Characteristics	LDO																										
1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively																										
2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0																										
3. Sediment percent by mass (max)	0.10																										
4. Total sulphur percent by mass (max)	1.5																										
5. Ash percentage by mass (max)	0.02																										
6. Carbon residue (Rams bottom) percent by pass (max.)	1.50																										
7. Acidity inorganic	Nil																										
8. Flash point (Min.) - Pensky Martens	66 deg.C																										
9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2																										
10. Water content, % by volume (max)	0.25																										
11. GCV(kcal/kg)	10,000																										
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 11 OF 15																								


CLAUSE NO.	PROJECT INFORMATION					
	ANNEXURE-IV-2					
	<u>DOMESTIC COAL CHARACTERISTICS</u>					
S No.	Characteristics (As received basis)	Range of 95% coal supplies			Range of 5% coal supplies	
		Column-1	Column-2	Column-3	Range of Adequacy coal	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	Worst	Best
1.1	Total Moisture (%)	14	17	11	18	10
1.2	Ash (%)	36	42	34	44	30
1.3	Volatile matter (%)	23	19	24	19	28
1.4	Fixed carbon (%)	27	22	31	19	32
2.0	ULTIMATE ANALYSIS					
2.1	Carbon (%)	33.31	27.23	39.07	25.72	44.43
2.2	Hydrogen (%)	3.49	3.05	3.53	2.93	3.72
2.3	Sulphur (%)	0.6	0.9	0.5	0.95	0.35
2.4	Nitrogen (%)	0.9	1.3	0.8	1.4	0.6
2.5	Oxygen (%) (By difference)	11.7	8.52	11.1	7	10.9
2.6	Total Moisture (%)	14	17	11	18	10
2.7	Ash (%)	36	42	34	44	30
2.8	GCV (kcal/kg)	3400	2900	3900	2800	4400
2.9	Hard Grove index	55	50	60	45	65
2.10	YGP Index (mg/kg)	75	80	70	85	65
2.11	Carbonates	0.3	0.38	0.27	0.2	0.43
2.12	Phosphorous	0.05	0.04	0.06	0.03	0.07
2.13	Chloride	0.08	0.15	0.05	0.18	0.04
2.14	Trace Elements (ppm)					
2.14.1	Arsenic	1	1.5	0.5	2.5	0.4
2.14.2	Lead	35	75	25	150	10
2.14.3	Mercury	0.1	0.5	0.08	0.6	0.06
2.14.4	Selenium	0.8	1	0.6	1.5	0.5
3.0	ASH ANALYSIS					
3.1	Silica (%)	59.25	63.4	56.92	63.56	54.2
3.2	Alumina (%)	27.62	27.29	28.47	27.2	29.89
3.3	Iron Oxide (%)	6.75	5.48	7	5.46	7.5
3.4	Titania (%)	1.95	0.88	2.5	0.98	2.82
3.5	P ₂ O ₅ (%)	0.24	0.3	0.11	0.35	0.1
3.6	Lime (%)	0.9	0.7	1.5	0.6	1.6
3.7	Magnesia (%)	0.2	0.3	0.15	0.35	0.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.4	1.7
3.9	Sodium Oxide (%)	0.17	0.25	0.15	0.3	0.15
3.10	Balance Alkalies (By Difference) (%)	1.72	0.9	1.8	0.8	1.94
4.0	ASH FUSION RANGE (Under reducing atmosphere)					
4.1	Initial Deformation Temperature (°C)	1100	1100	1100	1100	1100
4.2	Hemispherical temperature (°C)	1300	1250	1350	1250	1350
4.3	Flow temperature (°C)	1400	1400	1400	1400	1400
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION		PAGE 12 OF 15

CLAUSE NO.	PROJECT INFORMATION				
ANNEXURE-IV-3					
FUEL OIL CHARACTERISTICS					
Sl. No.	Characteristics	Heavy Furnace Oil grade HV (HFO) IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum stock (HPS) IS-11489-1985	
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.	
2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000	
3.	Flash Point (Min)	66 deg C	76 deg C	66 deg C	
4.	Water content by volume (Max)	1.0%	1.0%	1.0%	
5.	Sediment by weight (Max)		0.25%	0.25% 0.25%	
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%	
7.	Kinematic viscosity in Centistokes	370 at 50deg C	100 at 100deg C	100 at 100deg C	
8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%	
9.	Acidity (inorganic)	Nil	Nil	Nil	
10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C	
11.	Sodium content	—	—	100 ppm	
12.	Vanadium content	25 ppm	25ppm	25 ppm	
13.	Specific heat below pour point (KCal/Kg °C)		0.65		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION	PAGE 13 OF 15

CLAUSE NO.	PROJECT INFORMATION			
ANNEXURE-IV-4				
TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS				
	SI.No. Characteristics (as received basis)	Imported Coal		
		Worst	Best	
	1.0 Proximate Analysis			
	1.1 Total Moisture (%)	20	16	
	1.2 Ash (%)	10	10	
	1.3 Volatile Matter (%)	30	45	
	1.4 Fixed Carbon (%)	40	29	
	1.5 Total (%)	100	100	
	2.0 Ultimate Analysis			
	2.1 Carbon (%)	56.4	62.4	
	2.2 Hydrogen (%)	4.5	4.9	
	2.3 Sulphur (%)	0.9	0.8	
	2.4 Nitrogen (%)	0.9	0.5	
	2.5 Oxygen (%) (By difference)	7.3	5.4	
	2.6 Carbonates (%)	0	0	
	2.7 Phosphorous (%)	0	0	
	2.8 Total Moisture (%)	20	16	
	2.9 Ash (%)	10	10	
	Total	100	100	
	2.10 GCV (Kcal/Kg)	5800	6500	
	2.11 Hard Grove Index	45	60	
	2.12 YGP (mg/kg)	100	70	
	3.0 Ash Analysis			
	3.1 Silica (SiO ₂) (%)	32.74	34.94	
	3.2 Alumina(Al ₂ O ₃) (%)	30.5	28.43	
	3.3 Iron Oxides(Fe ₂ O ₃) (%)	18.2	15.2	
	3.4 Titania (TiO ₂)	1.56	1.76	
	3.5 Phosphoric Anhydride(P ₂ O ₅) (%)	0.44	0.54	
	3.6 Lime (CaO) (%)	6.12	7.62	
	3.7 Magnesia (MgO) (%)	1.83	1.93	
	3.8 Sulphuric Anhydride (%)	6.95	7.65	
	3.9 Sodium Oxide (Na ₂ O) (%)	0.3	0.4	
	3.10 Balance alkalies (by difference)	1.36	1.56	
	Total	100	100	
	4.0 Ash Fusion Temperature reducing temperature			
	4.1 Initial deformation Temp (°C)	1100	1250	
	4.2 Hemispherical Temp. (°C)	1300	1350	
	4.3 Flow Temp. (°C)	1400	1400	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 14 OF 15	

CLAUSE NO.	PROJECT INFORMATION			
	<p style="text-align: right;">ANNEXURE-IV-5</p> <p style="text-align: center;">LIMESTONE CHARACTERISTICS</p> <p>The details of Limestone data shall be furnished later.</p>			
<p style="text-align: center;">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02</p>	<p style="text-align: center;">SUB-SECTION-IB PROJECT INFORMATION</p>	<p style="text-align: center;">PAGE 15 OF 15</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS 																
	<p style="text-align: right;">ANNEXURE- (d)</p> <p>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</p> <p>All structures shall be designed for wind forces in accordance with IS 875 (Part-3) and as specified in this document. See Annexure – B for site specific information.</p> <p>Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.</p> <p>Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.</p> <p>Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than "5" and/or if the fundamental frequency of the structure is less than 1 Hz.</p> <p>Susceptibility of structures to across-wind forces, galloping, flutter, ovaling etc. should be examined and designed/detailed accordingly following the recommendations of IS 875(Part-3) and other relevant Indian standards.</p> <p>It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.</p> <p>Damping in Structures</p> <p>The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">a) Welded steel structures</td> <td style="width: 20%;">: 1.0%</td> </tr> <tr> <td>b) Bolted steel structures</td> <td>: 2.0%</td> </tr> <tr> <td>c) Reinforced concrete structures</td> <td>: 1.6%</td> </tr> <tr> <td>d) Steel stacks</td> <td>: As per IS 6533 & CICIND Model Code whichever is more critical.</td> </tr> </table> <p>SITE SPECIFIC DESIGN PARAMETERS</p> <p>The various design parameters, as defined in IS 875 (Part-3), to be adopted for the project site shall be as follows:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">a) The basic wind speed "V_b" at ten metre above the mean ground level: 39 metre/second</td> <td style="width: 20%;"></td> </tr> <tr> <td>b) The risk coefficient "K_1"</td> <td>: 1.06</td> </tr> <tr> <td>c) Category of terrain</td> <td>: Category-2</td> </tr> </table>			a) Welded steel structures	: 1.0%	b) Bolted steel structures	: 2.0%	c) Reinforced concrete structures	: 1.6%	d) Steel stacks	: As per IS 6533 & CICIND Model Code whichever is more critical.	a) The basic wind speed " V_b " at ten metre above the mean ground level: 39 metre/second		b) The risk coefficient " K_1 "	: 1.06	c) Category of terrain	: Category-2
a) Welded steel structures	: 1.0%																
b) Bolted steel structures	: 2.0%																
c) Reinforced concrete structures	: 1.6%																
d) Steel stacks	: As per IS 6533 & CICIND Model Code whichever is more critical.																
a) The basic wind speed " V_b " at ten metre above the mean ground level: 39 metre/second																	
b) The risk coefficient " K_1 "	: 1.06																
c) Category of terrain	: Category-2																
<p style="text-align: center;">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS--9585-001-2</p>	<p style="text-align: center;">SUB-SECTION-D-01 CIVIL WORKS</p>	<p style="text-align: center;">PAGE 333 OF 340</p>														

CLAUSE NO.	TECHNICAL REQUIREMENTS											
	<p style="text-align: right;">Annexure-(E)</p> <p>CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</p> <p>All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalization of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.</p> <p>A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Annexure-I.</p> <p>Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.</p> <p>The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Annexure-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 and Part 4).</p> <p>Damping in Structures</p> <p>The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:</p> <table border="0" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding-right: 20px;">Steel structures</td> <td style="text-align: right;">2 %</td> </tr> <tr> <td style="padding-right: 20px;">Reinforced Concrete structures</td> <td style="text-align: right;">5 %</td> </tr> <tr> <td style="padding-right: 20px;">Reinforced Concrete Stacks</td> <td style="text-align: right;">3 %</td> </tr> <tr> <td style="padding-right: 20px;">Steel stacks</td> <td style="text-align: right;">2 %</td> </tr> </table>			Steel structures	2 %	Reinforced Concrete structures	5 %	Reinforced Concrete Stacks	3 %	Steel stacks	2 %	
Steel structures	2 %											
Reinforced Concrete structures	5 %											
Reinforced Concrete Stacks	3 %											
Steel stacks	2 %											
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-D-01 CIVIL WORKS	PAGE 334 OF 340									

Annexure-2**CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**

All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

- | | | | |
|----|--------------------------------|---|----|
| a) | Steel structures | : | 2% |
| b) | Reinforced Concrete structures | : | 5% |
| c) | Reinforced Concrete Stacks | : | 3% |
| d) | Steel stacks | : | 2% |

Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).

In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).

The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve.

For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear (\bar{V}_B) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of \bar{V}_B / V_B . However, no reduction is permitted if \bar{V}_B is less than V_B .

For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (A_h) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Appendix-I.

Design/Detailing for Ductility for Structures

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.

APPENDIX – ISITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

The various site specific seismic parameters for the project site shall be as follows:

- | | | |
|----|--|----------|
| 1) | Peak ground horizontal acceleration (MCE) | : 0.41 g |
| 2) | Multiplied factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra | |
| a) | for ordinary moment resisting steel frames designed and detailed as per IS:800 | : 0.103 |
| b) | for braced steel frames designed and detailed as per IS:800 | : 0.077 |
| c) | For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 | : 0.062 |
| d) | for RCC chimney | : 0.205 |
| e) | for liquid retaining tanks | : 0.123 |
| f) | for steel chimney | : 0.154 |
| g) | for design of structures not covered under 2 (a) to 2 (f) above and under 3 below | : 0.103 |
| 3) | Multiplied factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted | : 0.205 |

Notes:

1. g = Acceleration due to gravity
2. For industrial structures, analysis for verification of mechanism shall be carried out as per IS:1893 (Part 4):2015

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
0	1.000	1.000	1.000
0.03	1.000	1.000	1.000
0.04	1.555	1.405	1.293
0.05	2.190	1.828	1.578
0.06	2.898	2.267	1.857
0.07	3.670	2.720	2.131
0.075	3.670	3.175	2.267
0.08	3.670	3.175	2.500
0.083	3.670	3.175	2.500
0.085	3.670	3.175	2.500
0.09	3.670	3.175	2.500
0.1	3.670	3.175	2.500
0.105	3.670	3.175	2.500
0.11	3.670	3.175	2.500
0.115	3.670	3.175	2.500
0.12	3.670	3.175	2.500
0.125	3.670	3.175	2.500
0.13	3.670	3.175	2.500
0.135	3.670	3.175	2.500
0.14	3.670	3.175	2.500
0.145	3.670	3.175	2.500
0.15	3.670	3.175	2.500
0.2	3.670	3.175	2.500
0.22	3.670	3.175	2.500
0.23	3.670	3.175	2.500
0.24	3.670	3.175	2.500
0.3	3.670	3.175	2.500
0.35	3.670	3.175	2.500
0.4	3.670	3.175	2.500
0.45	3.111	2.822	2.222
0.5	2.800	2.540	2.000
0.55	2.545	2.309	1.818
0.6	2.333	2.117	1.667
0.65	2.154	1.954	1.538
0.7	2.000	1.814	1.429
0.75	1.867	1.693	1.333
0.8	1.750	1.588	1.250
0.85	1.647	1.494	1.176
0.9	1.556	1.411	1.111
0.95	1.474	1.337	1.053
1	1.400	1.270	1.000

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
1.05	1.333	1.210	0.952
1.1	1.273	1.155	0.909
1.15	1.217	1.104	0.870
1.2	1.167	1.058	0.833
1.25	1.120	1.016	0.800
1.3	1.077	0.977	0.769
1.35	1.037	0.941	0.741
1.4	1.000	0.907	0.714
1.45	0.966	0.876	0.690
1.5	0.933	0.847	0.667
1.55	0.903	0.819	0.645
1.6	0.875	0.794	0.625
1.65	0.848	0.770	0.606
1.7	0.824	0.747	0.588
1.75	0.800	0.726	0.571
1.8	0.778	0.706	0.556
1.85	0.757	0.686	0.541
1.9	0.737	0.668	0.526
1.95	0.718	0.651	0.513
2	0.700	0.635	0.500
2.05	0.683	0.620	0.488
2.1	0.667	0.605	0.476
2.15	0.651	0.591	0.465
2.2	0.636	0.577	0.455
2.25	0.622	0.564	0.444
2.3	0.609	0.552	0.435
2.35	0.596	0.540	0.426
2.4	0.583	0.529	0.417
2.45	0.571	0.518	0.408
2.5	0.560	0.508	0.400
2.55	0.549	0.498	0.392
2.6	0.538	0.488	0.385
2.65	0.528	0.479	0.377
2.7	0.519	0.470	0.370
2.8	0.500	0.454	0.357
2.85	0.491	0.446	0.351
2.9	0.483	0.438	0.345
2.95	0.475	0.431	0.339
3	0.467	0.423	0.333
3.05	0.459	0.416	0.328
3.1	0.452	0.410	0.323
3.15	0.444	0.403	0.317

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
3.2	0.438	0.397	0.313
3.25	0.431	0.391	0.308
3.3	0.424	0.385	0.303
3.35	0.418	0.379	0.299
3.4	0.412	0.374	0.294
3.45	0.406	0.368	0.290
3.5	0.400	0.363	0.286



TITLE:

**PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS**

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-C1

REV. 00

DATE: JUL 2021

SHEET : 1 OF 1

**SPECIFIC TECHNICAL REQUIREMENT –
MECHANICAL**

	TITLE:	SPECIFICATION No: PE-TS-434-571-18000-A003		
	PATRATU STPP FGD PACKAGE			SECTION-C, SUB-SECTION-C1
	TECHNICAL SPECIFICATIONS FOR			REV. 0
	AGITATORS OF FGD SLURRY TANKS			DATE: DEC 2021
SHEET : 1				

1.0. APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Agitator shall follow the latest applicable Indian/International (AISI / ASME/EN/Japanese) Standards.

Bidder shall supply the equipment in accordance with relevant regulations, codes and standards specified in the specification. If required by relevant regulations, codes and standards specified in the specification, Successful Bidder shall assist BHEL to obtain approval against the equipment, documents and drawings by Indian authorities.

2.0. PROVENNESS CRITERIA/Pre-QUALIFICATION REQUIREMENT

The Bidders are required to meet the Qualification Requirement (PQR) for Agitators as per Provenness Criteria & shall submit the credentials as called in the tender document. Bidders shall submit the **Annexure-10** for qualification requirement (Attachment-3K). Only OEMs qualifying as per the Qualification requirement shall be considered for placement of order.

3.0. TECHNICAL INFORMATION

3.1 AGITATOR DETAILS:

For Agitator details refer "Agitator Schedule" in **Section-II, Annexure-8** of the specification.

3.2 MATERIAL OF CONSTRUCTION

S.N.	Material of construction	Horizontal agitators (side entry)	Vertical Agitators (Top entry)
i.	Impeller blade	Alloy 926 or better material	Alloy 926 or better material
ii.	Impeller Hub	Alloy 926 or better material	Alloy 926 or better material (or) Carbon steel with 6mm thick Bromo / Chloro Butyl Rubber Lining (as per Proven practice)
iii.	Shaft	Alloy 926 or better material	CS with Rubber Lining (min 6 mm thk Chloro/bromo butyl Rubber)
iv.	Fasteners in wetted parts or In Tank fasteners	Alloy 926 or better material	Alloy 926 or better material
v.	Fasteners in Non Wetted	GI fastener (40 μ plated) / SS	GI fastener (40 μ plated) / SS
vi.	Mounting base	Alloy 926/C276 (Wetted parts)	Carbon Steel
vii.	Tank Nozzle (for inserting agitator) with Flange	Not applicable (in BHEL scope)	Not applicable (in BHEL scope)
viii.	Flush pipe for Startup with flange	Not applicable	Not applicable

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE			
	TECHNICAL SPECIFICATIONS FOR			
	AGITATORS OF FGD SLURRY TANKS			
		SECTION-C, SUB-SECTION-C1		
REV. 0		DATE: DEC 2021		
SHEET : 2				

ix.	Tank nozzle with flange (for Flush Pipe)	Not applicable	Not applicable
x.	Agitator Support Leg	Carbon Steel	Not applicable

3.3 POWER SUPPLY DETAILS:

POWER SUPPLY	
The following voltage levels shall apply:	
3 phase, 3.3 kV AC ,50 Hz	Voltage for motors equal to / bigger than 200KW and for power distribution within the plant.
3 phase, 415 V, AC , 50 Hz	Standard voltage for power supplies to electric power consumers and motors Above 0.2 KW and upto 200 kW.
240V AC / 3 phase 415 V AC, 50 Hz	Standard voltage for power supplies to electric power consumers and motors Upto 0.2 kW.
<ol style="list-style-type: none"> 1. All equipments 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. Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition. 3. For further details, refer electrical specification under Section-I, Sub-Section-C3. 	

3.4 AGITATOR ARRANGEMENTS:

a) Auxiliary Absorbent Tank Agitator:

For arrangement of Agitators please refer “**INPUT DRAWINGS (GAD OF TANKS)**” Section-I, Sub-Section-D, Annexure-III.

These Agitators will operate continuously when Limestone / Gypsum Slurry is evacuated from Absorber for any Absorber maintenance work.

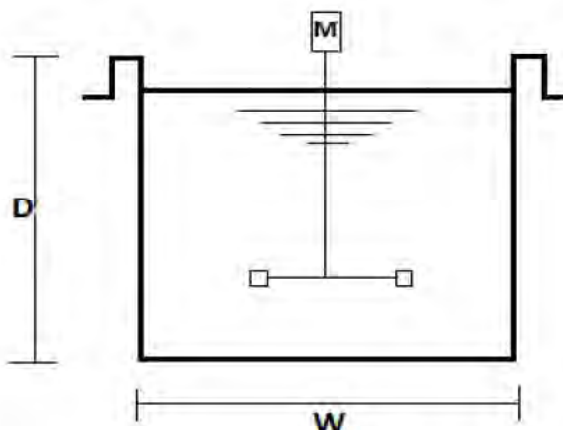
b) Other Slurry Tank Agitator:

For arrangement of Agitators please refer “INPUT DRAWINGS (GAD OF TANKS)” Section-I, Sub-Section-D, Annexure-III.

These Agitators will operate continuously for FGD system operation.

c) Drain Pit Tank Agitators:

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE			
	TECHNICAL SPECIFICATIONS FOR			
	AGITATORS OF FGD SLURRY TANKS			
	REV. 0	DATE: DEC 2021		
SHEET : 3				



For details of Drain Pits please refer “AGITATOR SCHEDULE” **Section-II, Annexure-8** of the specification. These Agitators will operate continuously for FGD system operation.

4.0. SCOPE OF SUPPLY & SERVICES

The bidder shall assume sole responsibility for the design, fabrication, testing, surface preparation & painting, packing, transportation and performance of the specified equipment with accessories, and shall ensure that the equipment with accessories are in conformance with this specification, as well as other documents which form part of the Purchase Order/Contract.

Various inspections by the BHEL/NTPC shall not relieve the Bidder in any way of his obligation to maintain an adequate test, inspection, and documentation program of his own, and shall not relieve the Bidder of any other obligation under this specification. Furthermore, any inadvertent overlook of deviations from some requirements of this specification by the buyer shall not constitute a waiver of these requirements, or of the Bidder's obligation to correct the condition when it is discovered, or of any other obligation under this specification.

This specification only states the lowest technical requirement, neither specifying all technical details, nor referring the pertaining code and standard fully. It is the Bidder's responsibility to ensure that the complete delivery complies with all relevant codes, standards and specifications.

The Bidder is obliged to supply relevant drawings and documentation to the buyer. All to be in English language and metric system, if not otherwise agreed in writing.

Scope for the bidders shall include Design, Manufacturing, Supply, and Supervision of Erection & Commissioning

Design: Broadly includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, Erection & assembly Drawings, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from customer.

Supply: The scope includes the following:

- Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.

	TITLE:	SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE		
	TECHNICAL SPECIFICATIONS FOR		
	AGITATORS OF FGD SLURRY TANKS		
	REV. 0	DATE: DEC 2021	
	SHEET : 4		

- Mandatory spares as defined as **Section-I, Sub-Section-D, Annexure-II.**
- Recommended spare parts list to be furnished (is not part of scope of supply)
- Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units.
- Start-up & Commissioning Spares
- First fill of consumables

Services: Services to be provided by the bidder:

- Detailed Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by BHEL.
- Supervision for Erection & Commissioning, trial run at site
- Performance guarantee tests at site & handover in flawless condition of the package to the customer
- Training of customer/ client O&M staff covering all aspects of the GDS- Operation & Maintenance, Trouble-shooting etc. at site
- Training of customer at manufacturer's works (3 persons for 2 days including lodging and boarding)
- Visits shall be planned by BHEL site team and prior intimation shall be sent to supplier for visit to site for supervision services. Bidder shall be informed at least 10 days in advance for the requirement of visit at site. Visiting team shall consist of one or two expert of bidder as deemed necessary by them.
- Bidder shall prepare the model of all Agitators under scope in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, BOQ, schematics and logic diagrams etc. in the aforesaid 3D model. After the completion of engineering the corresponding complete 3D review model shall be handed over to BHEL.

The scope of supply for AGITATORS shall include but not limited to the following:

A) For Horizontal (Side Entry) Agitators:

Sl. No	Scope
1.	AGITATOR complete with
	i. AGITATOR Blades
	ii. AGITATOR Shafts
	iii. Coupling arrangement (Flexible)
	iv. Single Mechanical Seals
	v. Shaft Sleeve
	vi. Lanterns/ Stools (Bearing Housing), Safety Guard
	vii. Bearings
	viii. Agitator Mounting Flanges with gaskets and fasteners
	ix. Drive Motor(IE3) with gearbox arrangement
	x. Supporting arrangement including tie rods, gusset plates etc. of Side Entry Agitator on the tank Wall. Vessel Nozzle and mating flange for supporting on the tank wall , gaskets and fasteners.
	xi. VOID
	xii. Foundation plate with foundation bolts, vessel nozzle
	xiii. Painting and Rust Prevention during shipment and construction
	xiv. Packing and transportation

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE			
	TECHNICAL SPECIFICATIONS FOR			
	AGITATORS OF FGD SLURRY TANKS			
		SECTION-C, SUB-SECTION-C1		
		REV. 0	DATE: DEC 2021	
SHEET : 5				


Sl. No	Scope
	xv. Supervision of Erection & commissioning at site
	xvi. Special tools & tackles as applicable
	xvii. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per Project Specific Requirement
	xviii. Installation, operation and maintenance manuals
	xix. Any other items required for completeness of the equipment except the items covered in the exclusions.


B) For Vertical (Top Entry) Agitators:


Sl. No	Scope
2.	AGITATOR complete with
	i. AGITATOR Blades
	ii. AGITATOR Shafts
	iii. Coupling arrangement (Flexible)
	iv. Gland Packing, Seals, O Rings, Glands
	v. Shaft Sleeve
	vi. Lanterns/ Stools (Bearing Housing), Safety Guard
	vii. Bearings
	viii. Agitator Mounting Flanges with gaskets and fasteners
	ix. Drive Motor(IE3) with gearbox arrangement
	x. Mating Flange for Supporting on Slurry Tank Roof
	xi. Shims
	xii. Painting and Rust Prevention during shipment and construction
	xiii. Packing and transportation
	xiv. Supervision of Erection & commissioning at site
	xv. Special tools & tackles as applicable
	xvi. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per Project Specific Requirement
	xvii. Installation, operation and maintenance manuals
	xviii. Any other items required for completeness of the equipment except the items covered in the exclusions.

The quantity, location of the agitators has been included in the agitator schedule (Section-II, Annexure-8)

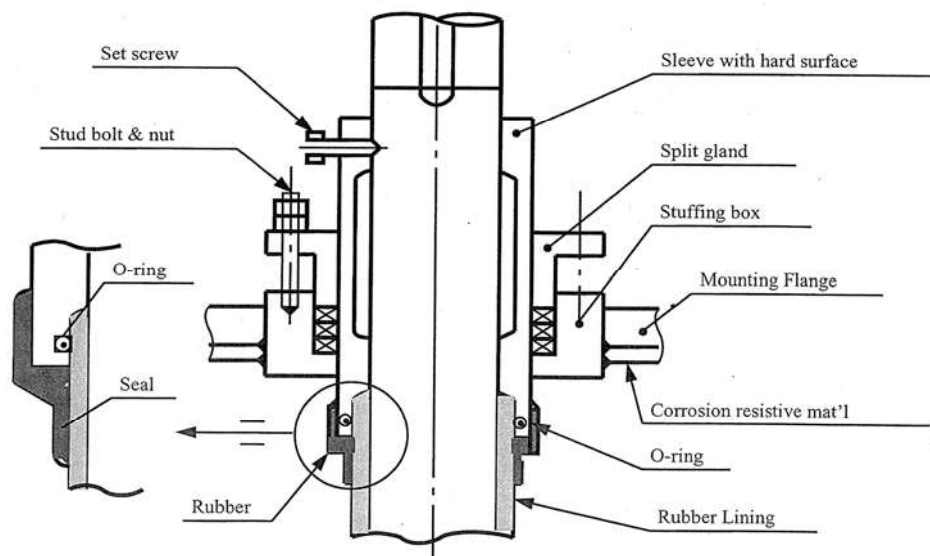
4.1	TECHNICAL REQUIREMENTS
I	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.
II	All agitators shall be designed for continuous operation unless otherwise specified. The design of the agitators shall be of proven type. BHEL, during detail engineering reserves the right to ask for CFD (Computational Fluid Dynamics) analysis to accurately determine equipment requirements. Successful Bidder shall provide the same without any additional price implication.
III	Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, mechanical seal (for side entry agitators), impeller, support legs, agitator mounting flange

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003		
	PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1		
	TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021	
	AGITATORS OF FGD SLURRY TANKS		SHEET : 6		
		including bolts nuts and gasket etc.			
IV	All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion.				
V	The material for the shaft (which is continuously in contact with slurry) and agitator blades of the Auxiliary Absorbent Tank Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades shall be made with Alloy 926 or better material and shaft can be rubber lined (minimum 6 mm thick Chlorobutyl Rubber). This does not release the bidder of the responsibility for selecting the correct materials.				
VI	Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation. It shall be possible to remove the sealing devices of the side mounted agitators without having to drain completely the slurry inside the tank.				
VII	-VOID-				
VIII	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.				
IX	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.				
X	All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.				
XI	All exposed moving parts shall be covered by guards.				
XII	The shape of the impeller blades of side entry agitators/top entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.				
XIII	Belt drives (if applied for side entry agitators) shall be properly designed to provide a minimum lifetime of 2 years under design conditions				
XIV	It shall be noted that all Agitators are meant for keeping the solid particles in suspended mode in liquid with "Full off-Bottom Suspension" of solid particles to 98% of liquid column to virtually "Uniform Solid Concentration". No chemical reaction will takes place.				
XV	Maintaining a uniform concentration over the 95% of liquid column. Absolute sweeping of solid particle from tank bottom is a must for all Agitators. If speed is required to be increased to guarantee the above requirements; the same can be increased by vendor. Bidder's machines that consume less power will be in an advantageous position.				
XVI	It is to be noted that in continuous process any deposit at tank bottom is the loss of material which are not getting converted as per process. Hence, total loss of material by sedimentation is a loss to FGD Process & determines the "In efficiency of the Agitator".				
XVII	Vendor should ensure nil settlement; utilization of solid material shall be a guaranteed parameter and will be assessed in percentage (%) term to net wet of solid mass of inflow or out flow. This is one of the guarantee parameter.				


		TITLE: PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS		SPECIFICATION No: PE-TS-434-571-18000-A003	
				SECTION-C, SUB-SECTION-C1	
		REV. 0	DATE: DEC 2021		
		SHEET : 7			
XXVIII	Agitator and its driver shall perform on the test stand at shop and on the Agitator's permanent location at site within vibration limit. The vibrations of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the "Acceptance Criteria" of the equipment. Please note vibration at test stand can only be taken as for information.				
XIX	Every Tank will have a pump whose suction line shall be connected to tank. These pumps are to operate continuously at the lowest operating level which is decided by Process requirement. Hence, the minimum operating level of liquid in every tank for every Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. The Tank water level is indicated as per "SECTION-II Annexure-8". Any minor change in liquid level required by Agitator supplier will be accommodated only if it is acceptable to the pump supplier.				
XX	Agitator must have low-pitch propeller with low solidity ratio and Power Number. The Maximum Input Power at motor terminal shall be considered as a guaranteed parameter under "Schedule of Guaranteed Parameters" in "SECTION-II Annexure-10-Schedule of Guarantees"- and the same shall be calculated for maximum liquid level in tank. A calculation of power specifying the hydraulic power of Agitator, Seal loss, Gear box and Motor internal loss must be submitted along with the offer. A characteristics curve showing power versus liquid level should be submitted from the lowest liquid level, required for Agitator to maximum liquid level in the tank. Motor should be selected based on the highest power demand with a 10% margin at maximum liquid level, taking into account frequency variation.				
XXI	The agitator shall be suitably designed for mounting and operation in purchaser's tank whose drawings is annexed with the enquiry specification. The bidder shall review and comment on the BHEL's tank drawings for number and size of the baffles, sparger locations, mounting nozzle details etc.				
XXII	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material. Impeller hub material has to be Alloy 926 or better material.				
XXIII	Unless otherwise specified, for small diameter impeller, it shall be possible to remove complete agitator assembly without dismantling through the opening provided on the tank/sump, and for large diameter impeller, the blade shall be of removable construction for ease of removal. Bidder shall also provide the headroom required for taking out the agitator as above.				
XXIV	Any instruments provided shall be Profibus Compatible.				
XXV	Bidder shall provide the design and arrangement of baffle plates in circular tanks/rectangular sumps. Baffle plates are in BHEL scope.				
XXV I	Bidder shall provide proper dowelling between motor and base plate, gear box and mounting tool/base plate, for ease of assembly of agitator unit. Tapered dowell shall be provided.				
XXVI	Vendor shall provide suitable arrangement for supporting the agitator shaft with impellers during removal of gear-box for maintenance and details of such arrangements shall be furnished.				
4.2	CONSTRUCTIONAL FEATURES				
A)	BLADE AND HUB OF PROPELLER				
I)	The blades of the agitators shall be of Alloy 926 or better material.				


		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
		PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS		SHEET : 8	
II)	The Blade design of the Agitator to be of most efficient design in order to offer least power consumption. The Agitator power consumption is part of the guarantee parameters.				
III)	Although Agitator will have substantial low speed because of reduction Gear Box, hydraulic unbalance at impeller can cause severe vibration, hence it is mandatory that rotating assembly shall be dynamically balanced to its rated speed. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.				
IV)	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.				
B)	SEAL				
1	<u>Horizontal / Side Entry Agitators:</u>				
I.	Agitators should be provided with Single Stage mechanical seal. the mechanical seal should be as per ISO-21049 / API 682				
II.	The Mechanical Seals shall be so arranged that repacking or fitting of replacement seals can be carried out with the minimum of disruption to plant operation.				
III.	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.				
IV.	Provide requirements for periodical flushing to rinse the seal face for leaked slurry.				
V.	All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.				
VI.	-VOID-				
VII.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.				
VIII	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, it should have a provision of collecting / or discharging back to the tank.				
IX.	Mechanical seals shall be fitted and installed in the Agitator before shipment and shall be clean. Mechanical seals shall be plugged with screw for shipping.				
X	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. Agitator manufacturer to decide the same along with seal manufacturer, the best seal that is suitable for the offered Agitator				
XI	Seal life has to be guaranteed, taking into consideration all its components for 25000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.				
XII	The sub-vendor of the seal shall be approved by customer during contract execution.				
2	<u>Vertical Agitators for Other Slurry Tanks & Drain Pit Tanks</u>				
I	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Construction of Gland Packing shaft seal system shall be as per the below fig:				

	TITLE:	SPECIFICATION No: PE-TS-434-571-18000-A003		
	PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1	
	TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021
	AGITATORS OF FGD SLURRY TANKS		SHEET : 9	



II	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Mechanical and hydraulic conditions in the seal chamber, required to maintain a stable film at seal face, including temperature, pressure and flow, shall be jointly established by Agitator manufacturer and seal manufacturer, and shall be noted in data sheet submitted in tender. If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.
C) SHAFT	
I.	MOC of Shaft shall be as per Clause no.3.2 & “Agitator Schedule”, Section-II, Annexure-8. Use of dissimilar material at flange joint shall be avoided to eliminate any crevice corrosion. Spacing of the shaft joint should not be more than 3.0 m for easy assembly if it is more than 40kg. If welding is used for joining two tubes, welding joint must be 100% radio graphed. If split shaft is proposed for larger tanks, shaft flange at the joining interface has to be rubber lined at manufacturer’s works and necessary fasteners have to be provided.
D) BEARING & BEARING HOUSING IN GEAR BOX	
I	Bearing shall be of rolling type radial and thrust bearing (FAG/SKF/Timken make only) as required. Thrust bearing shall be sized for continuous operation under all specified condition.
II	Thrust bearing shall provide full load capability if the Agitator’s normal direction of rotation is reversed. Up-thrust and Down-thrust load must be taken into account in sizing bearing. Life of the every anti-friction bearing, used in the bearing housing as per manufacturer’s design, should have L10 of 25000 hr (minimum).
III	Bearing housing should be grease/oil lubricated. If bearing is oil lubricated, constant-level sight-feed oiler of 100cc size or bigger capacity is to be provided. Bearing housing should have oil drain, constant oil level indicator. A provision of one(1) numberG1/2” thread(ISO-228,Part-1)port is required for remote control of temperature of bearing housing oil bath RTD.
IV	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1	
	TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021
	AGITATORS OF FGD SLURRY TANKS		SHEET : 10	
V	Lubricating oil will be the responsibility of Gear Box manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.			
E)	MATERIALS			
I	Agitator components designated as “Full Compliance Material” shall meet the requirements of the industry specification as listed for the material in the table as well as in the specification in the respective section.			
II	A detail quality plan is to be submitted along with offer for all items marked “Full Compliance Material”.			
III	Final acceptance of the quality plan will be by ultimate user during detailed engineering without any commercial implication. QAP should be as per the best practice followed internationally to avoid any conflict of interest.			
F)	DRIVER (MOTOR)			
I	Driver shall be sized to meet all specified operating conditions including bearing housing , seal, external gear box and coupling loss(if any).			
II	Motor shall be able to accelerate to speed at reduced voltage and frequency as specified in “Site Power Supply Condition” as per Clause: 3.3.			
III	It should meet the electrical specification (SECTION-C, SUBSECTION-C3) .			
G)	GEAR BOX			
I.	Gear box should be vertical flange mounted solid shaft type (Vertical Agitators), reducing speed type, specially designed for the requirement of Slurry mixing and to be manufactured by the Agitator supplier. Complete up-thrust and down-thrust, developed by Agitator shall be taken by thrust bearing housing of Gear Box. An auxiliary slow drive provision shall be provided in the Gear Box so that slurry is always kept in dynamic condition to avoid settling of slurry at bottom, in the event of Agitator is not operating at its rated speed. Rating of Gear box shall be at least 1.5 times the rated torque of Agitator. Gear box details are subject to customer approval during detailed engineering without any commercial implications.			
II.	The reduction unit shall be procured from a reputed manufacturer and shall confirm to BS:721 (latest edition)/AGMA/Equivalent specification. The sub-vendor of the gear-box shall be approved by CUSTOMER during contract execution.			
III.	Gear drives shall have splash type oil lubrication. If oil pumps are used, they shall be removable for maintenance without disturbing the motor or drive housing.			
IV.	The gear reduction unit shall always be provided with an oil drain, a breather and oil level gauge. The lubrication to be designed keeping in view that the temperature within the bearing should not exceed 85 Deg.C.			
V.	VOID			
VI.	The bidder shall provide an easily accessible oil level gauge and a dipstick that will indicate oil level under standstill and operating conditions.			
H)	COUPLING & COUPLING GUARD			


	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1	
	TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021
	AGITATORS OF FGD SLURRY TANKS		SHEET : 11	
I.	Coupling and coupling guard should be supplied between driver and driven equipment.			
II.	Coupling should be designed taking into consideration adequate service factor.			
III.	Design rating of the coupling (excluding service factor) should be indicated in data sheet.			
IV.	Coupling must be having locking screw so that it does not slide over shaft in due course operation.			
V.	Vertical Agitators - Coupling between Motor and Gear Box shall be Spacer-type flexible coupling, made of Cast Iron. Spacer length shall be of sufficient length so than Motor and Gear Box shall be able to run independently at no-load condition by detaching the respective coupling.			
VI.	It is desirable that for servicing of seal, coupling half should not be removed. Coupling should be dynamically balanced to Gr: G6.3, ISO-1940. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.			
VII.	Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations.			
I)	PLATE AND FASTENING BOLTS			
I.	Base plate shall be interpreted as the component of Agitator assembly through which the whole load will be transmitted to the Sole Plate/Nozzle over which the equipment will be mounted. The Base plate shall be fabricated with mild steel of structural quality (UTS=42N/sq mm minimum) with anti-corrosive paint of sufficient dry-film thickness.			
II.	Base plate must have provision of leveling on its intended mounting place. Nozzle is not in the scope of supply of Agitator manufacturer. It should be noted that Nozzle will be rubber lined to prevent any leakage of corrosive gases.			
III.	Alignment between Gear Head Shaft and Agitator shaft shall be within the permissible limit of Gear Box. Similarly, misalignment between Motor shaft and Gear Box Shaft shall be within 0.050 micron (radial) and 2 degree (angular) or better as per requirement of Motor and Gear Box			
IV.	Base plate with desired number of hole shall be provided by the bidder, will be machined on one side. Base Plate shall be welded to the structure after leveling, as recommended by Agitator manufacturer and rubber lining is completed before placing the equipment in its desired location.			
J)	OTHER COMPONENTS			
I	All fasteners used in wetted condition must be of Alloy 926 or better material so that even if it comes in contact with liquid by swelling of rubber, thread remains unaffected. Raw material of fastener must undergo Inter-granular Corrosion test as per ISO-3651, Part-1 for Nitric Acid test.			
II	Mounting flange dimensions shall be as per ASME B16.5 upto 600 Nb, ASME B 16.47 for more than 600 NB.			
III	Rubber Lining (As Applicable) <ul style="list-style-type: none"> a) Rubber lined surfaces shall utilize 6 mm nominal thickness chlorobutyl rubber. b) Areas of high wear (e.g. leading edges on impeller blades) shall have an additional 6 mm of rubber for abrasion protection. c) No field-applied linings are permitted except for file patch kits. 			


	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE			
	TECHNICAL SPECIFICATIONS FOR			
	AGITATORS OF FGD SLURRY TANKS			
	REV. 0	DATE: DEC 2021		
SHEET : 12				


K)	GENERAL REQUIREMENT OF SIDE ENTRY AGITATORS:			
I.	All Agitators shall be designed for continuous operation.			
II.	The Material of Construction (MOC) of Agitators shall be Alloy 926 or better material as per Cl. No. 3.2 & “Agitator Schedule””, Section-II, Annexure-8.			
III.	It should be of Flange mounted type.			
IV.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from side. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.			
V.	The Bidder to consider Gypsum Sedimentation during stoppage of Agitator.			
VI.	The following information to be provided along with the bid: a) Impeller Diameter b) Impeller Speed c) Agitator Pumping Capacity (m ³ /min) d) Volume per Agitator:			
L)	GENERAL REQUIREMENT OF TOP ENTRY AGITATORS IN OTHER SLURRY TANKS & DRAIN PITS:			
I.	All Agitators shall be designed for continuous operation.			
II.	The Material of Construction (MOC) of Agitators: Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined as per Clause No.3.2 & Agitator Schedule.			
III.	It should be roof mounted.			
IV.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box of rigid type, solid shaft coupling between gear box and agitator and flexible coupling of spacer type coupling between Motor and Gear Box. Both Gear Box and Motor should be vertically/horizontally flange mounted type with a common frame of the whole equipment. The entire thrust load of agitator should be transmitted to the thrust bearing of Gear box.			
V.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.			
VI.	Cable entry to the Motor terminal box should preferably be from top when motor is vertically mounted at its position and it should be easily accessible.			
VII.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.			
VIII.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material			
IX.	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.			
X.	-VOID-			
XI.	-VOID-			


	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003		
	PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1		
	TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021	
	AGITATORS OF FGD SLURRY TANKS		SHEET : 13		


4.3	MOTOR								
	<p>All AC motor shall be Squirrel cage induction motor and, shall be suitable for direct –on-line starting. Rating of the motor should of Type S1 (Continuously rated) as per ISO-60034, Part-1. Rating of motor must be selected with minimum margin(as per the below table) above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation:</p> <table border="0"> <tr> <td style="padding-right: 40px;">Agitator Rated BKW</td> <td>Motor Margin</td> </tr> <tr> <td><22KW</td> <td>125% of Agitator Rated BKW</td> </tr> <tr> <td>22KW-55KW</td> <td>115% of Agitator Rated BKW</td> </tr> <tr> <td>>55KW</td> <td>110% of Agitator Rated BKW</td> </tr> </table>	Agitator Rated BKW	Motor Margin	<22KW	125% of Agitator Rated BKW	22KW-55KW	115% of Agitator Rated BKW	>55KW	110% of Agitator Rated BKW
Agitator Rated BKW	Motor Margin								
<22KW	125% of Agitator Rated BKW								
22KW-55KW	115% of Agitator Rated BKW								
>55KW	110% of Agitator Rated BKW								
	It should meet the electrical specification (SECTION-I, SUBSECTION-C3) .								
5	GENERAL REQUIREMENTS								
1	Metric unit shall be used in the drawings and in the any displays on the equipment's. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm2G. For instance the pressure gauges should have dual unit's indication.								
2	Descriptions in the drawings, in the documents, and in the displays shall be in English								
3	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.								
4	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.								
5	Noise level produced by any rotating equipment individually or collectively shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor.								
6	The overall vibration level shall be as per ISO 10816.								
7	Suitable drain connections shall be provided.								
8	The equipment shall be suitable for stable operation continuously.								
9	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard. Carbon steel shaft shall have a corrosion allowance of 6mm on its diameter. On other non-pressure carbon steel parts a corrosion of 3mm shall be considered on each surface.								
10	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150								
11	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.								
12	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.								


		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
		PATRATU STPP FGD PACKAGE		SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR		REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS		SHEET : 14	
13	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.				
14	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.				
15	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.				
16	Bidder shall provide the necessary gaskets.				
17	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.				
18	Bidder to provide capacity of hoist required for material handling and the details of heaviest component to be handled. Bidder shall provide a typical arrangement/drawing of the handling arrangement.				
19	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.				
20	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in bidder's quoted price.				
21	Material of construction for all equipment/components shall be subject to CUSTOMER/ BHEL approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component (complying tender specifications), as per best engineering practice, global standard and global references, in case no MOC is available in specs.				
22	Bidder to provide sub vendor list and Bidder shall strictly adhere to customer approved vendor list (reference list is included in SUB-SECTION-D, Annexure-I). In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by Customer/ BHEL before placing order and bidder shall submit relevant documents to take up with CUSTOMER for approval. Bidder shall submit relevant documents as per Sub-Supplier Questionnaire provided in referred Annexure .				
23	It shall be the complete responsibility of the successful bidder to obtain "Sub Vendor Approval" from BHEL / CUSTOMER for all equipment's & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of CUSTOMER/ BHEL, the same may be replaced with another Customer/BHEL approved sub-vendor only, without any price implications to BHEL.				


	TITLE: PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS		SPECIFICATION No: PE-TS-434-571-18000-A003		
			SECTION-C, SUB-SECTION-C1		
	REV. 0	DATE: DEC 2021			
	SHEET : 15				
24	<p>The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the CUSTOMER and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP.</p> <ul style="list-style-type: none"> - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: <ol style="list-style-type: none"> a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments 				
25	During detail engineering, bidder to strictly adhere to BHEL/CUSTOMER drawing formats, document numbering, quality plan & FQP formats				
26	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.				
27	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/CUSTOMER during detail engineering				
28	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/MS-Word /Excel format.				
29	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/Customer should be addressed timely by the bidder.				
30	Bidder to note above mentioned points not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.				
31	<p>Bidder shall provide design support to assist the Purchaser in efficiently integrating the furnished equipment. Design support specifically includes:</p> <ul style="list-style-type: none"> • Bidder shall verify/ validate the number and location of agitators to keep material in suspension. • Static and dynamic loading information and requirements for agitator support design (applicable for top & side type) 				
32	Any other item required to meet the stipulations mentioned in GTR , GCC and SCC and relevant to Agitator package unless specifically excluded from scope of supply.				
6	PACKING AND FORWARDING				
1	<p>Proper packing to be ensured.</p> <p>Indigenous Supply: Agitator & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the Agitator internals during storage in the outer yard of power plant. Further the packing shall be done in line with requirements mentioned in point no. 2 to 20 of this section.</p> <p>Imported Supply: All imported supply should be packed as per Sea worthy packing standards as per Sub-Section D, Annexure-V. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.</p>				


	TITLE: PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS		SPECIFICATION No: PE-TS-434-571-18000-A003		
			SECTION-C, SUB-SECTION-C1		
	REV. 0	DATE: DEC 2021			
	SHEET : 16				
2	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.				
3	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.				
4	Crates and packing material used for shipping will become the property of owner.				
5	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.				
6	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.				
7	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking				
8	Each package or shipping units shall be clearly marked or stenciled on at least two sides as per the dispatch instruction givens during the contract. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.				
9	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.				
10	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.				
11	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.				


		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003			
		PATRATU STPP FGD PACKAGE				SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR				REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS				SHEET : 17	
12		Wherever necessary besides usual inscriptions the cases shall bear special indication such as “Top”, “Do not turn over”, “Care” , “Keep Dry” etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)					
13		Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: <ol style="list-style-type: none"> Upright position Slings position and center of Gravity position Void Fragile components (to be marked properly with a clear warning for safe handling) 					
14		Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.					
15		The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Agitator, BHEL item Code, Gross Weight and Net weight of Supplied items.					
16		Prior to transport from manufacturer’s work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.					
17		All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as “very severe” during final finishing/shipping.					
18		Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering.					
19		All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).					
20		Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.					
7		SUPERVISION OF ERECTION, TESTING AND COMMISSIONING					
1		The erection of Agitators will be done by owner as per Erection Manual and check List to be provided by the bidder during detail engineering. However, the bidder shall make visit as per enquiry/PO for the supervision of erection, pre-commissioning & post-commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply & Services.					


		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003			
		PATRATU STPP FGD PACKAGE				SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR				REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS				SHEET : 18	
2		The bidder will be informed well in advance for the visit.					
3		-VOID-					
4		Price comparison for evaluating the lowest bid will be considered for all main supply, supervision of E&C charges and mandatory spares price all together along with the loading on account of guarantee power consumption (as applicable).					
5		Scope of Supervision for Erection & commissioning: Tentatively following visits shall be planned by site team which shall be as follows: - <ul style="list-style-type: none"> • Three visits (for all agitators) of 20 days each for supervision for erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply & Services. • Two visits of 10 days each (for all agitators) for performance demonstrations and handing over of system. • Any additional visit as per requirement of BHEL site office during erection of equipment. 					
6		Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system shall be in bidders scope.					
8		EXCLUSION					
		The following work associated with the Agitators will be by others: <ol style="list-style-type: none"> a. Access, Walkways, platforms and ladders b. Handling equipment (hoist) along with the handling arrangement. However, bidder shall provide the details of the same to BHEL. c. Baffle plates d. Installation, however, supervision of erection and commissioning shall be in bidder's scope 					
9		INSPECTION AND TESTING					
		The General inspection requirements to be considered are as below:					
1		Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used on the Agitators for review by BHEL/CUSTOMER prior to manufacture.					
2		The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/customer.					
3		Since there is no standard for "Acceptance Test Procedure" for Agitator, Agitator manufacturer is to submit a test procedure and Quality Plan, clearly indicating that equipment will meet the desired parameter.					
4		Power consumption at motor terminal and vibration of equipment will be conducted at site. Vendor to indicate other material tests that are to be conducted as per their practice in their Quality plan.					
5		No liquid should enter the tube through any flange joint. "O"-ring used in the flange joint will deteriorate at a highly chlorinated and acidic environment of medium at a maximum operating temperature unless right quality of rubber is used. Hydrostatic testing of tube assembly is required at a pressure of twice that of maximum liquid column in any tank or 30m whichever is higher. The hydro test duration will be for a minimum of 1 hr to check sweating at any flange. Hydrostatic test is meant in part for a check of equipment joint at					


		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003			
		PATRATU STPP FGD PACKAGE				SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR				REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS				SHEET : 19	
		new condition only. It cannot be considered as a guarantee of functional objective of rubber used.					
7		<p>Mechanical Run Test (in air) Each Agitator unit shall be given a 4-hour mechanical run test in air at vendor's shop. Agitator unit shall be mounted in the same manner as it will operate in the field. During this test the record shall be made of:</p> <ol style="list-style-type: none"> Shaft run out at free end. Dynamic shaft deflection adjacent to the mechanical seal/packing/vapour seal. Gearbox oil temperature and temperature of bearing housing in stool. The temperature of the gear box oil shall not exceed ambient plus 40 Deg.C and that of bearing housing shall not exceed from room temperature plus 20 Deg.C after temperatures have stabilized. Bearing Housing vibration checks shall be carried out. maximum acceptable vibration velocity shall be 6 mm/sec. Noise level shall be checked and shall be within the specified limits mentioned in the specification. Agitator shaft RPM and motor RPM. Check of satisfactory operation of shut off and retracting arrangement. <p>Please also refer sl no 9 below.</p>					
8		<p>Mechanical Run Test (in slurry of similar concentration as applicable for the project) Each agitator unit shall be given a load test in slurry at the vendor's shop. The duration of this test shall be 4 hours unless agreed otherwise between the Purchaser and the vendor. The following parameters shall be recorded during the test:</p> <ol style="list-style-type: none"> Dynamic shaft deflection adjacent to the mechanical seal/packing/vapor seal. Gear box bearing oil temperature and temperature of bearing housing in stool. The temperature of gear box oil shall not exceed ambient plus 40°C and that of bearing housing shall not exceed room temperature plus 20°C after the temperatures have stabilized. Bearing housing vibrations. Maximum acceptable vibration velocity is 6 mm/sec. Noise levels shall be checked and shall be within the specified limits mentioned in the specification. Electrical power input to the motor. Agitator shaft RPM and motor RPM. Check of satisfactory operation of shut off and retracting arrangement. <p>As a part of the Quality Assurance Plan, where possible as per facility available at bidder's work, bidder may demonstrate the power consumption also of each agitator at shop with the available fluid along with relevant calculation to establish the correlation with the slurry used for the project, apart from necessarily demonstrating power requirement at site.</p> <p>Please also refer sl no 9 below.</p>					
9		In case of any constraints in carrying out shop tests indicated at S.No. 7 & 8 above, the Mechanical run tests for agitators shall be carried out with air/water at shop along with other test requirement in line with the QAP to be approved by customer during detail engineering.					
9A		<p>Acceptance Test (at Site) After the agitator has been installed at site and is ready for test, vendor shall depute his representative to supervise the site acceptance test</p>					
10		DYNAMICS					
10.1		CRITICAL SPEED					

		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003			
		PATRATU STPP FGD PACKAGE				SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR				REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS				SHEET : 20	
10.1.1	Operation speed of the Agitator motor shall be at least 25% below the first critical speed						
10.1.2	Additional to the requirement of the critical speed of Agitator, as specified above. Agitator manufacturer is to analyze the torsional critical speed of combined system of Agitator, Gear Box and Motor to establish there is a separation margin of minimum 20% between the torsional critical speed (dry/wet) and any operating speed.						
10.2	VIBRATION SEVERITY						
10.2.1	During performance test, unfiltered vibration measurements shall be made with running of Agitator in Air. Measurement shall be taken on the Gear Box thrust bearing housings as well in motor top.						
10.2.2	Guaranteed Site vibration of the equipment on its own pedestal, at commissioning with normal level of liquid and with maximum liquid at respective tank, Vibration limit at site will be as per ISO-10816, and 1.5-2.3mm/sec even if Motor rating falls below 15kw. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.						
10.2.3	Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity.						
10.2.4	Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.						
11	For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.						
12	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.						
13	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.						
14	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.						
15	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.						
16	Out of all Agitators One Number of each type will be inspected at the Bidder's works before dispatch or where the test facilities are available.						
17	The Bidder shall conduct performance test for the remaining Agitators and submit the reports.						
18	Contract shaft mechanical seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition, if applicable.						
19	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.						
20	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.						

		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003			
		PATRATU STPP FGD PACKAGE				SECTION-C, SUB-SECTION-C1	
		TECHNICAL SPECIFICATIONS FOR				REV. 0	DATE: DEC 2021
		AGITATORS OF FGD SLURRY TANKS				SHEET : 21	
21	Bidder to arrange all calibrated gauges, Instruments during inspection.						
22	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.						
23	All testing requirement/certificates shall be in line with QAP to be approved by customer during detailed engineering.						
10	PAINTING						
1.	Painting details for agitator support: - Please refer painting specification (SECTION-C, SUB-SECTION-C2C).						
2.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope						
3.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. Bidder shall submit the painting scheme during detail Engg in line with the specification and shall be subject to approval of BHEL / End Customer.						
11	SPARES, TOOLS & TACKLES						
	Bidder shall supply a set of special tools and tackles required either for erection or operation or maintenance of the agitator units. A list of such tools shall be submitted by bidder along with the offer.						
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools (SECTION-II Annexure-7).						
11.1	START UP & COMMISSIONING SPARES						
	Start-up & Commissioning Spares shall be part of the main supply of the Agitators. Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares required for successful operation till commissioning of Agitator shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipment's are energized. The List of such spares to be provided during bidding stage (SECTION-II Annexure-9).						
11.2	RECOMMENDED SPARES						
	Bidders shall also furnish the recommended spares list along with the offer required for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment.						
11.3	MANDATORY SPARES:						
	Bidder to quote for the mandatory spares as per the Mandatory Spare list given for a						

		TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
		PATRATU STPP FGD PACKAGE TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS		SECTION-C, SUB-SECTION-C1	
				REV. 0	DATE: DEC 2021
				SHEET : 22	
		<p>specific project (SECTION-I, SUB-SECTION-D Annexure-II).</p> <p>Bidder shall quote for the “Mandatory Spares Part List”, and it will be considered for L1 evaluation. Mandatory spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written “S” mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment’s. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years’ storage in a dry weatherproof building.</p> <p>All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the mandatory spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.</p>			
12	FIRST FILL OF CONSUMABLES				
I	<p>Bidder’s scope shall include supply and filling of all chemicals, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.</p>				
II	<p>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 applicable) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.</p>				
III	<p>Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the CUSTOMER/BHEL’s approval herein shall be furnished within 2 months of placement of Order. On completion of erection, complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.</p>				
13	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:				
1.	POWER GUARANTEE				
	Bidder to specify the total guaranteed power per Agitators operating at the rated capacity in their offer				
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:				
	Refer Annexure 11 of section-II.				
14	LIQUIDATED DAMAGES FOR POWER CONSUMPTION				
1	Refer Annexure 11 of section-II.				
15	PERFORMANCE GUARANTEE				

	TITLE:	SPECIFICATION No: PE-TS-434-571-18000-A003		
	PATRATU STPP FGD PACKAGE			SECTION-C, SUB-SECTION-C1
	TECHNICAL SPECIFICATIONS FOR			REV. 0 DATE: DEC 2021
	AGITATORS OF FGD SLURRY TANKS			SHEET : 23
<p>All performance tests for Agitators shall be carried out in accordance with latest international codes/standards.</p> <p>Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories</p> <p>The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days and average target availability of 95% for 1 year.</p> <p>Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed.</p> <p>Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.</p> <p>Life of Agitator components/parts from the date of commissioning for continuous operation shall be guaranteed for 24 months.</p> <p>Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ CUSTOMER approval.</p> <p>In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.</p> <p>For additional details of performance guarantee please refer 'functional guarantee' under Sub-section C2, Section-I.</p>				
16	DOCUMENTATION			
A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER			
	<p>The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial Offer. Vendors are requested to comply with above in all respect. List of such documents have been indicated in (SECTION-II Annexure-1).</p>			
B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT			
	<p>The Successful bidder shall submit necessary data, documents and drawings for review, approval as specified in this specification. Drawings that are reviewed by the CUSTOMER/ BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. CUSTOMER/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions.</p> <p>All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by CUSTOMER must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. All documents in hard and soft form are to be submitted in the English language.</p>			

	TITLE:		SPECIFICATION No: PE-TS-434-571-18000-A003	
	PATRATU STPP FGD PACKAGE			
	TECHNICAL SPECIFICATIONS FOR			
	AGITATORS OF FGD SLURRY TANKS			
	REV. 0	DATE: DEC 2021		
SHEET : 24				

	Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per CUSTOMER requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. The list of such drawing/documents have been indicated in (SECTION-I,SUB-SECTION-D Annexure-IV).
17	LIST OF REFERENCE DRAWINGS BY BHEL
I	The drawings specified in in Annexure-III, Sub-Section-D of Section-I are being provided along with the tender specification for estimation and calculation purpose of the bidder.

784074/2022/PS-PEM-MAX



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-C2

REV. 01

DATE: DEC 2021

SHEET : 1 OF 1

CUSTOMER SPECIFICATION



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003


SECTION-I, SUB-SECTION-C2A


REV. 01

DATE: DEC 2021

SHEET : 1 OF 1

CUSTOMER SPECIFICATION: TECHNICAL REQUIREMENT

CLAUSE NO.	TECHNICAL REQUIREMENTS		
9.03.00	<p>The pumps shall be designed for continuous operation. The pump shall be single stage centrifugal type with semi open or open impeller. The pump impeller shall be cantilever type and shall not be supported below the base plate for easy withdrawal.</p>		
9.04.00	<p>The pump shall deliver the rated flow at rated head with margins as specified in the respective clauses. The pump shall be capable of pumping of filtrate water with solid concentration upto 10% & particle lumps of 6-7mm. Sump pumps handling slurry shall be designed with a maximum concentration of 30% solid by weight.</p>		
9.05.00	<p>The material chosen for the pump components shall be suitable for the fluid handled and shall be proven in similar application.</p>		
9.06.00	<p>The pumps shall not be supported below the base plate level for easy withdrawal without entering the sump.</p>		
10.00.00	SLURRY & PROCESS WATER TANKS		
10.01.00	<p>All the slurry tanks (Slurry Tanks, Filtrate Tank, Secondary hydro cyclone feed tank, vacuum receiver tank, Waste water Tank, Lime Neutralization tanks etc.) & Process water tanks (Process water Storage tanks, Clarified water Storage tanks, Emergency water storage tanks etc.) shall be designed, fabricated, erected and tested in accordance with the IS:803, latest edition. Additional Corrosion allowance of 3mm on the minimum tank shell thickness as calculated by IS:803, latest edition shall be provided by the Contractor. Tanks shall be made from IS:2062 quality mild steel plates of tested quality. The tanks shall be of welded construction. Interior surface of the tanks shall lined with replacable chlorobuty/bromobutyl rubber lining of minimum 5 mm thickness and the outside surface shall be coated with paint as approved by the Employer. The Tanks shall be provided with drain, manholes, over flow & inlet level control valves etc. Coarse-screen(s) at suction-side of these pumps shall be provided.</p>		
11.00.00	AGITATORS		
11.01.00	<p>Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the absorber vessel, limestone mill recycle tanks, limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.</p>		
11.02.00	<p>All agitators shall be designed for continuous operation unless otherwise specified. Horizontal agitators shall be used for all big tanks and vessels (especially, absorber bottom and emergency drain tank). In other vessels and tanks vertical agitators are also acceptable if they are of proven make and the Bidders standard practice which can be proven by means of suitable references. The design of the agitators shall be of proven type.</p>		
11.03.00	<p>Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, mechanical seal, impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.</p>		
11.04.00	<p>All agitator parts and accessories in contact with the stirred fluid shall be constructed</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.:CS-9585-001-2</p>	<p>SUB-SECTION-A-05 (FGD)</p>	<p>PAGE 25 OF 37</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion.</p>			
11.05.00	<p>The material for the shaft and agitator blades of the Absorber Agitators and for Agitators in other tanks shall be in accordance with Alloy 926 or better. This does not release the Contractor of the responsibility for selecting the correct materials.</p>			
11.06.00	<p>Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation. It shall be possible to remove the sealing devices of the Agitators of the absorber vessel without having to drain completely the absorber.</p>			
11.07.00	<p>To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.</p>			
11.08.00	<p>Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.</p>			
11.09.00	<p>Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.</p>			
11.10.00	<p>All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.</p>			
11.11.00	<p>All exposed moving parts shall be covered by guards.</p>			
11.12.00	<p>Side entry agitator shall be flange mounted.</p>			
11.13.00	<p>The shape of the impeller blades of side entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.</p>			
11.14.00	<p>Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions</p>			
12.00.00	SLURRY LINES AND VALVES			
12.01.00	<p>Slurry pipes shall be designed to keep the velocity above the settling velocity under all operating conditions. The contractor may provide a recirculation line with motorized isolation valve for the above purpose.</p>			
12.02.00	<p>All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The Contractor can provide slurry pipes of size lower than 3" made up of abrasion resistant FRP material (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same.</p>			
12.03.00	<p>The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type unless specifically mentioned. Motorized actuators shall be provided for valves requiring frequent operation as indicated in the relevant scheme.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.:CS-9585-001-2</p>	<p>SUB-SECTION-A-05 (FGD)</p>	<p>PAGE 26 OF 37</p>	



TITLE:

**PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS**

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-C2B

REV. 01

DATE: DEC 2021

SHEET : 1 OF 1

**CUSTOMER SPECIFICATION: PROJECT SPECIFIC
GENERAL REQUIREMENTS**



TITLE:
**PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS**

SPECIFICATION No: PE-TS-434-571-18000-A001

SECTION-I, SUB-SECTION-C2B

REV. 01

DATE: DEC 2021

SHEET : 1 OF 1

**CUSTOMER SPECIFICATION : GENERAL
TECHNICAL REQUIREMENTS**



PART - C

GENERAL TECHNICAL REQUIREMENTS

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

CONTENTS

Clause No.	Description	Page No.
1.00.00	Introduction	1
2.00.00	Brand Name	1
3.00.00	Base Offer & Alternate Proposals	1
4.00.00	Completeness of Facilities	1
5.00.00	Codes & Standards	2
6.00.00	Equipment Functional Guarantee	4
7.00.00	Design of Facilities/ Maintenance & Availability Considerations	5
8.00.00	Documents, Data and Drawings to be furnished by Contractor	6
9.00.00	Technical Co-ordination Meeting	22
10.00.00	Design Improvements	22
11.00.00	Equipment Bases	23
12.00.00	Protective Guards	23
13.00.00	Lubricants, Servo fluids and Chemicals	23
14.00.00	Lubrication	24
15.00.00	Material of Construction	24
16.00.00	Rating Plates, Name Plates & Labels	24
17.00.00	Tools and Tackles	25
18.00.00	Welding	25

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.	Description	Page No.
19.00.00	Colour Code for All equipments/Pipings/PIPE Services	26
20.00.00	Protection and Preservative shop Coating	26
21.00.00	Quality Assurance Programme	27
22.00.00	General Requirements - Quality Assurance	28
23.00.00	Quality Assurance Documents	33
24.00.00	Project Manager's Supervision	35
25.00.00	Inspection, Testing and Inspection Certificates	36
26.00.00	Pre-commissioning and Commissioning Facilities	39
27.00.00	Taking over	42
28.00.00	Training of Employer's Personnel	42
29.00.00	Safety Aspects during Construction and Erection	44
30.00.00	Noise Level	44
31.00.00	Packaging and Transportation	45
32.00.00	Electrical Equipments/Enclosures	45
33.00.00	Instrumentation and Control	45
34.00.00	Electrical Noise Control	46
35.00.00	Surge protection for solid state equipment	47
36.00.00	Instrument Air System	47
37.00.00	Tapping Points for Measurements	47
38.00.00	System Documentation	47
39.00.00	Maintenance Manuals of Electronic Modules	48


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.	Description	Page No.
	Annexure - I	78
	Annexure - II	79
	Annexure - III	80
	Annexure - IV	81
	Annexure - V	82
	Annexure - VI	83
	Annexure - VII	85
	Annexure - VIII	92
	Annexure - IX	103
	Annexure - X	106
	Annexure - XI	107
	Annexure - XII	109


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	<p>INTRODUCTION</p> <p>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.</p>			
2.00.00	<p>BRAND NAME</p> <p>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.</p>			
3.00.00	<p>BASE OFFER & ALTERNATE PROPOSALS</p> <p>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.</p>			
4.00.00	<p>COMPLETENESS OF FACILITIES</p>			
4.01.00	<p>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.</p>			
4.02.00	<p>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.</p> <p>All same standard components/ parts of same equipment provided, shall be interchangeable with one another.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 1 OF 111</p>


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	<p>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 :</p> <ul style="list-style-type: none"> 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 			
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 2 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
5.02.00	<p>(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981</p> <p>(r.) Workmen's Compensation Act, 1923</p> <p>(s.) Workmen's Compensation Rules, 1924</p> <p>(t.) NTPC Safety Rules for Construction and Erection</p> <p>(u.) NTPC Safety Policy</p> <p>(v.) Any other statutory codes / standards / regulations, as may be applicable.</p> <p>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 :</p> <p>a) Bureau of Indian standards (BIS)</p> <p>b) Japanese Industrial Standards (JIS)</p> <p>c) American National Standards Institute (ANSI)</p> <p>d) American Society of Testing and Materials (ASTM)</p> <p>e) American Society of Mechanical Engineers (ASME)</p> <p>f) American Petroleum Institute (API)</p> <p>g) Standards of the Hydraulic Institute , U.S.A.</p> <p>h) International Organization for Standardization (ISO)</p> <p>i) Tubular Exchanger Manufacturer's Association (TEMA)</p> <p>j) American Welding Society (AWS)</p> <p>k) National Electrical Manufacturers Association (NEMA)</p> <p>l) National Fire Protection Association (NFPA)</p> <p>m) International Electro-Technical Commission (IEC)</p> <p>n) Expansion Joint Manufacturers Association (EJMA)</p> <p>o) Heat Exchange Institute (HEI)</p> <p>p) IEEE standard</p>			
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 3 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
5.03.00	<p>q) JEC standard</p> <p>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.</p>		
5.04.00	<p>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.</p>		
5.05.00	<p>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.</p>		
5.06.00	<p>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.</p>		
5.07.00	<p>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.</p>		
5.08.00	<p>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.</p>		
6.00.00	<p>EQUIPMENT FUNCTIONAL GUARANTEE</p>		
6.01.00	<p>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.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 4 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
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	<p>DESIGN OF FACILITIES</p> <p>All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.</p> <p>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.</p>		
7.02.00	<p>MAINTENANCE AND AVILABILITY CONSIDERATIONS</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>		
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 5 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR			
8.01.00	<p>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.</p> <p>The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.</p> <p>A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.</p>			
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	<p>A) BASIC ENGINEERING DOCUMENTATION</p> <p>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:</p> <ul style="list-style-type: none"> 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. 			
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 6 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.</p> <p>vii) Water Balance diagram.</p> <p>viii) Operation Philosophy and the control philosophy of the Main Plant and other plants.</p> <p>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.</p> <p>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.</p> <p>xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.</p> <p>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.</p> <p>B) DETAILED ENGINEERING DOCUMENTS</p> <p>i) General layout plan of the station.</p> <p>ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.</p> <p>iii) Flow diagram, process and instrumentation diagrams along with write up and system description.</p> <p>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.</p> <p>v) Piping isometric, composite layout and fabrication drawings.</p> <p>vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 7 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>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.</p> <p>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.</p> <p>ix) Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.</p> <p>x) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes..</p> <p>xi) Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).</p> <p>xii) Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.</p> <p>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.</p> <p>xiv) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.</p> <p>xv) Protection system diagrams and relay settings.</p> <p>xvi) Cables schedules and interconnection diagrams.</p> <p>xvii) Cable routing plan.</p> <p>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.</p> <p>xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.</p>		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 8 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.03.02	<p>xx) Sequence and protection interlock schemes.</p> <p>xxi) Type test reports, insulation co-ordination study report and power system stability study report.</p> <p>xxii) Control system configuration diagrams and card circuit diagrams and maintenance details.</p> <p>xxiii) Detailed DDCMIS system manuals.</p> <p>xxiv) Detailed flow chart for digital control system.</p> <p>xxv) Mimic diagram layout, Assignment for other application engg.</p> <p>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.</p> <p>xxvii) Underground facilities, levelling ,sanitary, land scaping drawings.</p> <p>xxviii) Geotechnical investigation and site survey reports (if and as applicable).</p> <p>xxix) Model study reports wherever applicable.</p> <p>xxx) Functional & guarantee test procedures and test reports.</p> <p>xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.</p> <p>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.</p> <p>INSTRUCTION MANUALS</p> <p>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</p>			
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 9 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.</p> <p>A) ERECTION MANUALS</p> <p>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.</p> <ol style="list-style-type: none"> 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. <p>B) OPERATION & MAINTENANCE MANUALS</p> <ol style="list-style-type: none"> 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 			
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 10 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>manufacturers shall be typewritten with a margin on the left hand side.</p> <p>b) The arrangement and contents of O & M manuals shall be as follows :</p> <p>1) <u>Chapter 1 - Plant Description</u> : To contain the following sections specific to the equipment/system supplied</p> <p>(a) Description of operating principle of equipment / system with schematic drawing / layouts.</p> <p>(b) Functional description of associated accessories / controls. Control interlock protection write up.</p> <p>(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).</p> <p>(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.</p> <p>(e) Design data against which the plant performance will be compared.</p> <p>(f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.</p> <p>(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).</p> <p>(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).</p> <p>2) <u>Chapter 2.0 - Plant Operation</u>: To contain the following sections specific to the equipment supplied</p> <p>(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.</p> <p>(b) Limiting values of all protection settings.</p> <p>(c) Various settings of annunciation/interlocks provided.</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 11 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.</p> <p>(e) Do's and Don'ts related to operation of the equipment.</p> <p>(f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.</p> <p>(g) Parameters to be monitored with normal value and limiting values.</p> <p>(h) Equipment isolating procedures.</p> <p>(i) Trouble shooting with causes and remedial measures.</p> <p>(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.</p> <p>(k) Routine Operational Checks, Recommended Logs and Records</p> <p>(l) Change over schedule if more than one auxiliary for the same purpose is given.</p> <p>(m) Preservation procedure on long shut down.</p> <p>(n) System/plant commissioning procedure.</p> <p>3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied.</p> <p>(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population.</p> <p>(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.</p> <p>(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.</p> <p>(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.</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 12 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
8.03.03	<p>(e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.</p> <p>(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.</p> <p>(g) Long term maintenance schedules</p> <p>(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.</p> <p>(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..</p> <p>(j) Tolerance for fitment of various components.</p> <p>(k) Details of sub vendors with their part no. in case of bought out items.</p> <p>(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.</p> <p>(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.</p> <p>(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.</p> <p>(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.</p> <p>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.</p> <p>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</p>		
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 13 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.</p>			
8.03.03	<p>PLANT HANDBOOK AND PROJECT COMPLETION REPORT</p>			
8.03.03.01	<p>PLANT HANDBOOK</p> <p>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</p> <ul style="list-style-type: none"> 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 <p>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.</p>			
8.03.03.02	<p>PROJECT COMPLETION REPORT</p> <p>The Contractor shall submit a Project Completion Report at the time of handing over the plant.</p>			
8.03.04	<p>DRAWINGS</p> <ul style="list-style-type: none"> 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. 			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 14 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p> <p>Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site.</p> <p>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.</p> <p>iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per Annexure-VI of Part-C.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>			
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 15 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>b) All documents/text information shall be in latest version of MS Office/MS Excel/PDF format as applicable.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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".</p> <p>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.</p> <p>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</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 16 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>j) As Built Drawings</p> <p>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.</p> <p>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</p>			
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 17 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.04.00	<p>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.</p> <p>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.</p> <p>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.</p> <p>ENGINEERING INFORMATION SUBMISSION SCHEDULE</p> <p>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.</p> <p>i) Information that shall be submitted for the approval to the Employer before proceeding further, and</p> <p>ii) Information that would be submitted for Employer's information only.</p> <p>The Master Drawing List(MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL.</p> <p>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.</p>			
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 18 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
<p>8.05.00</p> <p>8.05.01</p> <p>8.05.02</p> <p>8.05.03</p>	<p>Engineering Co-ordination Procedure</p> <p>The following principal coordinators will be identified by respective organizations at time of award of contract :</p> <p>NTPC Engineering Coordinator (NTPC EC) :</p> <p>Name : _____</p> <p>Designation : _____</p> <p>Address : _____</p> <p>a) Postal : _____</p> <p>b) Telegraphic / e-Mail : _____</p> <p>c) FAX : _____ TELEPHONE : _____</p> <p>Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):</p> <p>Name : _____</p> <p>Designation : _____</p> <p>Address : _____</p> <p>a) Postal : _____</p> <p>b) Telegraphic / e-Mail : _____</p> <p>c) FAX : _____ TELEPHONE : _____</p> <p>All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.</p> <p>Contractor's/Vendor's Drawing Submission and Approval Procedure :</p> <p>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".</p> <p>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.</p>	
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p> <p>PAGE 19 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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 :</p> <p>CATEGORY- I: Approved</p> <p>CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.</p> <p>CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.</p> <p>CATEGORY -IV For information and records.</p>			
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 20 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>h) Contractor shall resubmit the drawings approved under Category II, III & IVR 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>l) These comments will be taken care by the contractor while submitting the revised drawing.</p> <p>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.</p>			
8.06.00	ENGINEERING PROGRESS AND EXCEPTION REPORT			
8.06.01	<p>The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including</p> <p>a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission</p> <p>b) Drawings which were not submitted as per agreed schedule.</p>			
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 21 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.06.02	<p>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.</p>			
9.00.00	<p>TECHNICAL CO-ORDINATION MEETING</p>			
9.01.00	<p>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.</p>			
9.02.00	<p>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.</p>			
9.02.01	<p>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.</p>			
9.02.02	<p>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.</p>			
9.03.0	<p>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.</p>			
10.00.00	<p>DESIGN IMPROVEMENTS</p> <p>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.</p> <p>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.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 22 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
11.00.00	<p>Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.</p> <p>EQUIPMENT BASES</p> <p>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.</p>			
12.00.00	<p>PROTECTIVE GUARDS</p> <p>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.</p>			
13.00.00	<p>LUBRICANTS, SERVO FLUIDS AND CHEMICALS</p>			
13.01.00	<p>All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids, gases (excluding H₂, CO₂ and N₂ 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.</p> <p>Bidder scope shall also include supply of H₂, CO₂ and N₂ as applicable for the generator till successful commissioning of generator.</p> <p>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.</p>			
13.02.00	<p>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.</p> <p>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.</p>			
14.00.00	<p>LUBRICATION</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 23 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
14.01.00	<p>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.</p>		
15.00.00	<p>MATERIAL OF CONSTRUCTION</p>		
15.01.00	<p>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.</p>		
16.00.00	<p>RATING PLATES, NAME PLATES & LABELS</p>		
16.01.00	<p>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.</p>		
16.02.00	<p>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.</p>		
16.03.00	<p>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.</p>		
16.04.00	<p>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.</p>		
16.05.00	<p>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.</p>		
16.06.00	<p>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.</p>		
16.07.00	<p>Safety and relief valves shall be provided with the following:</p> <p>a) Manufacturer's identification.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 24 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	b) Nominal inlet and outlet sizes in mm. c) Set pressure in Kg/cm ² (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	<p>TOOLS AND TACKLES</p> <p>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.</p> <p>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.</p>		
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		
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 25 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
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.			
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 26 OF 111	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
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	<p>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:</p> <ol style="list-style-type: none"> 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. 		
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 27 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	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			
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 28 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p>			
22.05.00	<p>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.</p>			
22.06.00	<p>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.</p>			
22.07.00	<p>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).</p>			
22.08.00	<p>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</p>			
22.09.00	<p>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.</p> <p>All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.</p>			
22.10.00	<p>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.</p>			
22.11.00	<p>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</p>			
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 29 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	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..			
22.18.00	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			
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 30 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p>			
22.19.00	<p>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.</p>			
22.20.00	<p>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.</p>			
22.21.00	<p>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.</p>			
22.22.00	<p>For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.</p>			
22.23.00	<p>Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.</p>			
22.24.00	<p>Environmental Stress Screening</p> <p>All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 31 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> एनटीपीसी NTPC </div> <p>contractor / sub – contractor should meet the following.</p> <p>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.</p> <p style="text-align: center;">Or</p> <p>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.</p> <p><u>Elevated Temperature Test Cycle</u></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>2) <u>Burn in Test Cycle</u></p> <p>The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.</p> <p>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.</p> <p>During the above tests, the process I/O and other load on the system shall</p>		
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 32 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
22.25.00	<p>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.</p> <p>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.</p> <p>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.</p>			
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	<p>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.</p> <p>The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.</p> <p>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.</p>			
23.02.00	<p>Typical contents of QA Documentation is as below:-</p> <p>(a.) Quality Plan</p> <p>(b.) Material mill test reports on components as specified by the specification and approved Quality Plans.</p> <p>(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.</p> <p>(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.</p>			
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 33 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	(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.			
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 34 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
23.05.00	<p>TRANSMISSION OF QA DOCUMENTATION</p> <p>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.</p> <p>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.</p>	
24.00.00	<p>PROJECT MANAGER'S SUPERVISION</p>	
24.01.00	<p>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.</p>	
24.02.00	<p>The work shall be performed under the supervision of the Project Manager.</p> <p>The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:</p> <ul style="list-style-type: none"> (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. 	
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p> <p align="right">PAGE 35 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
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			
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 36 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p>			
25.07.00	<p>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.</p>			
25.08.00	<p>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.</p>			
25.09.00	<p>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.</p>			
25.10.00	<p>Associated document for Quality Assurance programme</p>			
25.10.01	<p>Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at Annexure-I.</p>			
25.10.02	<p>Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at Annexure-II.</p>			
25.10.03	<p>List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III).</p>			
25.10.04	<p>Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV.</p>			
25.10.05	<p>Field Welding Schedule Format enclosed at Annexure-V.</p>			
25.11.00	<p>TESTING OF MAJOR DESIGN FEATURES:</p> <p>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</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 37 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>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.</p> <p>a) System accuracy tests of DDCMIS for the various type of inputs identified in Part-B.</p> <p>b) Loop reaction time for sample loops/ logics.</p> <p>c) SOE functionality tests.</p> <p>d) Server changeover.</p> <p>e) Various response times, having serious implication on operation & maintenance philosophy.</p> <p>f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load.</p> <p>g) Unified HMI for DDCMIS.</p> <p>The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer.</p> <p>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.</p>			
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING			
25.12.01	<p>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.</p> <p>(i) Logics/Loops:</p> <p>a) Drive logics implementation for each type of binary drive along with its display in HMI.</p>			
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 38 OF 111	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA.</p> <p>ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA.</p> <p>iii) Mill noise which will be limited to 85-90 dBA.</p> <p>iv) TG unit in which case it shall not exceed 90 dBA.</p> <p>v) For HP-LP bypass valves and other intermittantly operating control valves, the noise level shall be within the limit of 90 dBA.</p> <p>vi) For BFP Motor Noise level shall be with in the limit of 90 dBA.</p>			
31.00.00	<p>PACKAGING AND TRANSPORTATION</p> <p>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.</p>			
32.00.00	<p>ELECTRICAL EQUIPMENTS/ENCLOSURES</p>			
32.01.00	<p>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.</p>			
33.00.00	<p>INSTRUMENTATION AND CONTROL</p> <p>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.</p>			
33.01.00	<p>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.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 45 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	
	<p>All scales and charts shall be calibrated and printed in Metric Units as follows:</p> <ol style="list-style-type: none"> 1. Temperature - Degree centigrade (deg C) 2. Pressure - 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. 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. 	
33.02.00	<p>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.</p>	
33.03.00	<p>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.</p>	
34.00.00	<p>ELECTRICAL NOISE CONTROL</p> <p>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).</p>	
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p> <p align="right">PAGE 46 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
35.00.00	<p>SURGE PROTECTION FOR SOLID STATE EQUIPMENT</p> <p>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.</p>			
36.00.00	<p>INSTRUMENT AIR SYSTEM</p> <p>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.</p> <p>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.</p>			
37.00.00	<p>TAPPING POINTS FOR MEASUREMENTS</p> <p>Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.</p> <p>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.</p> <p>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.</p> <ul style="list-style-type: none"> i) Temperature test pockets with stub and thermowell ii) Pressure test pockets 			
38.00.00	<p>SYSTEM DOCUMENTATION</p> <p>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</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>		<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 47 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
38.01.00	<p>documentation requirements for C&I systems shall be as stipulated under C&I "Technical 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.</p> <p>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.</p> <p>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.</p>			
39.00.00	<p>MAINTENANCE MANUALS OF ELECTRONIC MODULES</p>			
	<p>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.</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 48 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
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)	
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 49 OF 111	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
			(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)		
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 50 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
		<p>conductivity of thermal insulation materials (two slab guarded hot plate method)</p> <p>IS:3354 Outline dimensions for electric lifts.</p> <p>IS:3401 Silica gel</p> <p>IS:3588 Specification for electrical axial flow fans</p> <p>IS:3589 Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diameter)</p> <p>IS:3677 Unbonded rock and slag wool for thermal insulation</p> <p>IS:3815 Point hook with shank for general engineering purposes</p> <p>IS:3895 Specification for monocrystalline semiconductor rectifier cells and stacks</p> <p>IS:3963 Roof extractor unit</p> <p>IS:3975 Mild steel wires, strips and tapes for armouring cables</p> <p>IS:4503 Shell and tube type heat Exchanger</p> <p>IS:4540 Specification for monocrystalline rectifier assembly</p>	<p>ASTM C 163-1964 (American Society of Testing and materials)</p> <p>ASTM C 167-1974</p> <p>ASTM C 177-1963</p> <p>BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)</p>
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p>GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 51 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
		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.	
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 52 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers.</p> <p>ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors.</p> <p>ARI-450-6 Standard for water cooled refrigerant condensers.</p> <p>ARI-550 Standard for centrifugal water chilling packages.</p> <p>ARI-410 Standard for forced circulation air cooling and air heating coils</p> <p>ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2)</p> <p>BS:400 Low carbon steel cylinders for the storage & transport of permanent gases.</p> <p>BS:401 Low carbon steel cylinders for the storage & transport of liquified gases.</p> <p>CTI Code Acceptance test code for Water Cooling Tower. ACT-105</p> <p>ANSI-31.5 Refrigerant piping</p> <p>ASME-PTC- Atmospheric Water Cooling Equipment 23-1958</p> <p>AMCA A-21C Test Code for air moving devices</p> <p>API:618 Reciprocating Compressor for general refinery services.</p> <p>HYDRAULIC INSTITUTE STANDARDS.</p> <p>HYDRANT SYSTEM MANUALS OF TAC.</p> <p>TAC MANUALS OF SPRAY SYSTEM</p> <p>NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.</p> <p>INDIAN EXPLOSIVES ACT.</p> <p>INDIAN FACTORIES ACT.</p> <p>STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.</p>		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 53 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>CODE AND STANDARD FOR CIVIL WORKS</p> <p>Some of the applicable Standards, Codes and references are as follows:</p> <p>Excavation & Filling</p> <p>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.</p> <p>IS: 4701 Code of practice for earth work on canals.</p> <p>IS: 9758 Guide lines for Dewatering during construction.</p> <p>IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.</p> <p>Properties, Storage and Handling of Common Building Materials</p> <p>IS: 269 Specification for ordinary Portland cement, 33 grade.</p> <p>IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.</p> <p>IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.</p> <p>IS: 455 Specification for Portland slag cement.</p> <p>IS: 702 Specification for Industrial bitumen.</p> <p>IS: 712 Specification for building limes.</p> <p>IS: 808 Rolled steel Beam channel and angle sections.</p> <p>IS: 1077 Specification for common burnt clay building bricks.</p> <p>IS: 1161 Specification of steel tubes for structural purposes.</p> <p>IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.</p> <p>IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.</p> <p>IS: 1367 Technical supply conditions for Threaded fasteners.</p> <p>IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 54 OF 111</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	(Part-II) IS: 1542 IS: 1566 IS: 1786 IS: 2062 IS: 2116 IS: 2386 (Parts-I to VIII) IS: 3150 IS: 3495 (Parts-I to IV) IS: 3812 IS: 4031 IS: 4032 IS: 4082 IS: 8112 IS: 8500 IS: 12269 IS: 12894 Cast-In-Situ Concrete and Allied Works IS: 280 IS: 456	Calcined clay based. Specification for sand for plaster. Specification for hard-drawn steel wire fabric for concrete reinforcement. Specification for high strength deformed bars for concrete reinforcement. Specification for steel for general structural purposes. Specification for sand for masonry mortars. Testing of aggregates for concrete. Hexagonal wire netting for general purpose. Methods of tests of burnt clay building bricks. Specification for fly ash, for use as pozzolana and admixture. Methods of physical tests for hydraulic cement. Methods of chemical analysis of hydraulic cement. Recommendations on stacking and storage of construction materials at site. Specification for 43 grade ordinary portland cement. Medium and high strength structural steel. 53 grade ordinary portland cement. Specification for Fly ash lime bricks. Specification for mild steel wire for general engineering purposes. Code of practice for plain and reinforced 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	PAGE 55 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	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	
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 56 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part I to IV) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 concrete work. IS: 5624 IS: 6461 IS: 6494 IS: 6509 IS: 7861 IS: 9012 IS: 9103	liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced Specification for foundation bolts. Glossary of terms relating to cement concrete. Code of practice for water proofing of underground water reservoirs and swimming pools. Code of practice for installation of joints in concrete pavements. Code of practice for extreme weather concreting. (Parts I & II) Recommended practice for shot concreting. 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	PAGE 57 OF 111


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS: 9417		Recommendations for welding cold worked steel bars for reinforced concrete construction.	
IS: 10262		Recommended guidelines for concrete mix design.	
IS: 11384		Code of practice for composite construction in structural steel and concrete.	
IS: 11504		Criteria for structural design of reinforced concrete natural draught cooling towers.	
IS: 12118		Specification for two-parts poly sulphide.	
IS: 12200		Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.	
IS: 13311		Method of non-destructive testing of concrete.	
Part-1		Ultrasonic pulse velocity.	
Part-2		Rebound hammer.	
SP:23		Handbook of concrete mixes	
SP: 24		Explanatory Handbook on IS: 456-1978	
SP: 34		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.	
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 58 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.	
	SP: 20	Explanatory hand book on masonry code.	
	Sheeting Works		
	IS:277	Galvanised steel sheets (plain or corrugated).	
	IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.	
	IS: 513	Cold-rolled carbon steel sheets.	
	IS: 730	Specification for fixing accessories for corrugated sheet roofing.	
	IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.	
	IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.	
	IS: 3007	Code of practice for laying of asbestos cement sheets.	
	IS: 5913	Methods of test for asbestos cement products.	
	IS: 7178	Technical supply conditions for tapping screw.	
	IS: 8183	Bonded mineral wool.	
	IS: 8869	Washers for corrugated sheet roofing.	
	IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.	
	IS: 12866	Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced).	
	IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.	
	Fabrication and Erection of Structural Steel Work		
	IS: 2016	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		
	IS: 814 IS: 1852 IS: 3502 IS: 6911 IS: 3757 IS: 6623 IS: 6649 IS: 800 IS: 816 IS: 4000 IS: 9595 IS: 817 IS: 1811 IS: 9178 IS: 9006 IS: 7215 IS: 12843 IS: 4353 SP: 6 (Part 1 to 7)	Specification for covered Electrodes for Metal Arc Welding for weld steel. Specification for Rolling and Cutting Tolerances for Hot rolled steel products. Specifications for chequered plate. Specification for stainless steel plate, sheet and strip. Specification for high strength structural bolts Specification for high strength structural nuts. High Tensile friction grip washers. Code of practice for use of structural steel in general building construction. Code of practice for use of Metal Arc Welding for General Construction. Code of practice for assembly of structural joints using high tensile friction grip fasteners. Code of procedure of Manual Metal Arc Welding of Mild Steel. Code of practice for Training and Testing of Metal Arc Welders. Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes). Criteria for Design of steel bins for storage of Bulk Materials. Recommended Practice for Welding of Clad Steel. Tolerances for fabrication steel structures. Tolerance for erection of structural steel. Recommendations for submerged arc welding of mild steel and low alloy steels. 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		
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.	
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</p>	<p align="center">GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 62 OF 111</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
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: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.	
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 66 OF 111

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		एनटीपीसी NTPC
	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 (Part-I)	Specification for plastic emulsion paint-for exterior use	
	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 (Part-I TO V)	Code of practice for design and construction of machine 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 Part-I Part-II IS:12070 DIN:4024 VDI:2056 VDI:2060 Stop Log and Trash Rack IS:4622 IS:5620 IS:11388 IS:11855 Roads IRC:5 IRC:14 IRC:16 IRC:19 IRC:21 IRC:34 IRC:36 IRC:37 IRC:56 IRC:73 IRC:86	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Shallow foundations. Deep foundations. Code of practice for design and construction of shallow foundations on rocks. Flexible supporting structures for machines with rotating machines. Criteria for assessing mechanical vibrations of machines. Criteria for assessing rotating imbalances in machines. Recommendations for fixed - wheel gates structural design. Recommendations for structural design criteria for low head slide gates. Recommendations for design of trash rack for intakes. General requirements for rubber seals for hydraulic gates. Standard specifications and Code of practice for road bridges, section-I general Features of Design. Recommended practice of 2cm thick bitumen and tar carpets. Specification for priming of base course with bituminous primers. Standard specifications and code of practice for water bound macadam. Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). Recommendations for road construction in waterlogged areas. Recommended practice for the construction of earth embankments for road works. Guidelines for the Design of flexible pavements. Recommended practice for treatment of embankment slopes for erosion control. Geometric design standards for rural (non-urban) highways. 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 - Public- ation 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. National Building Code of India Hand book on functional requirements of buildings (other than industrial buildings)	
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			
	<p>Miscellaneous</p> <p>IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers.</p> <p>IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.</p> <p>IS:10430 Creteria for design of lined canals and liner for selection of type of lining.</p> <p>IS:11592 Code of practice for selection and design of belt conveyors.</p> <p>IS:12867 PVC handrails covers.</p> <p>CIRIA Design and construction of buried thin-wall pipes.</p> <p>Publication</p> <p>REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION</p> <p>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.</p> <p>Temperature Measurements</p> <ol style="list-style-type: none"> 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measurement by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848. <p>Pressure Measurements</p> <ol style="list-style-type: none"> 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). b) Electronic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134. 			
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 71 OF 111	

ANNEXURE-I

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

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	**	10.	11.	
<p>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 COLUMN "N" AS ' W'</p>													
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE		 FOR NTPC USE		DOC. NO.: REV..... CAT.....		APPROVED BY APPROVAL SEAL		REVIEWED BY	

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-III

	Project Package Supplier Contractor No.	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:
			SUB-SYSTEM :					REV. NO.:
								DATE :
								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-V


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	Spec. No.	ACC Norm Ref.	Remarks
											Temp.	Holding time					
<p>Project : _____ Stage : _____</p> <p>Contractor : _____</p> <p>Contractor No. : _____</p> <p>System : _____</p> <p>FIELD WELDING SCHEDULE (To be raised by the contractor)</p> <p>Welding Code:</p>																	
<p>DOC. NO.:</p> <p>REV. NO.:</p> <p>DATE :</p> <p>PAGE : OF</p>																	
<p>NOTES:</p>																	
<p>SIGNATURE</p>																	
<p>FORMAT</p>																	

1/1

Engg. Div. / QA&I

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

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
	S.No	Description of Drgs/Docs	No of Prints	No of 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) ▪ Other Drawings/Documents (A0&A1 sizes) ▪ P&ID (All sizes) a) Final drawings/documents (Directly to site) b) "As Built" Drawing/Documents (Directly to site) c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	4 2 4 6 6 2	- - - 2 2 2	
2	Erection Manual (Directly to site)	4 sets	2	
3	Operation & Maintenance manual i) First Submission	1 set	--	
	ii) Final Submission (Directly to site)	4 sets	2	
4	Plant Hand Book i) First Submission	1	1	
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--	
	ii) Final Submission (Directly to site)	4 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	PAGE 83 OF 111

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
S.No	Description of Drgs/Docs	No of Prints	No of ROMs/DVDs/Portable Hard Disk	CD
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	PAGE 84 OF 111	



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-
A003


SECTION-I, SUB-SECTION-C2B


REV. 01


DATE: DEC 2021

SHEET : 1 OF 1

**PROJECT SPECIFIC GENERAL REQUIREMENTS
INCLUDING: QUALITY ASSURANCE**

CLAUSE NO.	QUALITY ASSURANCE 		
1.08.00	STRUCTURES , DUCTS, HOPPERS:		
1.08.01	All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.		
1.08.02	Visual inspection of all welds shall be performed in accordance with AWS D1.1.		
1.08.03	NDT requirements of structural steel welds shall be as under:		
	i) 100% RT/UT on butt-welds of plate thickness ≥ 32 mm. ii) For plates of $25\text{mm} \leq \text{thickness} < 32\text{mm}$ - 10% RT and 100% MPI. iii) For plates of thickness $< 25\text{mm}$ - 10% MPI/LPI.		
1.08.04	Edge for shop and field weld shall be examined by MPI for plate thickness ≥ 32 mm.		
1.09.00	VACUUM BELT FILTER SYSTEM:		
1.09.01	Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.		
1.09.02	UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.		
1.09.03	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.		
1.09.04	Filter cloths and belts shall be tested for physical properties as per relevant standard		
1.09.05	Hydro cyclones shall be checked by visual, dimensional etc.		
1.10.00	SPRAY NOZZLES:		
1.10.01	Spray nozzles shall be tested for physical properties		
1.10.02	Spray nozzles also shall be subjected to performance test.		
1.11.00	AGITATORS:		
1.11.01	Rubber lining shall be tested for hardness and spark test		
1.11.02	Impellers shall be tested for dimensional and balancing check		
1.11.03	Gear Boxes shall be tested for run test as per standard practice		
1.12.00	FANS:		
1.12.01	Rotor components shall be subjected to ultrasonic test at mill and magnetic particle inspection / liquid penetrant examination after rough machining.		
1.12.02	Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving.		
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-04 FGD SYSTEM	Page 3 of 4

CLAUSE NO.	QUALITY ASSURANCE 		
1.12.03	All rotating components and assemblies of fan shall be balanced dynamically		
1.12.04	Performance test shall be carried out on fans as per Technical specification/ Relevant standard		
1.12.05	Test for Natural Frequency and hardness of Fans blades shall be carried out as per Technical specification/ Relevant standard		
1.13.00	<p>Thermal Insulation, Lagging & Cladding:</p> <p>(a) Lightly resin bonded mineral wool:</p> <p>LRB mattresses/sections of Rockwool/ Glasswool shall conform to & tested as per relevant clauses of Indian Standards and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Steam Generator & Auxiliaries.</p> <p>(b) Lagging & Cladding:</p> <p>All insulation shall be protected by means of an outer covering of Aluminium sheeting confirming to ASTM B-209-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.</p>		
1.14.00	OTHER CRITICAL EQUIPMENTS:		
1.14.01	Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.		
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-04 FGD SYSTEM	Page 4 of 4

CLAUSE NO.	QUALITY ASSURANCE 		
	<p>(b.) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out.</p> <p>(c.) All welds shall be subjected to 100% magnetic particle/dye penetrant check and butt welds shall be subjected to 100% radiographic testing.</p> <p>(d.) All the bellows subjected to vacuum service shall be subjected to vacuum test.</p> <p>(e.) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.</p> <p>(f.) The testing of MEJ shall be as per Expansion joint Manufacturer Association (EJMA) standard.</p>		
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-06 POWER CYCLE PIPING	Page 5 of 5

QUALITY ASSURANCE

10. Atmospheric Storage Tanks/ Pressure Vessels	Y ^a	Y	Y ^d	Y ^e	Y	Y ^g	Y	Y ^h	Y	Y ⁱ	Y ^c	Y ^f	Remarks
Tests/Check	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd.	Data Sheets	Other Tests		
Items / Components	Y ^a	Y	Y ^b	Y	Y	Y	Y	Y	Y	Y	Y ^g	Y ^f	
11. Rubber lining	Y ^a				Y				Y		Y ^g	Y ^f	Y ^f Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code.
12. Butterfly valves(HP)	Y ^a			Y	Y		Y	Y	Y				Y ^g RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.
13. Ball valves(HP)	Y ^a			Y	Y		Y	Y	Y				Y ^g Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.
12. Resins / Activated Carbon Filter	Y ^a	Y	Y ^b	Y	Y				Y		Y ^h		Y ^g Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
14. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y	Y ^h	Y	Y	Y		Y ^h		Y ^h One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.
15. Pipes (Fabricated)	Y ^a	Y	Y	Y	Y	Y	Y	Y	Y		Y ^{ic}		Y ^h Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
16. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y			Y ^h	Y		Y ^{ic}		

After erection, the complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher.



SUB-SECTION-E-51

MOTORS

**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**

MOTOR

TESTS/CHECKS TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						
<p>Note:</p> <ol style="list-style-type: none"> 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW. 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard 3. Makes of major bought out items for HT motors will be subject to NTPC approval. <p>Y1 = for HT Motor / Machines only.</p>									

MOTOR

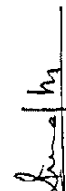

TESTS/CHECKS / ITEMS/ COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-1	vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD,CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y
<p>Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.</p> <p>2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard</p> <p>3. Makes of major bought out items for HT motors will be subject to NTPC approval. Y1 = for HT Motor / Machines only.</p>										




Agitator inspection requirement-Please note that attached QP is indicative only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).

SL. NO		COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS		TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY		REMARKS	
										M B						M C N					
1.		2.		3.		4.		5.		6.		7.		8.		9.		10.		11.	
4-2		Free Air Run Test of complete assembly		Measurement Current, RPM, Noise & Vibration		MA		Measurement		100%		Vendor Standard / Approved Drawing / Data Sheet		IR		V		P		W	
4-3		Review of QA Documents		Verification of QA Documents		MA		Verification		100%		As per Appd. MQP		IR		P		V		V	
5.0 Painting & Preservation																					
5.1				Painting Material		MI		Review of MTC		100%		Appd. "Painting Procedure"/Approved Painting Schedule		IR		V		P		V	
5.2				Surface treatment and Inspection		MI		Visual		100%		-do-		IR		V		P		-	
5.3				DFT Check		MI		Measurement		10%		-do-		IR		V		P		V	
5.4				Painting Surface Quality		MI		Visual		100%		-do-		IR		V		P		V	
6.0 Inspection before Delivery																					
6.1		Packing		Size, appearance & firmness		MI		Measurement & Visual		100%		As per "Packing Procedure"		IR		V		P		V	
6.2		Deliver Documents		Markings, Packing List & Details Packing List, etc., Check		MI		Verification		100%		As per "Packing Procedure"		IR		V		P		V	

NOTES:

- For Agitator Motor rating is 45KW and motor make NTPC/BHEL Approved source.
- Routine test report duly witnessed by main contractor as per applicable standard shall be reviewed during inspection (more than 30 KW Rating).

<p>LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR. N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS MA: MAJOR AND MI: MINOR</p>		<p>PREPARED BY</p>  <p>Rakesh Kumar Madhu, (SER/QA)</p>	<p>REVIEWED & APPROVED BY</p>  <p>K C Gandhi Parimalam, (DGM/QA)</p>
---	--	---	---

STANDARD QUALITY PLAN														
 MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU			ITEM: AGITATOR SYSTEM: FGD						QP NO FGS: 720					
									REV. NO: 00					
									DATE: 12.02.2019					
									PAGE NO: Page 1 of 2					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD			REMARKS		
					M	B			M	C	N			
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	*	11.		
1.0 Raw Material Inspection														
1.1	All materials including casting & forgings	Chem. & Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Measurement Visual	100% 100% 100%	1/Heat - -	As per spec. & Appd. Dwg	TC IR IR	V P P	V - -	V - -	Recent qualified WPS, PQR and WPQ shall be submitted for review during inspection		
2.0 Motor : Review Of Manufacture Test Certificate														
3.0 In Process Inspection														
3.1	Welding Qualifications	WPS & PQR	MA	WPS, PQR & WPQ	100%		ASME Sec IX	IR	V	P	V			
3.2	Marking, Cutting, Edge Preparation Tacking	Dimensions	MA	Measurement	100%	-	Appd.Dwg.	IR		P	-			
3.3	Welds	Dimensions & Surface Quality	MA	Measurement	100%		Appd.Dwg.& ASME Sec VIII	IR	V	P	W	V		
3.4	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%	-	Appd. Dwg.	IR		P	-			
3.5	Impeller	Static balance test	MA	Measurement	100%		As per Specs.	TR	V	P	V	V		
3.6	Rubber Lining	Hardness test & Spark test	MA	Measurement	100%		As per Specs.	TR	V	P	W	V		
3.7	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd.Drg.	IR	V	P	V	V		
4.0 Final Inspection														
4.1	Final Assembly	Overall Dimensions & Completeness	MA MA	Measurement Visual	100%	10%	Appd. Dwg	IR	V	P	W	V		
									PREPARED BY  Rakesh Kumar Madhu, (SER/QA)			REVIEWED & APPROVED BY  K C Gandhi Parimalam, (DGM/QA)		

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (V) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.
M: MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR.
N: CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS
MA: MAJOR AND **MI:** MINOR

QUALITY REQUIREMENT

- (a) Since this items comes under Sub-QR Category, hence inspection at vendor works is applicable by BHEL/BHEL TPI and NTPC as per NTPC Approved Quality plan.
- (b) Supplier shall submit the MQP in NTPC Format (Sample QP attached herewith) for approval of NTPC. Please note that attached QP is indicative and minimum requirement only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).
- (c) Painting : Painting details in the specification are minimum requirement. Painting shall be as per approved schedule which will be submitted by successful bidder during detail engg.
- (d) In case of order placed on foreign vendors, vendor has to finalize Inspection agency at their own cost and carry out inspection as per the approved Quality plan . Further, the list of third party insection agencies (as applicable) shall be provided by BHEL during detail engineering.Vendor has to furnish BHEL the inspection reports and other documents required as per approved Quality plan duly signed by the Inspection Agency after their witness for BHEL's review and acceptance.



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-C, SUB-SECTION-C2B

REV. 01

DATE: DEC 2021

SHEET : 1 OF 1


CUSTOMER SPECIFICATION : FUNCTIONAL GUARANTEES





FUNCTIONAL GUARANTEES


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.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
<p>1.00.00</p> <p>1.00.01</p>	<p style="text-align: center;">FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND GUARANTEE TESTS</p> <p>The term "Performance Guarantees" wherever appears in this Sub-Section shall have the same meaning and shall be synonymous to "Functional Guarantees". Similarly the term "Performance Tests" wherever appears in this Sub-Section shall have the same meaning and shall be synonymous to "Guarantee Test(s)".</p> <p>The term "BMCR" (Boiler Maximum Continuous Rating) appearing in the Technical Specification shall mean the maximum continuous steam output of Steam Generator (as defined Cl. No. 1.02.00 Sub-section A-02, Part-B) at super heater outlet at rated parameters.</p> <p>The term "TMCR" (Turbine maximum continuous rating) appearing in the technical specification shall mean 800 MW electrical power output at generator terminals (power at generator terminals as per clause indicated in this sub-section) under rated steam parameters, 0% cycle make-up and 160 mmHg (abs) condenser pressure unless used in conjunction with a different cycle make-up and/or a different condenser pressure and /or a different throttle steam pressure.</p> <p>PERFORMANCE GUARANTEES</p> <p>General Requirements</p> <p>a) The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in these specifications.</p> <p>b) The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.</p> <p>c) The Contractor shall conduct performance test and demonstrate all the guarantees covered herein, during performance guarantee/acceptance test. The various tests which are to be carried out during performance guarantee/acceptance test are listed in this Sub-section. The guarantee tests shall be conducted by the Contractor at site in presence of Employer on each unit individually.</p> <p>d) All costs associated with the tests including cost associated with the supply, calibration, installation and removal of the test instrumentation, shall be included in the bid price.</p> <p>e) It is the responsibility of the contractor to perform the Performance</p>			
<p style="text-align: center;">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p style="text-align: center;">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p style="text-align: center;">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p style="text-align: center;">PAGE 1 OF 98</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
	<p>Guarantee/Acceptance test as specified in this subsection. The performance tests will be performed using only the normal number of Employer supplied operating staff. Contractor, vendor or other subcontractor personnel shall only be used for instructional purposes or data collection. At all times during the Performance Tests the emissions and effluents from the Plant shall not exceed the Guaranteed Emission and Effluent Limits.</p> <p>f) The Contractor shall make the plant ready for the performance guarantee tests.</p> <p>g) All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, the contractor shall get these instruments calibrated in an independent test Institute approved by the Employer. All test instrumentation required for performance tests shall be supplied by the contractor and shall be retained by him upon satisfactory completion of all such tests at site. All calibration procedures and standards shall be subjected to the approval of the Employer. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.</p> <p>h) Tools and tackles, thermowells (both screwed and welded) instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the contractor free of cost.</p> <p>i) The Performance / Acceptance test shall be carried out as per the agreed procedure. The PG test procedure including demonstration tests shall be submitted within 90 days of the date of Notification of Award and finalization of the PG test procedure shall be done within 180 days from the date of Notification of Award. After the conductance of Performance test, the contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one months from the date of conductance of Performance test. However, preliminary test reports shall be submitted to the Employer after completing each test run.</p> <p>The P&G test procedures shall be submitted for equipments/ system & subsystem under Contractor's scope for all Guarantees under category I, II & III as mentioned below, as per latest International codes / standard including correction curves, meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees.</p> <p>j) The contractor shall submit for Employer's approval the detailed Performance Test procedure containing the following:</p>			
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p align="center">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p align="center">PAGE 2 OF 98</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
	<p>a) Object of the test.</p> <p>b) Various guaranteed parameters & tests as per contract.</p> <p>c) Method of conductance of test and test code.</p> <p>d) Duration of test, frequency of readings & number of test runs.</p> <p>e) Method of calculation.</p> <p>f) Correction curves.</p> <p>g) Instrument list consisting of range, accuracy, least count, and location of instruments.</p> <p>h) Scheme showing measurement points.</p> <p>i) Sample calculation.</p> <p>j) Acceptance criteria.</p> <p>k) Any other information required for conducting the test.</p> <p>k) In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. However if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified at clause 1.01.02 of this subsection, Employer will accept the equipment/system/plant after levying liquidated damages as per clause 1.01.02 of this sub-section. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:</p> <p>i) For Category-I Guarantees</p> <p>Reject the equipment/system/plant and recover from the Contractor the payments already made</p> <p style="text-align: center;">OR</p>			
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p>SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p>PAGE 3 OF 98</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>Accept the equipment/system/plant after levying Liquidated Damages as specified hereunder. The liquidated damages, for shortfall in performance indicated in clause 1.01.02 for this sub-section are on per unit basis and shall be levied separately for each unit, except for the rate indicated for auxiliary power consumption for station auxiliaries which is on station basis. The liquidated damages shall be prorated for the fractional parts of the deficiencies. The performance guarantees coming under this category shall be called 'Category - I' Guarantees.</p> <p>ii) For Category-II Guarantees</p> <p>Reject the equipment/plant/system and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category - II ' Guarantees. Conformance to the performance requirements under Category -II is mandatory.</p> <p>iii) For Category-III Guarantees</p> <p>Reject the equipment / system/plant & recover from the Contractor the payments already made.</p> <p style="text-align: center;">OR</p> <p>Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the EMPLOYER. Such damages shall, however be limited to the cost of replacement of the equipment(s) / system(s) replacement of which shall remove the deficiency so as to achieve the guarantee performance. These parameters/capacities shall be termed as category - III, guarantees.</p>		
1.01.00	GUARANTEES UNDER CATEGORY - I		
1.01.01	<p>The performance guarantees which attract liquidated damages (LD) are as follows:</p> <p>i) Unit Heat Rate</p> <p>a) Unit Heat rate in kcal/kWhr under rated steam conditions at 160 mm Hg (abs) condenser pressure with zero (0%) make up at 800 MW unit load (i.e. 100% of rated load).</p> <p>b) Unit Heat rate in kcal/kWhr under turbine throttle main steam pressure of 210 Kg/cm² (abs) and turbine throttle main steam temperature / reheat steam temp. at turbine inlet of 600 deg C / 600 deg C at 160 mm Hg (abs) condenser pressure with zero make up at 600 MW unit load (i.e. 75% of rated load) .</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 4 OF 98


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
	<p>Unit Heat rate shall be computed as per clause 1.01.03.</p> <p>ii) TG Output</p> <p>Continuous TG output of 840 MW unit load (i.e. 105% of rated load) under rated steam conditions at 160 mm Hg (abs) condenser pressure with 0% make-up.</p> <p>iii) Condenser Pressure in mm Hg (abs) measured at 300mm downstream of low pressure turbine last stage bottom blade tip at 840 MW output under rated steam conditions, 3% make up and ambient temperature of 38°C.</p> <p>Note: The condenser pressure measurement while conducting the guarantee tests from (i) to (iii) above shall be measured at 300 mm downstream of low pressure turbine last stage bottom blade tip.</p> <p>iv) Steam Generating Capacity</p> <p>Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet & rated steam temperature at reheater outlet (with any combination of mills working as per Employer's discretion) with the coal being fired from within the range specified in the table at Annexure-IV-2, Sub section I-B (Project information), Part A, Section VI.</p> <p>v) Coal Pulveriser Wear Parts Warranty</p> <p>Life of coal pulveriser wear parts, in hours of operation, for the entire range of coal characteristics specified. (To be demonstrated as per clause 1.01.04 of this sub-section).</p> <p>vi) SCR/ Hybrid (SCR+SNCR) Efficiency for Control of NOx emission</p> <p>Contractor shall guarantee and demonstrate that at the end of 16000 hrs of operation and with the originally installed catalyst (i.e. without the use of future layer of catalyst) the SCR/ Hybrid (SCR+SNCR) efficiency for control of NOx emission (from thermal as well as fuel) shall not be less than 80% at 6% oxygen (O2) content in flue gas on dry gas basis and ammonia slip not exceeding 3ppm at 100% TMCR load condition, when firing any coal from the range of coal(s) specified.</p> <p>The SCR/ Hybrid (SCR+SNCR) efficiency test for control of NOx emission shall be conducted at the end of 16000 hrs of operation or as and when SCR/ Hybrid (SCR+SNCR) efficiency for control of NOx emission based on online measurements available in the control room reaches to the level of 70%, whichever is earlier. The catalyst will be deemed to have exhausted its life as and when SCR/ Hybrid (SCR+SNCR) efficiency for control of NOx emission reaches to the level of 70%.</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 5 OF 98	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>vii) Catalyst Life</p> <p>Contractor shall guarantee and demonstrate minimum SCR catalyst life of 16000hrs. The catalyst shall be deemed to have exhausted its life as and when SCR/ Hybrid (SCR+SNCR) efficiency for control of NOx emission reaches to a level of 70%, with ammonia slip not exceeding 3ppm at 6% oxygen (O₂) content in flue gas on dry gas basis.</p> <p>viii) Ammonia Consumption Rate (applicable in case of SCR system alone)</p> <p>Guaranteed Ammonia consumption rate (in Kg/hr/unit, 99.5 wt %) at 100% TMCR for firing coal from the range of coal(s) specified shall be demonstrated. The ammonia consumption rate shall be measured during the test for SCR efficiency for control of NOx emission.</p> <p>ix) Urea consumption rate (Applicable in case of Hybrid (SCR+SNCR) system)</p> <p>Guaranteed solid Urea consumption rate (in Kg/hr/unit) at 100% TMCR for firing coal from the range of coal(s) specified shall be demonstrated. The urea consumption rate shall be measured during the test for Hybrid system (SCR+SNCR) efficiency for control of NOx emission.</p> <p>x) DM water consumption rate (Applicable in case of Hybrid (SCR+SNCR) system)</p> <p>Guaranteed DM water consumption rate (in ton/hr/unit) for making solution of urea and for dilution of urea at 100% TMCR for firing coal from the range of coal(s) specified shall be demonstrated. The DM water consumption rate shall be measured during the test for Hybrid system (SCR+SNCR) efficiency for control of NOx emission.</p> <p>xi) Particulate Emission/ ESP Efficiency</p> <p>Contractor's design shall ensure that the particulate emission from ESP(s) shall not be more than 17 mg/ Nm³ under guarantee point (refer clause no. 1.05.19 related to ESP sizing criteria Sub-Section–A-02, Part-B(Mechanical), Section-VI) condition at 100 %TMCR i.e. at 800 MW unit load with design coal firing. The corresponding ESP efficiency shall be worked out as per the procedure outlined in clause 1.01.06 of this Sub-section.</p> <p>xii) FGD SO₂ Removal Efficiency</p> <p>Contractor's design shall ensure that the SO₂ removal efficiency from FGD shall not be more than 80 mg/nm³ (6% O₂ dry basis) under guarantee point condition (refer clause no. 1.05.20.01 related to FGD sizing criteria, Sub-Section–A-02, Part-B (Mechanical), Section-VI). The corresponding SO₂ removal efficiency from FGD shall be worked out.</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 6 OF 98


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
1.01.02	<p>xiii) Limestone Consumption Rate</p> <p>Limestone consumption of FGD system in kg/hr under guarantee point conditions (refer clause no. 1.05.20.01 related to FGD sizing criteria, Sub-Section-A-02, Part-B (Mechanical), Section-VI).</p> <p>xiv) Unit Auxiliary Power Consumption</p> <p>Unit auxiliary power consumption comprising of all Unit Auxiliaries shall be guaranteed in line with the requirements stipulated in clause 1.01.08.01 of this sub section. Power consumption of all unit auxiliaries (except Air Cooled Condenser Fans) shall be taken for continuous unit operation at 800 MW (i.e. 100% rated load) under rated steam conditions and at condenser pressure of 160 mm Hg (abs) with 0% make-up. Power consumption of Air Cooled Condenser Fans shall be taken at 840 MW (i.e. 105% rated load) under rated steam conditions, guaranteed condenser pressure and ambient temperature of 38 deg.C.</p> <p>xv) Auxiliary Power Consumption for Station Auxiliaries</p> <p>Station auxiliary power consumption comprising of all station Auxiliaries required for continuous station operation at 3 x 800 MW (i.e. 100% rated load of all the units) under rated steam conditions and at condenser pressure of 160 mm Hg (abs) with 0% make-up shall be guaranteed in line with the requirements stipulated in clause 1.01.08.02 of this sub section.</p> <p>Notes:</p> <p>(a) The 16000 hrs, as mentioned above for SCR/ Hybrid system efficiency and catalyst life, shall be based on actual running hours of operation of SCR system counted from the date of successful completion of 'Initial Operation' of unit or start of operation of SCR system on sustainable basis, whichever is later.</p> <p>(b) Power consumption of each of the pump/fan/compressors/ Conveyors etc. wherever mentioned shall be measured with its own drive at the switchgear end.</p> <p>AMOUNT OF LIQUIDATED DAMAGES APPLICABLE FOR CATEGORY-I GUARANTEES</p> <p>If the performance guarantee(s) specified at clause 1.01.01 are not met by the Contractor even after the modifications and/or replacements mentioned at clause 1.00.01 of this Sub-section but are achieved within the stipulated Acceptable Shortfall Limit as indicated in this clause, Employer will accept the equipment/system/plant after levying liquidated damages as indicated here under, however, if the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, the Employer may at his discretion reject the</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 7 OF 98	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
	equipment/system and recover the payment already made or accept the equipment/system only after levying liquidated damages against the Contractor, at the rates listed herein, and such liquidated damages shall be deducted from the Contract Price:			
S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD	
i)	For Increase in the Guaranteed Unit Heat rate			
	a) At 100% TMCR (800 MW) Unit Load	US \$ 322,952 (US Dollar Three hundred twenty two thousand nine hundred fifty two only) per 1 Kcal/Kwhr increase in heat rate	(+) 2.5% of the guaranteed Unit heat rate	
	b) At 75% TMCR (600 MW) Unit Load	US \$ 242,214 (US Dollar two hundred forty two thousand two hundred fourteen only) per 1 Kcal/Kwhr increase in heat rate	(+) 2.5% of the guaranteed Unit heat rate	
ii)	For deficiency in Turbine Generator Output	US \$ 1097 (US Dollar one thousand ninety seven only) per 1 KW shortfall in TG output	(-) 2.0% of the guaranteed turbine generator output.	
iii)	For deficiency in condenser pressure	US \$ 657,355 (US Dollar Six hundred fifty seven thousand three hundred fifty five only) per 1 mm Hg increase in condenser pressure	(+) 2.5% of the guaranteed condenser pressure	
iv)	Steam Generator Capacity For shortfall in the guaranteed steam generating capacity in T/h at rated steam parameters at superheater outlet &	US \$ 137,021 (US Dollar One hundred thirty seven thousand twenty one only) for every 1 T/hr short fall in steam output from the guaranteed value.	(-) 1.0% of the guaranteed steam generator capacity	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 8 OF 98	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD	
	rated steam temperature at reheater outlet (with any combination of mills working as per Employer's choice) with the coal being fired from within the range specified			
v)	Coal Pulveriser Wear Parts Warranty Life of Coal Pulveriser wear parts in hours of operation	To be calculated as per clause 1.01.04 of this subsection.	(-) 500 hours	
vi)	SCR/ Hybrid (SCR+SNCR) Efficiency for Control of NOx Emission For shortfall in SCR efficiency for control of NOx emission in percentage point under condition stipulated in clause 1.01.01 (vi) of this Sub Section of Technical Specification	US \$ 136,643 (US Dollar One hundred thirty six thousand six hundred forty three only) for every 1% point shortfall in SCR/ Hybrid (SCR+SNCR) efficiency from the guaranteed value	(-) 10% points from the guaranteed value	
vii)	Shortfall in Catalyst Life For shortfall in catalyst life in hrs under condition stipulated in clause 1.01.01 (vii) of this Sub Section of Technical Specification	US \$ 40,976 (US Dollar Forty thousand nine hundred seventy six only) for every 100 hours shortfall in catalyst life from the guaranteed value	(-) 15% from the guaranteed value	
viii)	Ammonia Consumption Rate For increase in ammonia consumption rate (in Kg/hr/unit, 99.5wt %) under condition stipulated in	US \$ 74,521 (US Dollar Seventy four thousand five hundred twenty one only) for every 1 Kg/hr increase in ammonia consumption	(+) 10% of the guaranteed ammonia consumption	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 9 OF 98


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD	
	clause 1.01.01 (viii) of this Sub Section of Technical Specification	rate from the guaranteed value		
ix)	Urea Consumption Rate For increase in urea consumption rate (in Kg/hr/unit) under condition stipulated in clause 1.01.01 (ix) of this Sub Section of Technical Specification	US \$40,914 (US Dollar Forty thousand nine hundred fourteen only) for every 1 Kg/hr increase in urea consumption rate from the guaranteed value.	(+) 10% of the guaranteed urea consumption	
x)	DM water Consumption Rate For increase in DM water consumption rate (in ton/hr/unit) under condition stipulated in clause 1.01.01 (x) of this Sub Section of Technical Specification	US \$8,989 (US Dollar Eight thousand nine hundred eighty nine only) for every 1 ton/hr increase in DM water consumption rate from the guaranteed value	(+) 10% of the guaranteed DM water consumption	
xi)	ESP Efficiency For shortfall in guaranteed ESP efficiency in percentage points under conditions specified at clause 1.01.01 (xi) of this sub section	US \$ 1,354,181 (US Dollar One million three hundred fifty four thousand one hundred eighty one Only) for every 0.01% point shortfall in ESP Efficiency from the guaranteed value.	(-) 0.05% point from the guaranteed ESP efficiency	
xii)	FGD SO₂ Removal Efficiency For shortfall in guaranteed SO ₂ removal efficiency in percentage points under condition stipulated in clause 1.01.01 (xii) of this Sub Section of Technical Specification	US \$ 50,854 (US Dollar Fifty thousand eight hundred fifty four only) for every 0.1% point shortfall in guaranteed SO ₂ removal efficiency	(-) 0.25% points from the guaranteed SO ₂ removal efficiency	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 10 OF 98


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD	
xiii)	Limestone Consumption Rate For increase in limestone consumption of FGD system in kg/hr/unit under condition stipulated in clause 1.01.01 (xiii) of this Sub Section of Technical Specification	US \$ 263,017 (US Dollar Two hundred sixty three thousand seventeen only) for every 100 Kg/hr increase in limestone consumption rate from the guaranteed value	(+) 10% of the guaranteed limestone consumption	
xiv)	Auxiliary power consumption for unit auxiliaries For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 1.01.01 and 1.01.08.01 of this sub section	US \$ 3025 (US Dollar Three thousand twenty five only) per 1 KW increase in Auxiliary Power Consumption	(+) 1.0% of the guaranteed Auxiliary Power Consumption.	
xv)	Auxiliary power consumption for station auxiliaries For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 1.01.01 and 1.01.08.02 of this sub section	US \$ 3025 (US Dollar Three thousand twenty five only) per 1 KW increase in Auxiliary Power Consumption	(+) 1.0% of the guaranteed Auxiliary Power Consumption.	
<p>NOTE:</p> <p>i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.</p> <p>ii) If the contract currency is other than US dollars, then the liquidated damages shall be in equivalent amount in contract currency based on Bill selling exchange rate of State Bank of India prevailing on the date of award of contract.</p> <p>iii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of</p>				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 11 OF 98	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
1.01.03	<p>Contract (GCC)/ Special Conditions of Contract (SCC)</p> <p>iv) Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.</p> <p>v) The LD values and acceptable shortfall limits are applicable on per unit basis except for the value indicated for auxiliary power consumption for station auxiliaries, which is on station basis. The liquidated damages shall be prorated for the fractional parts of the deficiencies.</p> <p>UNIT HEAT RATE</p> <p>Tests for Turbine Cycle Heat Rate and Efficiency of Steam Generator shall be conducted simultaneously but independently and Unit Heat Rate is to be computed as follows:</p> <p>Unit Heat rate in kcal/kWhr under rated steam conditions at 160 mmHg(abs) Condenser pressure with zero make up at 800 MW unit load (i.e. 100% of rated load):</p> $= \frac{\text{THR (100\%)}}{\text{SG_EFF(100\%)}}$ <p>Unit Heat rate in kcal/kWhr under rated steam conditions at 160 mmHg(abs) Condenser pressure with zero make up at 600 MW unit load (i.e. 75% of rated load):</p> $= \frac{\text{THR (75\%)}}{\text{SG_EFF(75\%)}}$ <p>Where</p> <p>THR (100%) : Turbine Cycle Heat rate in kcal/kWhr under rated steam conditions at 160 mmHg(abs) Condenser pressure with zero make up at 800 MW unit load (i.e. 100% of rated load). (To be calculated as per clause 1.01.03.01 of this sub-section)</p> <p>SG_EFF(100%): Efficiency of the Steam Generator at 800 MW unit load (i.e. 75% of rated load) with 27 degree Celsius ambient temperature and 60% RH, while firing the design coal, at rated steam parameters, rated coal fineness and rated excess air. (To be calculated as per clause 1.01.03.03 of this sub-section). The efficiency shall be based on Heat Input GCV of coal.</p> <p>THR (75%) : Turbine Cycle Heat rate in kcal/kWhr under rated steam conditions at 160 mmHg(abs) Condenser pressure with zero make up at 600 MW unit load (i.e. 75% of rated load). (To be calculated as per clause 1.01.03.01 of this sub-section)</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 12 OF 98


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
1.01.06.05	<p>Further, during the performance test of the Electrostatic Precipitator, if the contractor establishes that the average of three tested outlet dust burden (Do) values (uncorrected) are either equal to or less than 14 mg/Nm³ at ESP outlet before FGD system inlet, then the contractor shall also be deemed to have successfully met the guaranteed ESP efficiency.</p>		
1.01.07	<p>METHOD OF COMPUTING TEST EFFICIENCY OF FGD</p> <p>The performance tests shall be carried out in accordance with ASME PTC 40 (1991) code. The details of the test shall, however be mutually agreed upon between the employer and the contractor.</p>		
1.01.08	<p>AUXILIARY POWER CONSUMPTION</p> <p>The respective auxiliary power consumption for unit and the station are to be calculated in isolation to calculate the respective guaranteed power consumption as is illustrated hereunder:</p>		
1.01.08.01	<p>Unit Auxiliary Power Consumption</p> <p>The unit auxiliary power consumption shall be calculated using the following relationship.</p> <p>$P_{au} = P_u + TL \text{ (Unit)}$</p> <p>$P_{au} = \text{Guaranteed Unit Auxiliary Power Consumption.}$</p> <p>$P_u = \text{Power consumed by the auxiliaries of the unit under test.}$</p> <p>$TL = \text{Losses of the Generator Transformer and Unit Transformers supplied by bidder based on works test reports and the criteria specified under the Clause 1.01.08.02 (j) under the subheading Transformers.}$</p> <p>The power consumption (P_u) of entire unit auxiliaries fed from unit transformers shall be measured at the incomers of respective unit boards. Suitable correction for auxiliaries not in service at the time of this measured power consumption like MDBFP etc, shall be done on as per the technical specification. If GCB scheme is adopted, suitable corrections for station auxiliaries shall be done.</p> <p>While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating unit auxiliaries. The auxiliaries to be considered shall include but not be limited to the following:</p> <p>(a) Turbine Unit Oil purifier.</p> <p>(b) Turbine Unit control oil purifier.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p>SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p>PAGE 24 OF 98</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>(c) Electric oil heater for turbine lube oil tank (rated power shall be considered).</p> <p>(d) Feed and discharge pumps of turbine oil purification system.</p> <p>(e) Main turbine Condenser air evacuation pumps.</p> <p>(f) Air Cooled Condenser fans.</p> <p>(g) Condensate extraction pumps.</p> <p>(h) Drip pump (if envisaged).</p> <p>(i) Hydrazine dosing pumps (if required).</p> <p>(j) Ammonia dosing pumps (if required).</p> <p>(k) Oil purifiers of 2x50% TDBFPs and their feed and discharge pumps.</p> <p>(l) Lube oil pumps of 2x50% TDBFPs and the electrical oil heater for lube oil.</p> <p>(m) Auxiliary oil pump for MDBFP.</p> <p>(n) Oil pumps for HP-LP bypass system.</p> <p>(o) Motor Driven Boiler Feed Pump (For this purpose only 15% of the power consumed by the MDBFP and MDBP at design point as determined during shop test shall be considered).</p> <p>(p) DM Cooling (normally working) Water pumps to supply cooling water on the primary (DM) side of the plate type heat exchangers in the closed loop Equipment cooling (Unit auxiliaries) water system.</p> <p>(q) Auxiliary Cooling (normally working) water pumps to supply cooling water on the secondary side of the plate type heat exchangers in the closed loop Equipment cooling (unit auxiliary) water system.</p> <p>r) Mills.</p> <p>s) PA Fans.</p> <p>t) FD Fans.</p> <p>u) ID Fans.</p> <p>v) Air Heaters.</p>		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p align="center">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p align="center">PAGE 25 OF 98</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>w) Coal Feeders.</p> <p>x) Steam Generator Start up drain recirculation Pumps (If required).</p> <p>y) Seal Air Fans.</p> <p>z) Lube oil pumps for fans/ Air heaters & mill system etc.</p> <p>aa) Scanner air fans.</p> <p>ab)</p> <ul style="list-style-type: none"> • SCR System: <ul style="list-style-type: none"> i. Selective Catalytic Reduction (SCR) System is in service and SCR bypass gate in closed condition. SCR with cyclone separator including all heaters, dilution air fan etc. ii. Ammonia unloading handling and storage system, power consumption for continuous operating auxiliaries for unit operation at 100% TMCR. • HYBRID (SCR+SNCR) SYSTEM: <ul style="list-style-type: none"> i. Selective Catalytic Reduction (SCR) and Selective Non Catalytic Reduction (SNCR) System are in service and SCR bypass gate in closed condition. SCR with cyclone separator including all heaters, dilution air fan etc. ii. Urea unloading, handling and storage system and urea to ammonia convertor power consumption for continuous operating auxiliaries for unit operation at 100% TMCR. <p>ac) Electrostatic Precipitator with all TR sets , all hopper heaters including wrap around heaters of adapters, if applicable & all insulator heaters/pent house fans (if applicable) of all ESP passes working and rapping system in normal operation. During the test all hopper heaters including wrap around heaters of adapters, if applicable & all insulator heaters/pent house fans (if applicable) of all ESP passes will be kept in continuously ON condition at 100% duty condition and set point temperature shall be kept 5 degree Celsius above the flue gas temperature. (Refer Note 3 below)</p> <p>ad) Gas Recirculation Fan (if applicable)</p> <p>ae) FGD System</p>		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p align="center">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p align="center">PAGE 26 OF 98</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>i. Absorber Recirculation Pump(s)</p> <p>ii. Absorber Oxidation Air Blower(s)/Compressor(s)</p> <p>iii. Absorber Oxidation Tank Agitators</p> <p>iv. Gypsum Bleed Pumps</p> <p>v. Limestone Slurry Pump(s)</p> <p>vi. Process water pump(s)</p> <p>vii. Mist Eliminator Wash Water pump(s)</p> <p>viii. Booster Fans in case Booster Fan is provided by the Contractor.</p> <p>af) Power consumption of fans of Air washer units for TG building and fans of air filtration units for ESP and FGD buildings at its rated duty point to be arrived based on shop test.</p> <p>ag) Power consumption of any other continuously operating auxiliary for unit operation at 100% TMCR.</p> <p>ah) GCB Losses of Unit : Losses and fan power for Generator Circuit Breaker (if applicable)</p> <p>Note :</p> <ol style="list-style-type: none"> The bidder shall furnish a list of equipments to be covered under Unit auxiliary power consumption, which shall be subject to Employer's approval. The bidder shall ensure that power supply to all such equipments to be covered under unit auxiliary power consumption is fed from unit board of the respective unit. Power consumption of Air Cooled Condenser Fans shall be taken at 840 MW (i.e. 105% rated load) under rated steam conditions, guaranteed condenser pressure and ambient temperature of 38 deg.C. Method of Computation of Auxiliary Power consumption for ESP:- <p>The measurement for guaranteed auxiliary power consumption shall be carried out during ESP collection efficiency test. The method for computing the power shall be as described below:-</p> <p>a) Power consumption of ESP will be measured pass wise and for one pass (Say ESP-A) at a time with the help of energy meter in ESP MCC.</p>		
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p>SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p>PAGE 27 OF 98</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
1.01.08.02	<p>b) Energy meter reading will be taken before starting the collection efficiency test and after completion of collection efficiency test.</p> <p>c) Before starting collection efficiency test, switch off all the TR sets, all hopper heaters, all insulator heaters/pent house fans (if applicable) and rapping systems serving to one pass (ESP-A) temporarily and note down energy meter readings for period t1 i.e. E1. The power consumption shall be $W2=E2/t1$.</p> <p>d) During the collection efficiency test the total energy fed in to ESP MCC of one pass (say ESP-A) will be measured during entire period of collection efficiency test i.e. E2. Total time period (t2) of test shall be noted. The power consumption shall be $W2=E2/t2$. During the test all hopper heaters of all ESP passes will be in ON condition and set point temperature shall be kept 5 degree Celsius above the flue gas temperature.</p> <p>e) Measured power consumption for one ESP pass (say ESP-A) = $(W2-W1)$</p> <p>f) Measured Electrostatic Precipitator power of one unit = Power of (ESP-A + ESP-B + ESP-C + ESP-D + ESP-E + ESP-F).</p> <p>Station Auxiliary Power Consumption</p> <p>The station auxiliary power consumption shall be calculated using the following relationship.</p> <p>$P_{\text{Stn}} = P_{\text{au. Stn}} + T_{L - \text{stn}}$</p> <p>$P_{\text{au. Stn}} = \text{SUM} (P_i \times D_i)$</p> <p>Where,</p> <p>P_{Stn} = Power consumed by the station auxiliaries</p> <p>$P_{\text{au. Stn}}$ = Total Power Consumption, while running at 100% design load for all the auxiliaries of the station supplied by bidder.</p> <p>P_i = Power consumed by each station auxiliary.</p> <p>D_i = Duty factor to be considered for each station auxiliary.</p> <p>$T_{L - \text{stn}}$ = Transformer Losses of the station/standby/startup transformers for meeting the station auxiliary power supply and that of any other transformer supplied by the bidder based on work test report.</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 28 OF 98

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES																		
	<p>Losses of all transformers included in bidder's scope, based on the works test reports as per the criteria specified under Clause 1.01.08.02 (j) under the subheading Transformers, associated with station auxiliary power supply distribution system (excluding those included in Unit system like GT, UT etc.) shall be included.</p> <p>While guaranteeing the station auxiliary power consumption the bidder shall necessarily include all the station auxiliaries <u>running at full load</u> with duty factors as have been defined at the ensuing para of this chapter.</p> <p>The station auxiliaries that shall be running during the guarantee test for calculating " Pau. Stn " shall include but not be limited to the following:</p> <p>(Where duty factor is not indicated the same is to be considered as 1.0)</p> <p>a) Plant & Instrument air compressors & Air drying plant</p> <p>Power consumption of:-</p> <table border="0"> <tr> <td>i)</td> <td>Instrument Air compressor</td> <td>2 Nos.</td> <td>Duty Factor =0.6</td> </tr> <tr> <td>ii)</td> <td>Plant Air compressor</td> <td>2 Nos.</td> <td>Duty Factor = 0.33</td> </tr> <tr> <td>iii)</td> <td>Air Drying plant (Heaters) (if applicable)</td> <td>2 Nos.</td> <td>Duty Factor =0.5</td> </tr> <tr> <td>iv)</td> <td>Air Drying plant (Blowers) (if applicable)</td> <td>2 Nos.</td> <td>Duty Factor = 1.0</td> </tr> </table> <p>Power consumption at rated duty point for compressors to be arrived based on shop test and power consumption at rated duty point for Air Drying plant to be arrived based on site test.</p> <p>b) Air Conditioning System & Ventilation System</p> <p>Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of Chilling machines, Chilled water Pumps, Condenser water Pumps, Air handling unit (AHU) fans, for the Air conditioning system of main plant building, Ash handling control room, Ash handling VFD room, FGD control room, ESP control room of each units, switchyard (GIS building), service building, administrative building and Canteen building. Power consumption at rated duty point for Air cooled & water cooled chiller shall be based on site test and for other drives like chilled water pumps, Condenser water Pumps & AHU fans shall be based on shop test.</p>	i)	Instrument Air compressor	2 Nos.	Duty Factor =0.6	ii)	Plant Air compressor	2 Nos.	Duty Factor = 0.33	iii)	Air Drying plant (Heaters) (if applicable)	2 Nos.	Duty Factor =0.5	iv)	Air Drying plant (Blowers) (if applicable)	2 Nos.	Duty Factor = 1.0		
i)	Instrument Air compressor	2 Nos.	Duty Factor =0.6																
ii)	Plant Air compressor	2 Nos.	Duty Factor = 0.33																
iii)	Air Drying plant (Heaters) (if applicable)	2 Nos.	Duty Factor =0.5																
iv)	Air Drying plant (Blowers) (if applicable)	2 Nos.	Duty Factor = 1.0																
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p align="center">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p align="center">PAGE 29 OF 98</p>																

CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<p>Note:</p> <p>33.33% of the total auxiliary power consumption of air-conditioning system as specified at above shall be considered for Unit#1, 33.33% for Unit#2 and balance 33.34% for Unit#3.</p> <p>c) Hydrogen Generation Plant</p> <p>One third (33%) of power consumption of one stream of hydrogen generation plant shall be based on shop test)</p> <p>d) FGD System</p> <ul style="list-style-type: none"> i. Limestone Gravimetric feeder, Wet ball mill and their integral Auxiliaries ii. Vacuum Belt Filter, Vacuum Pump and its integral auxiliaries iii. Booster water pump iv. Waste water pump v. Limestone Slurry Tank Agitators vi. Filtrate Pump(s) vii. Belt Filter Wash Water Pump viii. Hydro-cyclone Waste Water Sump Pump and Waste Water Pump ix. all other continuous running Agitators <p>e) Auxiliary Water System Pumps (Working Pumps)</p> <ul style="list-style-type: none"> i. Makeup (Clarified water) water pump (if applicable) ii. AC & Ventilation system make-up pumps. iii. DM water make up pump iv. Potable water pumps v. Filtered water feed pumps for DM plant vi. Degassed water pump (if applicable) vii. High pressure pumps for RO based DM plant (if applicable) 		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2</p>	<p align="center">SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p align="center">PAGE 30 OF 98</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES			
1.02.00	<u>GUARANTEES UNDER CATEGORY - II</u> NOT USED			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 34 OF 98	


CLAUSE NO.	FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES		
	<u>GUARANTEES UNDER CATEGORY – III</u>		
1.03.00	The parameters/capabilities to be demonstrated for various systems/ equipments shall include but not be limited to the following:		
1.03.01	<p>Noise</p> <p>All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in General Technical Requirement, Part-C Section-VI of the technical specifications.</p> <p>Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.</p> <p>Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation.</p> <p>A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.</p>		
1.03.02	<p>Steam Turbine and Auxiliaries</p> <p>Turbine hall and other EOT Crane :</p> <p>Over load test, travel & hoist speed checks etc., shall be demonstrated as per IS: 3177 (latest edition).</p>		
1.03.03	<p>Steam Generator and Auxiliaries</p> <p>Category-III Guarantees of this sub-section for various systems/ equipment for steam generator and auxiliaries shall be based on and demonstrated corresponding to ambient air condition of 27 deg. C temperature & 60% RH.</p> <p>(i) Coal Pulverizer capacity at rated fineness</p> <p>Performance testing shall be conducted on coal pulverizers toward</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID Doc. No.- CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 35 OF 98


CLAUSE NO.	GUARANTEE TEST PROCEDURE			
ANNEXURE – IIA				
FORMAT FOR SUBMISSION OF GUARANTEE TEST PROCEDURE				
Clause No. as per LOA/ Tech. Specs.	Provision of LOA / Tech. Specs.	Name and Methodology of Test proposed by Vendor	NTPC comments on the tests proposed by vendor	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 86 OF 98	


784074/2022/PS-PEM-MAX

CLAUSE NO.	GUARANTEE TEST PROCEDURE			एनटीपीसी NTPC
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 87 OF 98	

CLAUSE NO.	GUARANTEE TEST PROCEDURE							
	APPENDIX-IV							
	GUARANTEE TEST PROFORMA							
	POWER MEASUREMENT							
	Project:							
	Package :							
	Date :							
	1. Equipment/Stream Composition :							
	2. Motor Description :							
	3. Sr. No. of meters used :							
	4. Date of Calibration of instrument and name of test house :							
	5. Multiplying factor (M.F.) of the wattmeter :							
	6. Wattmeter Readings (to be taken at 1 minute intervals) :							
SI. No.	Measurement Terminal Location	Time	Voltage (Volts)	Current (amps)	kw Reading M.F.		Total (W1+W2) MF kw	Remarks
					W1	W2		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2			SUB-SECTION-IV FUNCTIONAL GUARANTEES		PAGE 90 OF 98

CLAUSE NO.	GUARANTEE TEST PROCEDURE							
APPENDIX-IV								
7. Energymeter Readings								
Sl.	Equip- Ment	Time Duration		Energymeter Readings kW Hr		Equipmen t kw (R2- R1)/ (t2-t1)	Remarks	
		Initial	Final	Initial	Final			
*Reason and duration for system trip/stop may be recorded in remarks column.								
NTPC				Contractor				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2			SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 91 OF 98	

CLAUSE NO.	GUARANTEE TEST PROCEDURE																			
	<p style="text-align: right;">APPENDIX-V</p> <p>GUARANTEE TEST PROFORMA</p> <p>VIBRATION LEVEL MEASUREMENTS</p> <p>Project:</p> <p>Package :</p> <p>Date :</p> <p>Time :</p> <p>Details of vibration Level Meter</p> <ol style="list-style-type: none"> Make Model & Sl.No. Date of calibration with name of Test House <table border="1"> <thead> <tr> <th rowspan="2">Sl.No.</th> <th rowspan="2">Equipment</th> <th rowspan="2">Pick *Point</th> <th colspan="3">Vibration level Amplitude/Velocity</th> </tr> <tr> <th>Horizontal Micron/ mm/ sec.</th> <th>Vertical micron/ mm/sec.</th> <th>Axial Micron / mm/sec.</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> <p>* Reading shall be taken at all the bearings of motor, gear box and driven equipment. In case of conveyor galleries, vibrations shall be measured at min. three locations, at midpoint of stringer between two short supports.</p> <p>NTPC Contractor</p>					Sl.No.	Equipment	Pick *Point	Vibration level Amplitude/Velocity			Horizontal Micron/ mm/ sec.	Vertical micron/ mm/sec.	Axial Micron / mm/sec.						
Sl.No.	Equipment	Pick *Point	Vibration level Amplitude/Velocity																	
			Horizontal Micron/ mm/ sec.	Vertical micron/ mm/sec.	Axial Micron / mm/sec.															
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 92 OF 98																	

CLAUSE NO.	GUARANTEE TEST PROCEDURE																
	<p>APPENDIX-VI</p> <p>GUARANTEE TEST PROFORMA</p> <p>NOISE LEVEL MEASUREMENT</p> <p>Project:</p> <p>Package :</p> <p>Date :</p> <p>Details of Sound Level Meter</p> <p>1. Make</p> <p>2. Model</p> <p>3. Date of calibration with name of Test House</p>																
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Sl.No</th> <th>Equipment with location</th> <th>Equipment load/capacity</th> <th>Measurement* point no.</th> <th>Sound level dBA.</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td style="height: 150px;"></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks							
Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks												
	<p style="text-align: center;">NTPC Contractor</p> <p>* For each equipment location, a Projected Plan Diagram shall be made and the location of measurement points shall be identified.</p>																
<p>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-1 (3X800 MW)</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-A Bidding Doc No CS-9585-001-2</p>	<p>SUB-SECTION-IV FUNCTIONAL GUARANTEES</p>	<p>PAGE 93 OF 98</p>														



TITLE:

PATRATU STPP FGD PACKAGE
TECHNICAL SPECIFICATION FOR
AGITATORS OF FGD SLURRY TANKS

SPECIFICATION No: PE-TS-434-571-18000-A003

SECTION-I, SUB-SECTION-C2C

REV. 01

DATE: DEC 2021

SHEET : 1 OF 1

CUSTOMER SPECIFICATION: PAINTING SPECIFICATION





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

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	<p>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.</p> <p>SP1 Solvent cleaning</p> <p>SP2 Application of rust converter (Ruskil or equivalent grade)</p> <p>SP3 Power tool cleaning</p> <p>SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)</p> <p>SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns</p> <p>SP5 Shot blasting/ abrasive blasting.</p> <p>SP6 Emery sheet cleaning/Manual wire brush cleaning.</p>		
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	Page 1 of 9 Page 181 of 331

CLAUSE NO.	 TECHNICAL REQUIREMENTS		
<p>1.06.04</p> <p>1.06.05</p> <p>1.06.06</p> <p>1.06.07</p> <p>1.06.08</p> <p>1.06.09</p>	<p>as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.</p> <p>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.</p> <p>Following are the Primer/painting schemes envisaged herein:</p> <p>PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.</p> <p>PS3* - Zinc Chrome primer (Alkyd base) by dip coat.</p> <p>PS4 - Synthetic Enamel (long oil alkyd) to IS2932.</p> <p>PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744</p> <p>PS9 - Aluminium paint to IS 2339.</p> <p>PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1</p> <p>PS13 - Rust preventive fluid by spray, dip or brush.</p> <p>PS14 - weldable primer-Deoxaluminat or equivalent.</p> <p>PS16 - High Build Epoxy CDC mastic `15` .</p> <p>PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)</p> <p>PS18 - Epoxy based TiO2 pigmented coat</p> <p>PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.)</p> <p>PS-20 - Epoxy based finish paint</p> <p>All weld edge preparation for site welding shall be applied with one coat of weldable primer.</p> <p>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.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO2 pigmented coat ▪ Finish coat - Epoxy based finish coat <p>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.</p> <p>c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard</p>		
<p align="center">EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</p>	<p align="center">TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2</p>	<p align="center">SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING</p>	<p align="center">Page 2 of 9</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.06.10	<div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">  </div> <p>A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:</p> <p>Primer : One coat of unmodified epoxy resin along with polyimide hardener.</p> <p>Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener.</p> <p>Total thickness of primer and paint should not be less than 400 microns.</p> <p>B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:</p> <p>i) For Indoor vessel, tanks, piping, valves & other equipments:</p> <p>(a) Surface preparation shall be done either manually or by any other approved method.</p> <p>(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.</p> <p>(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.</p> <p>(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.</p> <p>Total DFT of paint system shall not be less than 150 microns.</p> <p>ii) For Outdoor vessel, tanks, piping, valves & other equipments:</p> <p>(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.</p> <p>(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.</p> <p>(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.</p> <p>(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.</p> <p>The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.</p> <p>Total DFT shall not be less than 300 microns.</p>		
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	Page 3 of 9 Page 183 of 331



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.

<p>F) FGD System</p>	<ul style="list-style-type: none"> (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.
-----------------------------	--

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



Reference: null109:6559

Date:04-12-19

From:	B DASH AGM	To:	BHEL BHEL sirifort New delhi
		CC:	Gauravbhatia@bhel.in sajal@bhel.in pmgrishipal@bhel.in
SUBJECT : PSTPP, EPC-FGD			
Please find enclosed following drawings/documents for necessary action at your end as indicated in purpose code.			
VENDOR DRG NO:	null		
NTPC DRG NO:	9585-001-109-PVM-H-001		
REVISION NO:	07		
DRG TITLE:	Painting schedule of FGD System		
APP CATEGORY:	I		
RELEASE DATE:	04-12-19		
COMMENTS:	No comments.		

Note: 1) For PGMAs of Agitator and and its sub-components shall be the same as that of similar items provided in the list. For Example, for motor, gear box, coupling etc. which are applicable for agitators PGMA-FW 212 & FW 701 are to be followed.

2) Painting : Painting details in the specification are minimum requirement. Painting shall be as per customer approved schedule to be submitted by successful bidder during detail engineering.



Engineering Division
ISO 9001:2008 Certified

अभियंत्रिकी कार्यालय परिसर, जगत नं.- ए 8ए, सेक्टर-24, पोस्ट बॉक्स नं.- 13, नोएडा (उ प्र) पिन-201 307

टेलिफोन नं.- 0120-2410333, 2410116 फैक्स-0120-2410136, 2410137

पंजीकृत कार्यालय: एनटीपीसी भवन, स्कोप कॉम्प्लेक्स, 7 इन्स्टीट्यूशनल एरिया, लोधी रोड, नई दिल्ली-110 003


टेलिफोन नं.- 011-24361018 फैक्स-011-24361018, वेबसाइट: www.ntpc.co.in

ENGINEERING OFFICE COMPLEX, Plot No: A-8A, Sector-24, Post Box No: 13, Noida (UP), Pin-201 307

Telephone No: 0120-2410333, 2410116 Fax-0120-2410136, 2410137

Registered Office: NTPC Bhawan, Scope Complex, 7 Institutional Area, Lodhi Road, New Delhi-110 003

Telephone No: 011-24360100 Fax-011-24361018, Website: www.ntpc.co.in

 RANIPET	 Bharat Heavy Electricals Limited Boiler Auxiliaries Plant Ranipet – 632 406		BHEL DOC NO.	PS : PATR :FGD: R4R3-R4S4
			REVISION NO.	07
			DATE	25.11.2019



PATRATU STPP FGD PACKAGE

PAINTING SCHEME for FGD SYSTEM, GATES& DAMPERS

NTPC CONTRACT NO: 01/PVUNL-CS-9585-001-2/N0A-SC

NTPC DRG NO: 9585-001-109-PVM-H-001

BHEL RANIPET Customer No(s): R4R3, R4S3-R4S4

Prepared By	Reviewed & Approved By
 Rajamanickam M Dy. Mgr/QA	 K.C. (M) Kishore <small>Digitally signed by Kishore Date: 2019.12.04 Time: 15:10:05 IST Reason: CAT I Location: NTPCEOC</small>

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

RECORD OF REVISION

DETAILS OF REVISION	
REV NO	DATE
00	25.08.2018
	Original Issue - First Submission Revised Issue NTPC comments: This document can be reviewed in totality after receipt of inputs on FGD system. Any equipment detail and any missing equipment can be reviewed only after receiving of basic drawings of FGD system BHEL reply: We wish to submit that the painting scheme was prepared after taking all the inputs from Engg in the form of PGMA release. Hence there will not be any equipment missed. Also Engg has confirmed that it has started the submission of basic documents. NTPC comments: SI no: 09 of FGD, what all items are covered under emergency quench system? Kindly mention here BHEL reply: Items covered under the emergency quench system are mentioned in the PGMA details at the end of the document. NTPC comments: SI no: 10 of FGD, kindly include details of items covered under air oxidation system BHEL reply: Items covered under air oxidation system are mentioned in the PGMA details at the end of the document. NTPC comments: SI no: 11 of FGD, kindly include details of items covered under oxidation air distribution system BHEL reply: Items covered under the oxidation air distribution system are mentioned in the PGMA details at the end of the document. NTPC comments: SI no: 12 of FGD, Description not clear. Kindly give detail & Indicate temperature & Primer paint BHEL reply: Expansion joint comes in the bypass ducts. It is of straight pieces without any round corner joints. It is of metallic in construction. The items covered in the PGMA are mentioned in the PGMA details at the end of the document. Temperature and primer paint is changed as per comments and finish paint is incorporated. NTPC comments: SI no: 13 of FGD, Description not clear. Kindly give detail& indicate temperature & primer paint BHEL reply: Expansion joints between scrubbers comes in the absorber region. It is of non-metallic in construction. The reason for giving painting is that items like flanges and sleeves are envisaged in this PGMA, hence painting is given. Temperature is indicated in the document. Primer paint is changed as per comments and finish paint incorporated. NTPC comments: SI no: 14&15 of FGD, Indicate temperature ad primer and finish paints BHEL reply: Temperature, Primer and finish paints are incorporated in the document. NTPC comments: SI no: 16, 17, 19, 23, 29,30,34, 37 of FGD, comments on paints BHEL reply: Comments on paints are incorporated in all the above sl nos. Also since as per spec for civil works, finish coat of 70 microns only specified, hence finish DFT of 70µ and Total DFT of 245µ is indicated. NTPC comments: SI no: 21, 27, 32 of FGD, Furnish details BHEL reply: Details of all PGMA's are mentioned at the end of the document.
01	06.12.2018

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)	
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)		
02	11.01.2019	<p>NTPC comments: Sl no: 4& 5 Give details surface finish and primer on inside surfaces</p> <p>BHEL reply: Incorporated in the document.</p> <p>NTPC comments: PHC, SHC & Vacuum Belt Filter related items to be covered.</p> <p>BHEL reply: Incorporated in the document.</p> <p>NTPC comments: Blower with motor, is it seal air fan, kindly give basis for painting of this item; Motor paint will be RAL 5012.</p> <p>BHEL reply: It is seal air fan as it supplies seal air. Motor paint shade will be RAL 5012 only which will be indicated by the electrical group in the drawing. The basis for selecting the paint is as per Sub- Section A-12, B) Steam generator and Auxiliaries and Clause 20.03.00 of Part- C Section VI. Since it is under auxiliaries, we have chosen this painting. Also the surfaces are less than 95°C. Hence we request you to retain the same painting specification.</p> <p>NTPC comments: Furnish paint details of major electrical equipment like motors, Transformers, bus duct, MCC & control panels, cable trays etc</p> <p>BHEL reply: Electrical items are bought out items and therefore the painting specification will be given by respective Engg group as per the tender specification in the drawing itself which will submitted to NTPC for approval. Therefore, the painting of electrical items is not covered under this painting scheme. This is the practice which is being followed for Auxiliaries as well. Also we would like to state that same comment was given for Dadri FGD painting scheme and the above reply was also accepted by M/s NTPC. We request you to kindly accept our explanation and accord approval.</p>							
		<p>NTPC comments: Please include the surface coating and painting details for individual equipment of LHP/GHP</p> <p>BHEL reply: We would like to state that scope of LHP, Limestone handling plant and GHP, Gypsum handling plant lies with BHEL, ISG, Bangalore. They will be submitting the separate painting scheme for the LHP and GHP. Also we would like to inform that all items pertaining to Ranipet scope of supply has been included in this painting scheme. We request you to kindly approve the painting scheme.</p> <p>NTPC comments: The same has to be ensured and taken care in the respective equipment drgs.</p> <p>BHEL reply: BHEL will ensure the same in the respective equipment drawings.</p> <p>NTPC comments: Sl no: 5& 7 of FGD, Inorganic ethyl zinc silicate primer to be applied as per spec requirement as proposed for all other items.</p> <p>BHEL reply: Incorporated in the document.</p> <p>NTPC comments: Sl no: 24 of FGD, Other Items—Blast cleaning</p> <p>BHEL reply: Incorporated in the document.</p> <p>NTPC comments: Please clarify whether SS lining is all around the cylindrical and conical portion of silo?</p> <p>The inside painting of silo where SS lining is not provided shall be as per structural steel painting scheme</p> <p>BHEL reply: SS lining is all around the conical portion of silo. For cylindrical portion- inside painting, primer as given for structural steel painting scheme is incorporated in the document.</p> <p>NTPC comments: Sl no: 39 to 41, Painting scheme to be followed as per (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9) in line with other FGD components. Details of related items to be included in the list.</p> <p>BHEL reply: Incorporated in the document.</p>							
03	30.01.2019								

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
03	30.01.2019							
			NTPC comments: SI no: 03 of Painting scheme to be followed as per (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9) in line with other FGD components, Motor paint RAL 5012 BHEL reply: We wish to state that the referred item is coming under gates and dampers which is part of auxiliaries and therefore painting under Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6 of 9 is considered. Also these components are sub-items to the main component. Hence we request you to accept the painting as mentioned under above spec. NTPC comments: Note 11 to be incorporated BHEL reply: Note incorporated in the document.					
04	18.02.2019							
			NTPC comments: Inside surface painting on silo (cylindrical portion) shall be as per outside surface painting scheme of Limestone silo BHEL reply: We wish to state that the painting envisaged is until erection only. Once the system is commissioned, paint will peel off completely and application of intermediate and finish paints will become redundant, therefore we have proposed only primer. Also primer given is of Inorganic Zinc silicate which offers superior protection against corrosion, abrasion and chemical resistance. Hence we request you to kindly consider and approve the painting envisaged. NTPC comments: Blast cleaning to be done. Is there any liner provided on mill inside surface? Inorganic ethyl zinc silicate primer to be applied as per spec requirement as proposed for all other items. BHEL reply: Blast cleaning is incorporated in the document. We wish to state that rubber liner is provided on the mill inside surface as per the specification. Primer paint of Epoxy zinc phosphate primer is envisaged as per the spec requirement vide clause Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9 . We request you to kindly accept our proposed painting and approve our document.					
05	05.03.2019							
			NTPC comments: As commented earlier, all painting coats on inside surface of silo (cylindrical portion) shall be same as per outside surface painting scheme of Limestone silo. BHEL reply: Based on NTPC directive, we have incorporated in the document. Kindly approve the document. Revised Issue- New PGMA added under FGD system and Engg has deleted some PGMA too as they have been amalgamated, hence addition & deletion of new PGMA done under SI nos: 2,3,5,7,11,13,15,20, 21,22, 23, 24, 28,29, 30, 34, 35, 36, 37, 38, 40, 41, 42, 46, 47& 48 under FGD and resubmitted for your kind approval. There is no change in the painting scheme, only the PGMA are added/deleted under the above mentioned SI nos. We request you to kindly review and approve our painting scheme.					
07	25.11.2019							
			NTPC comments: SI no: 18 of FGD, earlier painting scheme as per S.N. 17 (PGMA 257) is different. BHEL reply: We wish to submit that the painting for PGMA 257 is same only. The commented SI no is SI no: 18 which is of duct structures hence painting as per Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03 is given. NTPC comments: Miscellaneous FGD system removed in this revision? Limestone silo accessories missing in this revision. BHEL reply: We wish to submit that our Engg has removed this PGMA as they have added the items under new PGMA for which painting is given in SI no: 30 of this painting scheme. (FW 725 is Nozzles and Flanges which are Miscellaneous FGD items and FW 723& 724 are limestone silo accessories). We also wish to add that there is no change in the painting specification. Since many of the PGMA are added and some are deleted, we have gone for this resubmission of the painting scheme. We request you to kindly approve the painting scheme.					

784074/2022/PS-PEM-MAX

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

	<p>NTPC comments: PHC & SHC and accessories structural items missing in this revision. BHEL reply: Our Engg has amalgamated these PGMAs with FW 738 PGMA (Gypsum Belt filter and accessories). Hence those PGMAs are removed from the painting scheme. We wish to add that there is no change in the painting specification and same painting specification is only retained. We request you to kindly approve the painting scheme.</p>
--	--

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

1. FGD SYSTEM

1	Slurry recirculation pump System (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 212	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 40 – 60 µm	<p>Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ</p> <p>Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ</p>	100	<p>Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ</p> <p>Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Light Blue, RAL 5012</p>	75	300
2	Absorber System Internals – Structural items (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 213	Blast cleaning to Sa 2 1/2	<p>Primer: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat</p> <p>Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ</p>	100	<p>Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ</p> <p>Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL9002</p>	75	300
3	Mist eliminator and accessories, Absorber baffle grating support, Mist eliminator support & Absorber Spray pipe support - Structural items (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 215 FW 216 FW 217 FW 218	Blast cleaning to Sa 2 1/2	<p>Primer: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat</p> <p>Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ</p>	100	<p>Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ</p> <p>Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL9002</p>	75	300

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
4	Absorber System- Base (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 219	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min..30% on pigment) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min..1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
5	Absorber system structures, Absorber shear plate, Hook up duct structure (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 220 FW 231 FW 238	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min..30% on pigment) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min..1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
6	Absorber system casing bottom (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03) Inside surfaces of Absorber casing top& bottom is lined with C-276 material, hence no paint is envisaged.	FW 221	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
7	Absorber system casing top, Duct supports & Structures for RC pump house (Tec. Spec. Sec.VI, Part-B, Subsection- D-01, cl. 6.04.03)	FW 222 FW 232 FW 234 FW 236	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
8	Absorber system accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 223	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ	75	300

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
9	Emergency Quench water tank- Outside surfaces (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 226	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	intermediate paint pigmented with MIO/Tio2 DFT- 100µ	75	Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	70	245
10	Emergency Quench water tank- Inside surfaces	FW 226	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	100	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002		
				Primer Coat: Two coats of Red Oxide Zinc phosphate primer, (Primer is only envisaged as lining is given in inside surfaces of the tank) DFT = 30 µm per coat; Total DFT- 60µ				

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
11	Emergency quench system Handling Equipment RC pump (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 227 FW 249	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75	300
12	Air oxidation system (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 230	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75	300
13	Oxidation Air distribution system & Slurry distribution system, Absorber W/D interface and W/D wash system (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 228 FW 229 FW 243 FW 244	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Sky blue, Shade no.101 of IS:5	75	300
14	Expansion joint between bypass	FW 251	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (two coats) DFT- 100µ	60	NIL	--	60

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
15	(Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6, 9 of 9) Temp>60°C	FW 252	Insulated surfaces	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	40
	Expansion joint between scrubbers		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60	
16	(Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6, 9 of 9) Temp>60°C	FW 255	Flue gas swept surface (Inside)	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	40
	Insulated surfaces		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60	
16	Ducts between bypass duct inlet& Absorber	FW 255	Flue gas swept surface (Inside)	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	40
	Insulated surfaces		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60	
16	(Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6, 9 of 9) Temp-150°C	FW 255	Flue gas swept surface (Inside)	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	40
	Insulated surfaces		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60	

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
17	Ducts between Absorber & Stack (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6, 9 of 9) Temp-60°C	FW 257	Flue gas swept surface (Inside) Insulated surfaces	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
18	Duct structure between by pass duct & Absorber (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 260	Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	HR Aluminium paint to IS 13183 Gr.I (upto 600 deg C)	20	40
			Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	<p>Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00</p> <p>Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment) DFT = 100 µm per coat (min)</p>	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE)	70	245

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
19	Duct structure between Absorber & Stack (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 262	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	<p>Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00</p> <p>Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment) DFT = 100 µm per coat (min)</p>	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)	
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)		
20	Foundation material for duct structures, Absorber, RC shed,tanks, pipe racks& Silo Structure	FW 280 FW 281 FW 282 FW 283 FW 740 FW 760 FW 762 FW 763	Temporary rust preventive fluid application as per PRQA 523 DFT- 20µ	All Threaded and other surfaces of foundation bolt and its materials shall be coated with temporary rust preventive fluid. During execution of civil works the dried film of coating will be removed using Organic Solvents.					
21	Structures for Elevator& Supporting structures for Emergency Quench Water Tank (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 285 FW 292	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min..1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245	
22	Elevator and accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 293 FW 716	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey white, Shade no. RAL 9002	75	300	

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
23	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.08, 6.04.09)	FW 237 FW 610 FW 612 FW 613 FW 722	Gratings- Blast cleaning to Sa 2½	Hand rails, Gratings- Hot dip galvanizing to 610gms/sq.m (minimum) and to a coating thickness of 87µm (minimum)				
24	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks – Structures other than the above (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 237 FW 610 FW 612 FW 613 FW 722	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	75	70	245
25	Slurry pumps & accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 701	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ	100	75	300

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
26	Water pumps & accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 702	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	intermediate paint pigmented with MIO/Tio2 DFT- 100µ Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µ	100	Shade: Light Blue, RAL 5012 Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Light Blue, RAL 5012	75	300
27	Monorail for hoist & cranes (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 710	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0AE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
28	Handling Equipment in FGD (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 713 FW 714	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75	300

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
29	Man hole door & Viewing ports (Tec. Spec VI, Part B, Subsection A-12 Page 6 of 9)	FW 239 FW 717	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	100
30	Agitator support, Air cannon silo, Bag filter and fan assy silo and Nozzles and Flanges (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 721 FW 723 FW 724 FW 725	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/TiO2 DFT- 100µ	100 100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75 25	300
31	Limestone silo structures (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 730	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75 100	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
32	Limestone Silo- Outside surfaces (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	<p>Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00</p> <p>Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)</p>	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
33	Lime stone Silo- Inside surfaces (Conical portion)	FW 731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm conforming to ISO 8501-1	<p>Primer: Two coats of Red Oxide Zinc phosphate primer to IS: 12744 (SS lining is inside the Limestone silo conical portion, hence primer is only envisaged; SS lining will be done at shops itself)</p>	60	NIL	--	60
34	Lime stone Silo- Inside surfaces (Cylindrical portion)	FW 731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	<p>Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00</p> <p>Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)</p>	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
35	Limestone silo approach platform, Platform for Pipe racks (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.08, 6.04.09)	FW 733 FW 766 FW 767	Gratings- Blast cleaning to Sa 2½;	Hand rails, Ladders, Gratings- Hot dip galvanizing to 610gms/sq. m (minimum) and to a coating thickness of 87µm (minimum)				
36	Limestone silo approach platform, Pipe racks platform- Structures other than the above (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 733 FW 766 FW 767	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	<p>Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00</p> <p>Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)</p>	<p>Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE)</p> <p>DFT = 35 µm per coat, Shade: Grey white RAL9002</p>	75	70	245
37	Limestone Mill – Outside surfaces (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 735	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	<p>Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ</p> <p>Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µ</p>	<p>Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 75µ</p> <p>Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002</p>	100	75	300
38	Lime stone mill- Inside surfaces	FW 735	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 40 – 60 µm	<p>Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ</p>	<p>--</p>	100	--	100

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
39	Gypsum belt filter and accessories Structural items (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 738	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75	300
40	Lime stone slurry storage tank, Auxiliary absorber tank, Filtrate tank, Wastage water tank, Hydro cyclone waste water tank, Neutralization tank, Process Water tank, Belt filter washing tank, Primary Hydro-cyclone feed tank Outside surfaces (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 742 FW 743 FW 744 FW 745 FW 747 FW 748 FW 785 FW 786 FW 802	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
41	Lime stone slurry storage tank, Auxiliary absorber tank, Filtrate tank, Wastage water tank, Hydro cyclone waste water tank, Neutralization tank, Process Water tank, Belt filter washing tank, Primary Hydro-cyclone feed tank Inside surfaces	FW 742 FW 743 FW 744 FW 745 FW 747 FW 748 FW 749 FW 785 FW 786 FW 802	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 35-50µm	Primer: Two coats of Red Oxide Zinc phosphate primer to IS: 12744 (Lining is inside the tanks, hence primer is only envisaged for protection till erection)	60	NIL	--	60

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
42	Process water pipe accessories, Cooling water pipe accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	FW 751 FW 752	Power Tool Cleaning to Sf3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat Identification Tag: Sea Green Shade no: 217 as per IS 5	70	150
43	Slurry pipe accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	FW 753	Power Tool Cleaning to Sf3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat Identification Tag: Sea Green Shade no: 217 as per IS 5	70	150
44	Service Air pipe accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	FW 754	Power Tool Cleaning to Sf3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat Identification Tag: Sky blue Shade no: 101 as per IS 5	70	150
45	Instrument air pipe accessories (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	FW 755	Power Tool Cleaning to Sf3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat Identification Tag: Sky blue Shade no: 101 as per IS 5	70	150
46	All Valves and fittings (Temp <95 deg C) (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	FW 815 to FW 851	Power Tool Cleaning to Sf3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat	70	150

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
47	Structure for Pipe racks Trestle for pipe racks & Structures inside Gypsum dewatering building and Ball mill building (Tec. Spec. Sec.- VI, Part-B, Sub section D-01, cl. 6.04.03)	FW 761 FW 765 FW 768 FW 769 FW 787	Blast cleaning to Sa 2 1/2 (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 75 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00 Intermediate Coat: One coat of two component polyamide cured Epoxy based MIO pigmented Intermediate coat (solid by volume- 80% (min), containing lamellar MIO min.30% on pigment)) DFT = 100 µm per coat (min)	75	Two coats of Two Pack Aliphatic Isocyanate cured acrylic finish Paint to IS 13213 (solid by volume- 55% (min) with gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min.1000 hours of exposure. Gloss loss less than 30 and color change less than 2.0ΔE) DFT = 35 µm per coat, Shade: Grey white RAL9002	70	245
48	Supports for Cable trays, Tools, Air receivers, commissioning spares (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 9 of 9)	FW 779 FW 798 FW 988 FW 996 FW 997	Blast Cleaning to SA 2 1/2 (Near white metal) with surface profile 40 – 60 µm	Primer: One coat of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 100µ Intermediate: One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µ	100	Finish: One coat of Epoxy based finish paint to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL 9002	75	300

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

2-GATES & DAMPERS

01	Gates & Dampers > 95° C Insulated Surfaces & Uninsulated surfaces (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6 of 9)	57 560 57 570 57 580 57 583	Power Tool Cleaning to St3 (SSPC-SP3)	One coat of HR Aluminium paint to IS 13183 Gr. I	20	One coat of HR Aluminium paint to IS 13183 Gr. I	20	40
02	Seal air piping (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 7 of 9)	57 141	Power Tool Cleaning to St3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Intermediate: One coat of Synthetic Enamel undercoat to IS: 2932	50 30	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- DFT- 35µ/ coat Identification Tag: Sky blue Shade no: 101 as per IS 5	70	150
03	Blower with Motor Knife Gate valve (Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6 of 9) & (Clause 20.03.00 of Part- C Section VI)	57 491 57 497	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats) Motor paint Shade: RAL 5012	40	100
04	Ladder, Cage for Ladder Toe Guard Plate Floor Grill, Hand Rails, Hand Rail Post (Tec. Spec. Sec.- VI, Part-B, Sub section D- 01, cl. 6.04.08, 6.04.09)	57 466	Gratings- Blast cleaning to Sa 2½	Hot Dip Galvanizing to 610 gm per sq. Meter (minimum) and to a coating thickness of 87 µm (minimum)				
05	Other Structural Items- Other than sl.no. 4 of above & Mounting bracket	57 209 57 466	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	100

784074/2022/PS-PEM-MAX

No	SURFACE LOCATION	PGMA	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
				PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
	(Tec. Spec. Sec.- VI, Part-B, Sub section A-12 Page 6 of 9)							