

**PATRATU VIDYUT UTPADAN NIGAM LIMITED**

**3X800MW PVUNL PATRATU TPP PHASE-1**

***TECHNICAL SPECIFICATION***

***FOR***

***FUEL OIL HANDLING SYSTEM***

**SPECIFICATION NO.: PE-TS-434-166-A001 Rev 01**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
NOIDA (INDIA)**



**3X800 MW PVUNL PATRATU TPP PHASE-1  
FUEL OIL HANDLING SYSTEM**

SPECIFICATION NO. PE-TS-434-166-A001

REV 01

SHEET 1 OF 1

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**SECTION- I**

**INTENT OF SPECIFICATION**



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**1.0 INTENT OF SPECIFICATION**

- 1.1** This specification includes, but not limited to 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 (as applicable), fill of lubricants & consumables, mandatory spares along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, final painting at site, obtaining CCOE approval, minor civil work, trial run at site, and carrying out Performance guarantee / Functional / Demonstration tests at site (As applicable), training of customer/client O&M staff (if applicable) and handover in flawless condition of the package to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification as specified above, amendment & agreements till placement of order for **3X800MW PVUNL PATRATU TPP PHASE-I**.
- 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 the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, demonstration testing of **Fuel Oil Handling System**.
- 1.3** It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to highest 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 and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 1.5** The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.



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- 1.6 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 SECTION-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.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 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/its customer.
- 1.9 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the owner shall apply.
- 1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.11 For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please referred relevant clause(s) of GCC.



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**SECTION: I**

**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**



**PATRATU STPS EXPANSION PHASE-I (3X800 MW)**

**1.00.00**

**BACKGROUND**

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.

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.

The present proposal is for Patratu STPS Phase-I (3x800 MW). The project is envisaged to be commissioned during XIII Plan period.

**2.00.00**

**CAPACITY**

Patratu STPS Phase-I: 3x800 MW - Present proposal

**3.00.00**

**MODE OF OPERATION**

Base Load

**4.00.00**

**LOCATION AND APPROACH**

4.01.00

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.

4.02.00


**The latitudes and longitudes of the site are as follows:**


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

4.03.00


**Airport**

The nearest commercial airport is Ranchi at about 45 km by road.

CLAUSE NO.	PROJECT INFORMATION			
<p><b>5.00.00</b></p> <p><b>LAND</b></p> <p><b>6.00.00</b></p> <p><b>WATER</b></p>	<p>A copy of Vicinity plan of the project site is placed at <b>Annexure - I</b>.</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><b>7.00.00</b></p> <p>7.01.00</p> <p>7.02.00</p> <p>7.03.00</p> <p>7.04.00</p>	<p><b>COAL</b></p> <p><b>Coal Requirement, Availability and Linkage</b></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><b>Coal Transportation</b></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><b>Coal Quality</b></p> <p>The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in <b>Annexure-IV-2</b> and imported coal parameters are indicated in <b>Annexure-IV-4</b> are to be considered for steam generator design.</p> <p><b>Fuel Oil</b></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 <b>Annexure-IV-3</b> and Light Diesel Oil having the characteristics given at <b>Annexure-IV-1</b>.</p>			
<p><b>8.00.00</b></p>	<p><b>NOT USED</b></p>			
<p><b>9.00.00</b></p>	<p><b>STEAM GENERATOR TECHNOLOGY</b></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>			
<p><b>10.00.00</b></p>	<p><b>FLUE GAS DESULPHURIZATION SYSTEM (FGD) &amp; SCR:</b></p> <p>The project is envisaged with Flue Gas Desulfurization (FGD) system and SCR meeting Ministry of Environment, Forest &amp; 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>			
<p><b>11.00.00</b></p>	<p><b>POWER EVACUATION SYSTEM</b></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>	

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	<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	<b>METEOROLOGICAL DATA</b>			
	The meteorological data from nearest observatory is placed at <b>Annexure-II.</b>			
13.00.00	<b>PLANT WATER SCHEME</b>			
	The Plant water scheme is described below.			
13.01.00	<b>Equipment Cooling Water (ECW) System (Unit Auxiliaries)</b>			
	<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 &amp; auxiliaries and TG &amp; its auxiliaries.</p>			
13.02.00	<b>Not used</b>			
13.03.00	<b>Other Miscellaneous Water Systems</b>			
	<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 &amp; DM Water is enclosed with this sub-section as <b>Annexure-III.</b></p> <p>(d) Effluent from various areas in TG &amp; 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>			
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 4 OF 15	

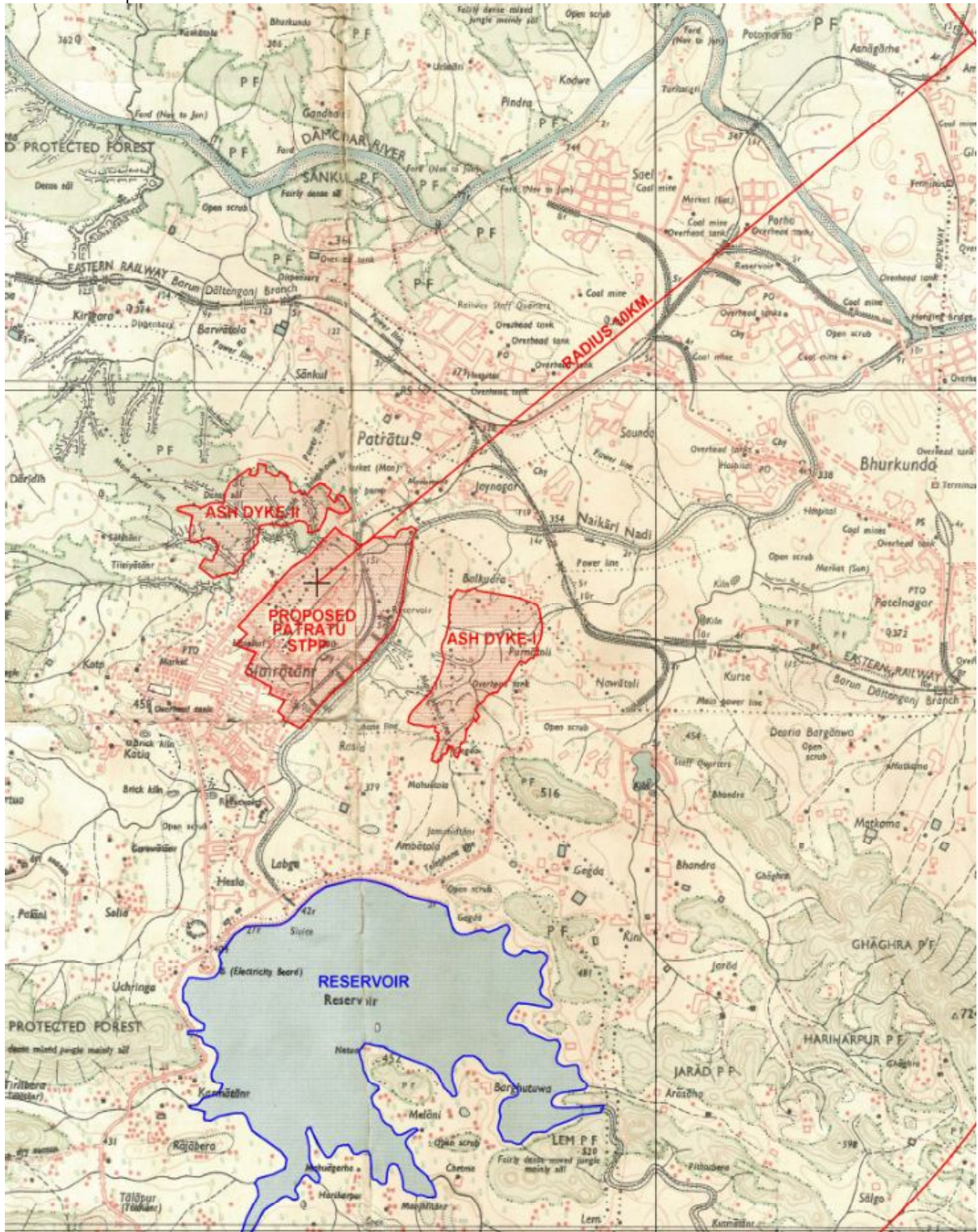
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14.00.00	<p><b>CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></p> <p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section.</p>			
15.00.00	<p><b>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></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>	

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ANNEXURE-I



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

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**जलवायवी सारणी**  
**CLIMATOLOGICAL TABLE**

1953 से 1980 तक के अवधि पर अवलोकन  
BASED ON OBSERVATIONS FROM 1953 TO 1980

अक्षांश: 23°30' N LONG: 85°30' E  
उचाई: 335 METRES  
रेखांक: 85°30' E  
उचाई: 335 METRES

**वायु तापमान**

माह	MEAN				EXTREMES				HUMIDITY				CLOUD AMOUNT				RAINFALL				दि. सं. वर्ष
	DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	HIGHEST YEAR	LOWEST YEAR	DATE AND YEAR	DATE AND YEAR	RELATIVE HUMIDITY	VAPOUR PRESSURE	ALL DAY CLOUDS	LOW CLOUDS	NO. OF DAYS	TOTAL MONTHLY	TOTAL YEARLY	HEAVIEST FALL IN HOURS	DATE AND YEAR		
MONTH	°C	°C	°C	°C	°C	°C	°C	°C	°C	%	mm	%	mm	mm	mm	mm	mm	mm	YEAR		
JAN	14.6	11.9	24.5	8.2	28.5	3.7	33.4	31	1.2	1978	68	11.8	1.2	0.6	16.7	1.7	62.3	0.0	42.0	04	
FEB	16.2	13.2	27.6	10.5	32.7	5.5	37.8	24	3.0	1978	55	13.3	1.3	0.7	19.3	1.3	84.0	0.0	54.0	08	
MAR	23.5	19.2	33.0	15.1	37.3	10.4	41.4	29	7.9	1979	48	13.4	1.1	0.6	11.4	1.2	36.4	0.0	23.2	06	
APR	30.2	21.3	38.4	21.0	42.3	15.6	45.2	16	13.5	1987	50	14.6	1.1	0.4	16.0	1.4	52.7	0.0	41.0	01	
MAY	32.6	24.1	40.8	24.5	44.8	20.0	48.0	11	17.0	1979	47	23.2	1.6	0.2	28.7	2.3	136.6	0.0	76.4	28	
JUN	36.3	24.3	37.5	25.5	43.2	21.7	47.6	12	19.5	01	38	20.7	2.4	1.2	129.4	7.4	334.4	13.4	140.0	07	
JULY	32.0	25.5	32.3	24.3	37.3	22.1	46.5	19	19.5	1979	62	27.3	4.4	2.7	106.1	19.3	196.1	19.4	197.3	1961	
AUG	28.1	25.4	32.3	24.3	37.3	22.1	46.5	20	20.0	1974	77	30.3	5.5	4.0	289.9	16.5	565.3	131.9	205.2	18	
SEP	27.6	25.3	31.7	24.1	35.3	22.1	38.0	06	18.2	20	79	30.5	5.3	3.5	288.7	15.8	616.0	50.0	109.9	24	
OCT	22.2	24.8	31.6	23.0	35.0	21.1	38.0	05	18.9	30	79	23.5	4.5	3.0	253.8	11.4	776.8	92.7	108.1	01	
NOV	21.9	22.1	31.4	19.1	34.4	14.4	38.0	02	10.6	27	74	24.4	2.4	1.4	91.7	4.2	265.7	2.6	13.4	12	
DEC	18.6	18.3	28.3	12.4	31.5	8.2	35.1	01	5.4	23	66	15.9	0.9	0.2	3.9	0.5	77.5	0.0	34.3	07	
MEAN	27.5	21.4	31.8	18.0	44.9	3.0	48.0	06	18.1	1961	68	12.0	0.9	0.4	2.7	0.3	56.4	0.0	56.4	28	
TOTAL OR MEAN	27.5	21.4	31.8	18.0	44.9	3.0	48.0	06	18.1	1961	68	12.0	0.9	0.4	2.7	0.3	56.4	0.0	56.4	28	
NO. OF YEARS	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	



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PROJECT INFORMATION



ANNEXURE-III

RAW WATER ANALYSIS

S.No	Constituent	As	mg/l
1	Calcium	CaCO <sub>3</sub>	105
2	Magnesium	CaCO <sub>3</sub>	81
3	Sodium	CaCO <sub>3</sub>	70
4	Potassium	CaCO <sub>3</sub>	7
	Total cations	CaCO <sub>3</sub>	263
5	HCO <sub>3</sub>	CaCO <sub>3</sub>	180
6	P- Alkalinity	CaCO <sub>3</sub>	0
7	Chloride	CaCO <sub>3</sub>	60
8	Sulphate	CaCO <sub>3</sub>	23
	Total Anions	CaCO <sub>3</sub>	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 <sub>4</sub> )		2

CLAUSE NO.

PROJECT INFORMATION



ANNEXURE-III

**THE MINIMUM QUALITY OF DM WATER TO BE CONSIDERED FOR MAKE-UP WATER**

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.02 ppm as SiO <sub>2</sub>
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 <sub>2</sub>

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



**LIGHT DIESEL OIL CHARACTERISTICS**

AS PER IS 15770-2008

<b>Characteristics</b>	<b>LDO</b>
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

ANNEXURE-IV-2

**DOMESTIC COAL CHARACTERISTICS**

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 <sub>2</sub> O <sub>5</sub> (%)	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



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	

## ANNEXURE-IV-4

## TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS

SI.No.	Characteristics (as received basis)	Imported Coal	
		Worst	Best
<b>1.0</b>	<b>Proximate Analysis</b>		
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
<b>2.0</b>	<b>Ultimate Analysis</b>		
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
<b>3.0</b>	<b>Ash Analysis</b>		
3.1	Silica (SiO <sub>2</sub> ) (%)	32.74	34.94
3.2	Alumina(Al <sub>2</sub> O <sub>3</sub> ) (%)	30.5	28.43
3.3	Iron Oxides(Fe <sub>2</sub> O <sub>3</sub> ) (%)	18.2	15.2
3.4	Titania (TiO <sub>2</sub> )	1.56	1.76
3.5	Phosphoric Anhydride(P <sub>2</sub> O <sub>5</sub> ) (%)	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 <sub>2</sub> O) (%)	0.3	0.4
3.10	Balance alkalies (by difference)	1.36	1.56
	Total	100	100
<b>4.0</b>	<b>Ash Fusion Temperature reducing temperature</b>		
4.1	Initial deformation Temp ( °C)	1100	1250
4.2	Hemispherical Temp. ( °C)	1300	1350
4.3	Flow Temp. ( °C)	1400	1400

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

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
	<p style="text-align: right;"><b>ANNEXURE- (d)</b></p> <p><b>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></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><b>Damping in Structures</b></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" data-bbox="384 1238 1398 1462"> <tr> <td>a) Welded steel structures</td> <td style="text-align: right;">: 1.0%</td> </tr> <tr> <td>b) Bolted steel structures</td> <td style="text-align: right;">: 2.0%</td> </tr> <tr> <td>c) Reinforced concrete structures</td> <td style="text-align: right;">: 1.6%</td> </tr> <tr> <td>d) Steel stacks</td> <td style="text-align: right;">: As per IS 6533 &amp; CICIND Model Code whichever is more critical.</td> </tr> </table> <p><b>SITE SPECIFIC DESIGN PARAMETERS</b></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" data-bbox="384 1659 1361 1816"> <tr> <td>a) The basic wind speed “<math>V_b</math>” at ten metre above the mean ground level:</td> <td style="text-align: right;">39 metre/second</td> </tr> <tr> <td>b) The risk coefficient “<math>K_1</math>”</td> <td style="text-align: right;">: 1.06</td> </tr> <tr> <td>c) Category of terrain</td> <td style="text-align: right;">: 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.																	
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b) The risk coefficient “ $K_1$ ”	: 1.06																	
c) Category of terrain	: Category-2																	
<p style="text-align: center;"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p style="text-align: center;"><b>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS--9585-001-2</b></p>	<p style="text-align: center;"><b>SUB-SECTION-D-01 CIVIL WORKS</b></p>	<p style="text-align: center;"><b>PAGE 333 OF 340</b></p>															

<b>CLAUSE NO.</b>	<b>TECHNICAL REQUIREMENTS</b>	
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Annexure-(E)

**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):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.

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.

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 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).

**Damping in Structures**

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

Steel structures		2 %
Reinforced structures	Concrete	5 %
Reinforced Stacks	Concrete	3 %
Steel stacks		2 %

<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS--9585-001-2</b>	<b>SUB-SECTION-D-01 CIVIL WORKS</b>	<b>PAGE 334 OF 340</b>
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## **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.

**SITE 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) Multiplying 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) Multiplying 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.

**APPENDIX – I**

**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

**APPENDIX – I**

**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')**

<b>Time Period (Sec)</b>	<b>Damping Factor (as a percentage of critical damping)</b>		
	<b>2%</b>	<b>3%</b>	<b>5%</b>
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

3X800MW PVUNL PATRATU TPP PHASE-1

TECHNICAL SPECIFICATION

FOR

FUEL OIL HANDLING SYSTEM

SECTION I-A

(SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL)



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



**TECHNICAL SPECIFICATION FOR  
FUEL OIL HANDLING SYSTEM  
3X800 MW PVUNL PATRATU TPP PHASE-1**

SPECIFICATION NO. PE-TS-434-166-A001

SECTION IA

REVISION 01

DATE:20.03.2020

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### 1.0.0 SCOPE OF WORK

This specification includes, but not limited to Supply part, Services part and Mandatory spares (if applicable) 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 (as applicable), fill of lubricants & consumables, mandatory spares along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, final painting at site, obtaining CCOE approval, minor civil work, trial run at site, and carrying out Performance guarantee / Functional / Demonstration tests at site (As applicable), training of customer/client O&M staff (if applicable) and handover in flawless condition of the package to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification as specified above, amendment & agreements till placement of order.

### 1.1.0 SCOPE OF SUPPLY FOR FUEL OIL HANDLING SYTEM

Scope of supply by bidder shall comprise of but not necessarily be limited to the following. P&I Diagrams given with this specification may pls. be referred.

- 1) Two (2) nos. of vertical cylindrical, fixed roof type HFO storage tanks each of net capacity 3000 cum dully fitted with steam heated floor coil heaters and other appurtenances, accessories, instrumentation, controls and fittings etc.
- 2) Two (2) nos. of vertical cylindrical, fixed roof type LDO storage tank of net capacity 500 cum dully fitted with appurtenances, accessories, instrumentation, controls and fittings etc.
- 3) One (1) nos. of vertical cylindrical, fixed roof type LDO day oil tank of net capacity 100 cum dully fitted with appurtenances, accessories, instrumentation, controls and fittings etc.
- 4) One (1) no drain oil tank (with steam heating coils) of 10m3 capacity to be located in the fuel oil pump house, including its all the accessories .Plates for DOT are in bidder scope.
- 5) Two (2) nos. (1W+1S) Drain oil pump motor set of capacity 10 m3/hr. in Drain oil tank.
- 6) Five (5) (4W+1S) nos. HFO twin screw unloading pump motor set each of capacity 100 cum/hr. with twin simplex type strainers of matching capacity at the suction of each pump.
- 7) Two (2) (1W+1S) nos. LDO twin screw unloading pump motor set each of capacity 50 cum/hr. with twin simplex type strainers of matching capacity at the suction of each pump.
- 8) Two (2) (1W+1S) nos. LDO transfer pump motor set each of capacity 25 cum/hr. with twin simplex type strainers of matching capacity at the suction of each pump.
- 9) 100 Nos. HFO unloading flexible neoprene/ metallic hoses. Five (5) nos. LDO unloading flexible neoprene/ metallic hoses. **80** nos. metallic flexible hoses each for Steam heating & receiving condensate respectively. Length of each hose shall be to suit the layout in unloading area. However minimum length shall be 8 m.
- 10) Two (2) nos. suction heater for HFO tanks of required size.
- 11) Floor coil heater for the tank (pipe for floor coil heater of main storage tank shall be in vendor scope).
- 12) Control valves for controlling steam flow to Floor coil heating and Suction heater installed on FO storage tank and drain oil tank.
- 13) Pressure reducing and De-Superheating station of required size.
- 14) Traps for separating condensate from steam.
- 15) Flow gauge and Coriolis type mass flow meter in HFO and LDO discharge header.



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- 16) One (1) no. single chamber gravity type oil water separator pit along with its accessories.
- 17) Instrumentation & control System including instruments, interlocking & protection devices complete in all respects required for safe, efficient and reliable operation of the plant and to be read in conjunction with C&I portion of specification. Minimum instrument and control system requirement is mentioned in the P&ID.
- 18) Two (2) nos. (1W+1S) Vertical Single screw type dirty oil pump motor set of Capacity 5 m<sup>3</sup>/hr. in Oil pit of Oil Water Separator.
- 19) Two (2) nos. (1W+1S) sump pump motor set in of capacity 10 m<sup>3</sup>/hr. in unloading header trench.
- 20) Two (2) nos. (1W+1S) sump pump motor set in of capacity 10 m<sup>3</sup>/hr. in unloading area drain trench.
- 21) Two (2) nos. (1W+1S) sump pump motor set in of capacity 10 m<sup>3</sup>/hr. in unloading Pump House.
- 22) Complete Fuel oil piping including steam tracing, drain piping, vent piping, valves, insulation & cladding (for restricting heat loss and maintaining outside temp below 60 deg. C) etc. as applicable to Fuel oil unloading & storage system.
- 23) Drain and vent connection in lines along with isolation valve at every low and high point as per layout requirement of FOHS.
- 24) All foundation bolts/ anchor bolts required for any equipment foundation under the package.
- 25) Pipes will be free issued to bidder for Fuel oil handling system package. However, flanges, fasteners, gaskets, supports, pipe trestle within dyke and pump house as required etc. as applicable within the terminal point will be in vendor scope.**
- 26) Pipe-supporting structures over the insert plates for pedestal supported pipes and also on pipe rack supported pipe.
- 27) Pipes required for tank nozzles (HFO and LDO, Drain Oil Tank etc.), manholes, pipe support etc. shall be in bidder scope.
- 28) Nozzle for foam pourer, heat detector on tank roof & pad plates welded to the tanks as per details to be furnished to the successful bidder for welding supports for water piping and hydrant piping.
- 29) Platform and approach ladder to the platform for foam pourer.
- 30) Wrapping and coating of any buried MS pipes as required.
- 31) All MS structures for cross overs, valve / instruments / equipment operating & maintenance platforms, approach ladders for access to platforms, trench/pit.
- 32) Painting of equipment along with their accessories within battery limit.
- 33) Electrical scope as per enclosure elsewhere in the specification.
- 34) C&I Scope as per enclosure elsewhere in the specification.
- 35) Erection & commissioning spares as required for the complete system.
- 36) One set of special maintenance tools & tackles, if any. These tools shall not be used for erection/ commissioning purposes and shall be in an unused and new condition when they are handed over to the customer at site. Each tool shall be stamped so as to be identified easily for its use. The tools shall be supplied in a steel toolbox. This list shall be reviewed during detail engineering.
- 37) Mandatory spares as per enclosure elsewhere in the specification.
- 38) Initial charge of all lubricants and fluids except LDO / HFO
- 39) All valves, counter- flange with nuts, bolts and gaskets at all the terminal points.



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- 40) Flowable non- shrink grout of one grade higher than concrete used for civil work grouting below base plate for all structure/ equipment & for grouting of foundation / anchor bolts.
- 41) Any other item covered in specification for Fuel Oil Handling System
- 42) Relevant scope of supply as per GTR, GCC & SCC.
- 43) Valves in pit outside dyke as required as per latest OISD recommendation complying with requirement whichever is more stringent.
- 44) Any other instrument, equipment / item required for making the installation complete in all respect and for satisfactory operation of the system for the scope within the terminal point, as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of supply.
- 45) All **mechanical items for oil water separator pit including skimmer pipe, butterfly valve, heating arrangement, rung ladder etc. for OWS.**
- 46) Any changes required to take care of temperature effect to be considered by bidder as part of total cost quoted.
- 47) STEEL PLATES FOR SHELL, ROOF & BOTTOM OF FUEL OIL TANKS SHALL BE FREE ISSUED TO BIDDER BY BHEL.**

### **1.3.0 SCOPE OF SERVICES FOR FUEL OIL HANDLING SYSTEM**

Scope of services by bidder will include but not necessarily limited to the following:

- 1) Unloading, Storage, handling and transportation at site.
- 2) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried MS pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation.
- 3) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- 4) **Erection & Commissioning of Fuel Oil System (including Plates and pipes free issued to bidder)**
- 5) Erection of all foundation bolts/ anchor bolts etc. as required for any equipment. In case these are not erected when foundation is being cast refer point no b above.
- 6) Inspection & testing, Performance Requirements and Performance Guarantees.
- 7) Painting of tank and all other items within scope of supply.
- 8) Making Good/Repairing/replacement of and damaged done by bidder to adjacent structure, pipes etc. while erecting equipment's related to Fuel Oil system
- 9) Electrical scope as per enclosure elsewhere in the specification
- 10) Preparation of drawing showing common facilities, if any, between BHEL & Vendor supplied equipment.
- 11) Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by customer based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.



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- 12) Preparation of all drawings as per list enclosed under Annexure -III.
- 13) Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority related to installation of Fuel Oil Handling System on behalf of the customer. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- 14) Layout drawing to be prepared for statutory approval apart from showing the technical requirements shall necessarily show key plan showing approach to site with mile stone, Survey No., Khesra No, Plot No. etc.
- 15) Supply of temporary equipment and services for chemical cleaning, steam blowing, energization, testing etc. as applicable.
- 16) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- 17) All other facilities/ services as described in section on site services in specification and related to Fuel Oil Handling System scope of work within terminal point.
- 18) Relevant requirements as per GTR, GCC, ECC & SCC.
- 19) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of services.

## **2.0.0 EXCLUSION**

- a) Supply of pipes for fuel oil system. However, E&C of the same including supporting arrangement shall be in bidder's scope of supply:
- b) Steel plates for Shell, roof & bottom of fuel oil tanks.
- c) Civil work for fuel oil unloading & storage system including
  - i. Civil work in Railway wagons unloading area
  - ii. Road tanker unloading platform
  - iii. Tank & Pump foundations
  - iv. Unloading Pump House
  - v. Dyke wall and barbed fencing
  - vi. Encasing of buried pipes, providing culvert for the same, if required.
  - vii. Hume Pipes, if any
  - viii. Civil works like pits, wherever required.
  - ix. Handrails other than those on the storage tanks.
  - x. Various cable & pipe trenches, pipe pedestals, drains, sumps, insert plates for pedestals for pipe supports.
  - xi. Pipe rack/trestle (refer definition of pipe rack/ trestle elsewhere in the specification) outside pump house and dyke area.



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However, location, sizing and loads, top of concrete elevations, top of grout elevations etc. and any other input related to above as applicable for above shall be given by the vendor.

- d) Fire Protection system for storage tanks,
- e) Air Conditioning / ventilation of Fuel Oil pump houses.
- f) DCS control panel for Fuel Oil pump houses
- g) Lifting equipment for unloading pump house for maintenance purpose of these pumps. Capacity of lifting equipment is envisaged as 2 T with lift as 8 m. Bidder to confirm adequacy of the same.
- h) DCS control. However, all logic for implementation of control and monitoring from DCS shall be provided by successful bidder during detail engineering.
- i) Exclusion as indicated in Electrical & C&I portion of technical specification
- j) Relevant exclusion as per GTR, GCC, SCC & ECC.

**3.0.0 SERVICES TO BE PROVIDED BY THE CUSTOMER**

- a) Relevant services as per GCC, SCC & ECC.

**4.0.0 TERMINAL POINT**

**LDO**

**: Near oil unloading area:**

LDO Road Tanker nozzle connections towards LDO U/L Pump suction side.

**Near fuel oil unloading & pressurizing pump house:**

Up to 1000 mm outside Pump house wall for suction & return line of LDO. Further routing shall be in BHEL-Try scope.

Bidder to plan the layout and size the pipe between storage tank and P&H unit in a manner so as to ensure availability of above TP pressure 1.0 Kg/cm<sup>2</sup> (a) limiting the tank foundation height for storage tanks to 1 m and the P&H unit FFL approx. 500 mm above ground level

**HFO**

**: Near oil unloading area:**

HFO Railway wagons nozzle connections towards HFO U/L Pump suction side.

**Near fuel oil unloading & pressurizing pump house:**

1000 mm outside pump house towards suction of HFO pressurizing pumps. Further, routing shall be in BHEL-Try scope.

Bidder to plan the layout and size the pipe between storage tank and P&H unit in a manner so as to ensure availability of above TP pressure 1.0 Kg/cm<sup>2</sup> (a) limiting the tank foundation height for storage tanks to 1 m and the P&H unit FFL approx. 500 mm above ground level.



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**Aux. Steam** : Steam header at **16 kg/cm<sup>2</sup>, 290 degC** by BHEL at 2000 mm from FO pressurizing building.

At the TP BHEL shall supply 27 MT/hr of steam as approved by customer.

**Effluent from Oil Water Separators** : Water pit of OWS. Further, pumps and piping up to CMB be under ETP scope).

**Drain from dyke area** : To OWS during normal condition & to plant drain during rainy season through two-way valve pit. Valves in the valve pit along with limit switch for the same are included in bidder's scope. In case the tanks are provided with intermediate dyke wall of height 0.6m, separate draining arrangement for dykes independent of each other shall be provided.

Change in location of terminal points by up to 50 meters in plan view and 10 m in elevation view shall have no price implication. Isolation valves at the terminal points shall be in the scope of the bidder.

Wherever exact coordinate of TP is not given, bidder to consider location at specified distance from the respective facilities from where distance in bidder's scope will be maximum.

## 5.0.0 PERFORMACE REQUIREMENTS

This will comprise of:

### 5.0.1 PERFORMANCE requirement at shop:

- Capacity, total dynamic head, noise & vibration level of all pumps in isolation.
- Noise level for safety valve to be limited to 105 dB (A)
- Inspection and testing of all valves as per approved QAP.

### 5.0.2 Functional Guarantees at site:

- Capacity, total dynamic head and power consumption, noise & vibration level of all operating pumps in parallel. The capacity of pumps while operating in parallel will be verified by indication in tank level difference.
- Noise level for safety valve to be limited to 105 dBa
- Entire piping & support for smooth operation
- All other machines / components / system shall be acoustically designed for a surface sound pressure level of  $L_p < 85$  dB (A), measured in accordance with ISO 3746 / IEC 651 / BS: 5969 /



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IS:9779 respectively at a distance of 1.0 m from equipment surface and at a height of 1.5m above ground level. The surface sound pressure level ( $L_p$ ) shall be averaged over the measurement surface and corrected for effect of background noise and the influence of reflected sound at measurement surface (environmental correction). With sound pressure levels of 85 dB (A) or less according ISO it shall be ensured that maximum surface noise levels of any item of plant of less than 85 dB (A) at 1.0 m from outline and a height of 1.5m from the floor shall be met during normal operating conditions.

- e. In case during test 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. However, if the contractor is not able to demonstrate the guarantees, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by BHEL, after the tests have been completed, BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or 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 BHEL.
- f. The successful bidder will prepare a document titled "HANDLING OVER PROTOCOL" consisting various activities to be demonstrated by them for handing over of the package.

**6.0.0 LAYOUT REQUIREMENTS**

- a) System layout shall conform to the requirements of the Petroleum Act 1934 & Petroleum Rules 2002, OISD 118 latest edition whichever is more stringent. The layout shall also conform to all other relevant OISD specifications
- b) All established engineering practices with regard to layout of various equipment & piping shall be followed and the same shall be subject to customer approval during detail engineering without any commercial implication.
- c) The pipes between storage tank, fuel oil unloading area shall be running on Pipe rack or pedestal as applicable.
- d) Tentative Location of items related to Fuel Oil handling System is shown in enclosed **PLOT PLANS**. This will be finalized during detail engineering based on equipment dimensions and other layout related requirements. There will however be no cost implication on account of the same.
- e) For railway wagons unloading of fuel oil, LDO/HFO pumps will be located below ground level.
- f) While selecting pipe size, velocity inside the pipe shall not overshoot the velocity criteria indicated elsewhere in the specification.
- g) To the extent possible, all valves shall be located at grade level for easy operation & maintenance. Where location at grade level is not possible, suitable operating and maintenance platform made of MS grating and access ladder/ staircase/walkways to the same shall be given by the bidder. The platform and walkways will be designed by considering load of at least 750Kg/M<sup>2</sup>.
- h) Where pipes are routed in a manner that it hampers man movement in any area, suitable no. of cross overs made of MS gratings shall be given across such pipes to facilitate easy man movement. Further suitable access ladder of MS construction shall be given for access to



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equipment/ pipes located in pit/ trench. Such structures shall be designed by considering a load of at least 750Kg/M2.

- i) Expansion bellows / pipe loops shall be provided in the steam line and HFO lines to accommodate pipe expansions at suitable distances as per calculation to be furnished by the successful bidder during detail engineering.
- j) For all pedestal supported pipes, BHEL scope will be limited to pedestal with insert plates. Maximum height of pedestal to be provided by BHEL shall be 300 mm from FGL/FFL in the corresponding area. Structures required above these pedestals for supporting the pipes are included in the scope of the bidder. However, inside the pump house and tank farm area no pedestals / insert plate shall be provided for fixing. Bidder shall support the pipes using structural supports and anchor fasteners inside the pump house and tank farm area.
- k) Layout shall be prepared in a way to avoid the buried piping to the maximum possible extent.
- l) Oily water collected in storage tank area, oil unloading area will normally be collected in OWS pit by gravity either through trench (limited to a depth of 0.5 m) or through buried pipe (limited to a depth of 1.0 m) . However, in case depth of pipe between the pit and OWS pit exceeds 1 m or gravity flow is not possible due to layout constraints (which can be reviewed during detail engineering), the oily water waste shall be collected by pumping to OWS pit. Necessary pumps, valves, pipes, pipe supports, and instruments etc. for the same shall be in the bidder's scope.
- m) Straight length required before and after control valve s, flow element/ flow meters, shall be provided as per latest standard/ applicable codes.
- n) Rainwater collected inside the dyke shall be diverted to storm water drain while contaminated oily waste shall be sent to OWS. All valves required in pits outside the dyke are included in bidder's scope of supply.
- o) Instruments to be mounted on tank shall be suitably located so as to have easy access from the staircase without interfering with man movement on the staircase. Wherever this is not possible, suitable platform along with access to the same shall be provided by FO System bidder.
- p) Signals from all field instruments shall be first terminated in Junction boxes before transmitting this signal either to Control panel or to I/O rack or to DCS. Junction box is included in bidder's scope. Erection of cable between field instruments to Junction Box is also included in bidder's scope. Scope of cable supply shall be as per project specific scope split sheet given under electrical portion of this specification.
- q) All piping shall be arranged to provide clearance for removal of equipment requiring maintenance and easy access to valve and other piping accessories required for operation and maintenance. The layout drawing to be submitted by the successful bidder will necessarily show the valve orientation and access to valve and accessories.
- r) Instrument/ LIE/LIR shall not be located in space meant for walkway & maintenance space across the equipment, maintenance bay of building. Location of all instruments shall be marked in layout drawing to ensure correct location of the same.



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**7.0.0 EQUIPMENT SELECTION & DESIGN CRITERIA**

The minimum design criteria/ technical details to be followed for various equipment shall be as per Data Sheets / Design criteria under given under SECTION-IA. Any contradictory requirement for specification of particular equipment, and clarifications not having been sought by the bidders, the most stringent requirement as per interpretation of the BHEL will prevail. Successful bidder will furnish detailed data sheets/ specifications / design calculations for various equipment for customer's/ consultant's approval during detail engineering. For items for which specific technical specification is not enclosed, data sheet / dwgs / design calculations for such items shall be subject to customer/ consultant approval during detail engineering. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

**8.0.0 SYSTEM WRITE UP & CONTROL**

For system write up and control requirement of fuel oil unloading and storage system, pls refer **Section-IA**.

**9.0.0 PAINTING / CORROSION PROTECTION REQUIREMENT**

This will be as per specification given under **Section-IA**. During detailed engineering stage, successful bidder shall prepare and submit the painting schedule for FOHS in line with customer specification for each equipment pipe, tanks, structure etc. for customer approval and changes suggested shall be taken care without any commercial implication.

**10.0.0 QUALITY ASSURANCE, QUALITY PLANS, INSPECTION & TESTING PROCEDURE:**

- a) The Quality plans / checklist for the previous executed jobs for the equipment's / instruments are attached under **Section IA**.
- b) The successful bidder shall furnish Quality Plans/ Inspection Check Lists for various item for the package in line with minimum requirement indicated in specification during detail engineering for Customer's approval.
- c) For other items for which any specific inspection requirement is not indicated in the specification but the same included in scope of work , vendor specific QPs/ CLs shall be furnished by the successful bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.
- d) The Field Quality Plan of bidder shall also be submitted by the successful bidder during detail engineering for customer's / consultant's approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.
- e) For flame proof actuator, motors, junction boxes, instruments etc. as per specification requirement, valid test certificate for the same shall be submitted by the vendor as part of QC documentation. In case valid test certificates are not available, necessary test shall be conducted in line with applicable standard in presence of customer and cost of such test shall be deemed to be included in the contract price



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#### **11.0.0 SUB-VENDOR ITEMS**

The tentative make of Sub-vendor items shall be generally as per **Annexure-I** enclosed which is subject to customer approval during detail engineering. Make of any unlisted items shall be subject to customer approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for BHEL's review and approval. Bidder shall furnish along with his offer the following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

- a) Documentation to show that the equipment /system have been supplied for a plant of similar or higher capacity.
- b) Documentation in the form of certificate that the equipment/system has been **operating satisfactorily for one year as on the scheduled date of bid opening.**

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily be submitted within one month of placement of LOI to ensure timely placement of order for BOIs.

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

#### **12.0.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID**

The drawings and documents to be submitted with the bid shall strictly be as per list given under **SECTION-III**. Any documents other than those indicated in the list will not be reviewed and will not form part of contract.

#### **13.0.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING**

Tentative list of drawing / document required during detail engineering is attached in **Annexure –III**. Any other drawings and documents as required by BHEL / Customer / Consultant shall be furnished by the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL.

#### **14.0.0 DRAWINGS DISTRIBUTION SCHEDULE**

Vendor needs to submit hard copies of each drawing/document during detail engineering along with editable soft copy of the same as per **Annexure-II**. However, exact no. of drawings / documents and submission/distribution procedure for the same shall be intimated to the successful bidder after award of contract and the same shall be complied by the successful bidder without any commercial implication.



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**15.0.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION**

Input drawings for this package are given under **Annexure-IV** namely:

- a) Plot plan, DOC. No. PE-DG-L07-100-M001
- b) P&IDs OF FOHS Doc. No. 9585-001-130-PVM-L-001.
- c) GA/Nozzle Orientation of HFO, LDO Storage Tank & LDO DAY OIL TANK 9585-001-130-PVM-B-004 R-0
- d) Piping layout of tank farm area. Doc. No. 9585-001-130-PVM-P-034
- e) Piping layout of unloading pump house. Doc No. 9585-001-130-PVM-P-033

The flow diagrams are indicative and show the minimum requirement to be followed including minimum requirement of instruments. Any other item and instruments required (within the terminal points) to make the system complete in all respect and for satisfactory operation of the system shall also deemed to have been included by the bidder in their scope.

**16.0.0 OTHER REQUIREMENTS**

**i) Site Visit before submission of offer.**

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

ii) Bidder shall submit detail erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

iii) The O&M Manual to be submitted by the successful bidder should necessarily address "Checklist of O&M Manual" given under **SECTION-IIB**.

iv) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

v) In case vendor submits revised drawing/doc after approval of the corresponding drawing/doc, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

vi) Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per dwg/document distribution schedule. Bidder would be provided access to the DMS for drg/doc approval



**TECHNICAL SPECIFICATION FOR  
FUEL OIL HANDLING SYSTEM  
3X800 MW PVUNL PATRATU TPP PHASE-1**

SPECIFICATION NO. PE-TS-434-166-A001

SECTION IA

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and adequate training for the same. Detailed methodology would be finalized after award of contract. Bidder to ensure following at their end

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)

DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website ([www.bhelpem.com](http://www.bhelpem.com)) under the Vendor session.

For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

- vii) Engineering for this project is being carried out in 3D environment at BHEL end. Name of engineering platform on which BHEL is doing the project is Smart Plant Suite. This is being done to have automated interface checking and thereby minimising rework at site. Hence bidder, in their own interest, is requested to prepare all layout drawings using 3D Modelling software. These drawings will also be made available to BHEL in soft for checking interface with other agencies in consolidated layout drawings. Bidder's inability to prepare drawing using 3D Modelling software will not be criterion for evaluation of their bid.
- viii) Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- ix) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- i) Site storage and preservation manual has been placed under **SECTION-II**. Bidder to note down all the requirement of storage and preservation required for several items given under this manual. Bidder shall necessarily follow all the practices given in the manual as applicable for its items/ equipments under scope of supply.



**TECHNICAL SPECIFICATION FOR  
FUEL OIL HANDLING SYSTEM & MISC. TANKS  
3X800 MW PVUNL PATRATU TPP PHASE-1**

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**SECTION: I-A  
CUSTOMER SPECIFICATIONS**



**TECHNICAL SPECIFICATION FOR  
FUEL OIL HANDLING SYSTEM  
3X800 MW PVUNL PATRATU TPP PHASE-1**

SPECIFICATION NO. PE-TS-434-166-A001

SECTION 'I A'

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**SECTION: I-A  
CUSTOMER SPECIFICATIONS  
TECHNICAL REQUIREMENT**

# **SCOPE OF SUPPLY & SERVICES**

**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.	SCOPE OF SUPPLY & SERVICES			
1.00.00	<b>GENERAL SCOPE OF SUPPLY AND SERVICES</b>			
1.01.00	<p>The scope of work for the equipment and accessories to be furnished in accordance with this Sub-section "Steam Generators and Auxiliaries including ESP", "Selective Catalytic Reduction (SCR) System including Cyclone Separator" and "Flue Gas Desulphurisation (FGD) System" shall include design, manufacture, engineering, inspection and testing at suppliers works, packing, forwarding to site, unloading, erection, supervision, pre-commissioning, testing and commissioning and performance testing of the equipment/system and works indicated in this Sub-section of the technical specification. Any item or works though not specifically mentioned in this specification but needed to complete the equipment &amp; systems to meet the intent of the Specification shall also be furnished.</p>			
1.02.00	<p><b>Tests</b></p> <p>The scope of the Contractor includes all shop tests, type tests, site tests, routine tests, etc., fulfillment of complete quality assurance &amp; inspection requirements and related activities for all the equipment &amp; systems covered under the scope of work of bidder as per the stipulations of Technical Specifications.</p>			
1.03.00	<p><b>Pre-commissioning and Commissioning Activities</b></p> <p>Contractor's Scope shall include all pre-commissioning and commissioning activities, required for successful performance of all equipment and systems under this Sub-section and shall include, but will not be limited to, activities detailed in Part-B of Technical Specification. Contractor's scope shall also include supply of all materials and services including the following for successful conductance of pre-commissioning and commissioning activities:</p>			
1.03.01	<p>Complete pre-commissioning work including tests of facilities such as line flushing, hydraulic testing of pressure parts, air and gas tightness tests of steam generator enclosure, duct work and ESP, SCR System including Cyclone Separator, FGD System, chemical cleaning of pressure parts, steam blow off, pressure drop test of ESP and SCR System, gas distribution test of ESPs, etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.</p>			
1.03.02	<p>Commissioning and initial operation of the facilities.</p>			
1.03.03	<p>Supply of all consumables (except coal and fuel oil for firing) like chemicals for chemical cleaning, passivation, inhibition etc., oil for line flushing, nitrogen for blanketing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities.</p>			
1.03.04	<p>(a) Supply of all temporary equipment such as tanks, piping, including supports, valves, Electrically Operated Temporary Valves (EOTVs) including one (1) no. as a spare in addition to the required number for Steam blowing process, nitrogen blanketing and purging equipment including nitrogen cylinders, pumps, blowers and all necessary instrumentation for successful conductance of pre-commissioning and commissioning activities. All temporary equipment, pumps, blowers, valves etc. brought to sites, by the Contractor for pre-commissioning/ commissioning purpose shall be in good working condition to ensure its safe and reliable operation at site. All such temporary equipment/components shall be brought to site atleast three (3) months prior to commencement of relevant pre-commissioning/ commissioning activities. On receipt of the temporary equipment/components at site, the same shall be inspected by the Employer to ensure its safe and reliable operation and if in the opinion of the Employer the temporary equipment/components are not in satisfactory conditions to ensure it's safe and reliable operation the same shall be immediately replaced by the Contractor.</p> <p>(b) The temporary equipment specifically brought by the Contractor solely for the pre-commissioning and commissioning work shall on completion of these activities,</p>			
<p><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</b></p>		<p><b>TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO. CS-9585-001-2</b> Page 47 of 606</p>	<p><b>SUB SECTION-II A-01 STEAM GENERATOR &amp; AUXILIARIES INCLUDING ESP</b></p>	<p><b>PAGE 1 OF 25</b></p>


# **FUEL OIL UNLOADING SYSTEM**

**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.	SCOPE OF SUPPLY & SERVICES			
<b>FUEL OIL HANDLING SYSTEM</b>				
<b>1.00.00</b>	<b>GENERAL INFORMATION</b>			
1.01.00	The Fuel Oil Handling Plant as specified in this specification shall meet the requirements of three (3) nos. steam generating units of 800 MW capacity each and the Auxiliary Boiler being installed for the project.			
1.02.00	HFO / LSHS/ HPS shall be used for initial start-up of the boiler and up to a load of 30% MCR. This shall also be used for coal flame stabilization up to 50% MCR of the steam generation.			
	Light Diesel Oil (LDO) shall be used for Auxiliary Boiler and initial ignition, warm-up and low load operation up to 7.5% MCR of the Steam Generating units. LDO shall also be used for flushing of HFO/LSHS/HPS pipe lines. The light oil required for flushing operation shall be supplied by Employer.			
1.03.00	The heavy fuel oil (HFO) / Low Sulphur Heavy Stock (LSHS)/ Heavy Petroleum Stock (HPS) shall be received at site in 4 wheeler wagons or in 8 wheeler wagons of the Indian Railway system			
	The receiving yard shall be designed to unload one (1) full rake of 76 nos/48 nos. railway wagons at a time. The oil from railway wagons shall be unloaded to unloading header by gravity which shall then be pumped to storage tanks through unloading pumps.			
	The heavy oil shall be pumped to two (2) nos. storage tanks each of capacity 3000 cu.meter.			
1.04.00	The Light Diesel oil (LDO) shall be received at the power station in road tankers and will be unloaded into the LDO storage tanks by LDO unloading cum transfer pumps.  The light oil shall be pumped to two (2) nos. storage tanks each of capacity 500 cu.meter. One (1) no. day oil tank (if applicable) of capacity 100 cu.m. for auxiliary boiler shall be provided. The day oil tank shall be fed from the 500 cu.m. storage tank(s) by a separate set of transfer pumps and pipe line.			
1.05.00	Each rail wagon (TOH type) for HFO/LSHS/HPS shall have steam heating arrangement for heating of HFO to 50 deg. C, LSHS to 70 deg. C and HPS to 85 deg. C for free flowing of the oil. Bulk heating will be performed by the serpentine heater at the bottom of wagons. For heating purposes, steam shall be provided by Bidder.			
1.06.00	In the event of wagons without heating coils (TORX type wagon), it is proposed that the oil shall be heated with live steam.			
1.07.00	A 450 NB HFO/LSHS/HPS unloading header with <del>eighty (80)</del> <span style="border: 1px solid red; padding: 2px;">100</span> Numbers hose connections for connecting neoprene rubber flexible hoses (100 nos.) to railway wagons shall be provided. 5% spare connection has been kept in the unloading header.			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</b>	<b>TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2</b>	<b>SUB-SECTION-IIA-13 FUEL OIL UNLOADING AND STORAGE SYSTEM</b>	<b>PAGE 1 OF 4</b>	

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			एनटीपीसी NTPC
2.00.00	<b>SCOPE OF WORK</b>			
	The scope of the equipment to be furnished & erected under this specification is detailed hereunder. The items though not specifically mentioned but are needed to make the equipment / system complete and safe from operational view point, shall also be treated as though included and the same shall also be furnished and erected unless other wise specifically excluded.			
2.01.00	<b>Mechanical Systems</b>			
2.01.01	<b>Tanks and Accessories</b>			
	<p>(a) Two (2) numbers fixed roof storage tank each of 3000 cu meter for storage of HFO/LSHS/HPS complete with accessories, instrumentation, floor coil heater, suction heater, insulation and cladding.</p> <p>(b) Two (2) numbers storage tank each of capacity 500 cu meter for storage of LDO. The tanks shall be located in the same installation.</p> <p>(c) One (1) number day oil tank <del>(if applicable)</del> for auxiliary boiler of capacity 100 cu.m for storage of LDO. The tank shall be located in the vicinity of the auxiliary boiler.</p> <p>(d) One (1) number Drain oil tank of capacity <del>six (6) cu.</del> <b>10cum</b> meter complete with accessories, instrumentation, floor coil heater, insulation and cladding.</p> <p>(e) <del>One (1) number condensate flash tank of minimum capacity 2 cu meter, complete with accessories, insulation and cladding.</del></p>			
2.01.02	<b>Pump Sets</b>			
	<p>(a) Five (5) numbers HFO/LSHS/HPS unloading pump motor sets each of 100 cu meter per hour capacity each complete with all the accessories of drive and mounting as specified for unloading the fuel oil from the railway wagons and pumping to the storage tanks.</p> <p>(b) Two (2) nos. LDO unloading pump motor sets each of capacity 50 cu meter per hour for unloading the fuel from road tankers and pumping to the LDO storage tanks.</p> <p>(c) Two (2) nos. LDO transfer pump motor sets <del>(if applicable)</del> each of capacity 25 cu.meter per hour for transfer of LDO from the storage tanks to day oil tank for auxiliary boiler.</p> <p>(d) Two (2) numbers HFO/HPS/LSHS drain pumps-set each of capacity 10 cu.m/hr, complete with all the accessories of drive and mounting as specified.</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB-SECTION-IIA-13 FUEL OIL UNLOADING AND STORAGE SYSTEM	PAGE 2 OF 4

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
2.01.03	<p>(e) <del>Two (2) numbers sump pumps set of capacity 10 cu.m /hr each in the oil water separator pit complete with all accessories of drive and mounting as specified.</del></p> <p>(f) Two (2) numbers dirty oil pumps of capacity 5 cu.m /hr each in the oil water separator pit complete with all accessories of drive and mounting as specified.</p> <p>(g) Two (2) nos sump pumps of capacity 10 cu.m /hr each at the sump in HFO unloading pump house complete with all accessories of drive and mounting as specified.</p>			
	<p><b>Piping System consisting of pipes, valves, fittings, supports, insulation etc.</b></p> <p>(a) Fuel oil piping, fuel oil drain pipe lines, auxiliary steam heating pipe lines, condensate pipe lines, LDO pipe lines, LDO drain pipe lines, all instrument air lines, Rail track drain steam tracing pipes, oil water separator pit heating arrangement pipes, complete with all supports, hangers, strainers, bends, flanges, counter flanges, gaskets, valves, fittings, steam traps etc. All piping required to complete the system shall be furnished by contractor.</p> <p>(b) Complete insulation and cladding of all steam, condensate and Fuel oil piping, valves, etc. as required and specified.</p> <p>(c) A pressure reducing station of 2x60% capacity for steam, complete with pressure reducing valves (self control type), isolating valves, manually operated bypass valves, pressure gauges, temperature gauges, relief valves etc. <span style="border: 1px solid red; padding: 2px;">100 nos.</span></p> <p>(d) <del>Eighty (80) nos. of 75 NB neoprene rubbers flexible hoses each of 8000 mm length with coupling &amp; fitting for connecting to wagons for fuel oil unloading. The hoses shall be provided with universal type of couplings for connecting to wagon outlet flanges.</del></p> <p>(e) 50 NB flexible hoses each of 8000 mm length with coupling &amp; fitting for connecting to wagons. Eighty (80) nos. hoses will be supplied for steam service and eighty (80) nos. for condensate service. The hoses shall be provided with universal type of couplings for connecting to wagon outlet flanges.</p> <p>(f) Complete steam heat tracing of all piping, valves, fittings, pumps, strainers and other equipments</p> <p>(g) Five (5) numbers neoprene rubber flexible hoses for unloading LDO from Road Tankers each of 75 NB size each of 8000 mm length with coupling &amp; fitting for connecting to road tankers.</p> <p>(h) <del>One (1) no hand operated monorail Hoist of 2 tonnes capacity alongwith monorail in the fuel oil unloading pump house.</del></p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB-SECTION-IIA-13 FUEL OIL UNLOADING AND STORAGE SYSTEM	PAGE 3 OF 4


CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			एनटीपीसी NTPC
2.01.04	<p>(i) Two (2) nos. flow meters for flow measurement. <b>Out of these two nos., One (1) flow meter shall be of minimum range of 50-500 cu meter/ hour capacity (for HFO/LSHS/ HPS) and one (1) flow meter shall be of minimum range of 5-50 cu meter/hr capacity (for LDO).</b></p> <p>(j) HFO and LDO tanks shall be provided with fixed fire protection system using foam. Additionally medium velocity water spray system shall be provided for LDO tanks. All necessary nozzle openings required for above fixed fire protection system on the storage tanks shall be in Bidder's scope of supply.</p> <p><b>Other Service Related to the system and forming part of Bidder's Scope of Work are :</b></p> <p>(a) Approval is required from statutory authorities for the entire F.O. storage and pumping installation. The contractor shall prepare all necessary drawings / data / documents as per the requirements of the statutory authority and assist the Employer in obtaining the necessary approval from the authorities.</p> <p>(b) For piping system coming under the preview of Indian Boiler Regulations, detailed calculation of pipe thickness shall be submitted and approval as required from the Chief Inspector of Boilers shall be obtained.</p> <p>(c) Submitting detailed design of oil-water separator pit required for the system. The oil water separator pit shall be designed as per API manual.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>OTHER WORKS CONTINUED...</b></p> <p>1. Review of civil drawings prepared by BHEL based in civil input drawing furnished by the contractor / vendor.</p> <p>2. Preparation of drawing showing common facilities for customer and contractor / vendor supplied equipment.</p> </div>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC.NO. CS-9585-001-2	SUB-SECTION-IIA-13 FUEL OIL UNLOADING AND STORAGE SYSTEM	PAGE 4 OF 4	


CLAUSE NO.	TECHNICAL REQUIREMENTS		
		Limestone	Gypsum
	a) For volumetric computation	-1400 kg/m <sup>3</sup>	900 kg/m <sup>3</sup>
	b) For load/ strength	- 1700 kg/m <sup>3</sup>	1250 kg/m <sup>3</sup>
4.04.04	2x100 %( one working + one standby) conveying stream shall be provided in the limestone and gypsum handling system.		
4.04.05	The covered storage shed for limestone shall be sufficient to store limestone equivalent to consumption of minimum 7 days. The covered storage shed for gypsum shall be sufficient to store gypsum equivalent to generation of minimum 7 days.		
<b>4.05.00</b>	<b>FUEL OIL HANDLING AND STORAGE SYSTEM</b>		
<b>4.05.01</b>	Fuel oil unloading & storage system shall be designed to handle both Heavy fuel oil (HFO) and light diesel oil (LDO).		
<b>4.05.02</b>	Fuel oil system shall meet the requirements of steam generator.		
<b>4.05.03</b>	The HFO shall be received at site in wagons of Indian railway system. The receiving yard shall be designed to unload one (1) full rake of 76nos/ 48nos railway wagons at a time. The Oil from rail wagons shall be unloaded to unloading header by gravity which shall then be pumped to storage tanks through unloading pumps. Five (5) nos of unloading cum transfer pumps, each of 100 m <sup>3</sup> /hr. capacity shall be provided. Out of five (5) pumps, four (4) will be working and one (1) will be for standby / maintenance purposes.		
<b>4.05.04</b>	In addition to the above provision for unloading LDO from minimum five (5) nos. road tankers shall also be kept. The Oil from tankers shall be unloaded to unloading header by gravity which shall then be pumped to LDO storage tanks through unloading pumps. Two (2) nos of unloading cum transfer pumps, each of 50 m <sup>3</sup> /hr. capacity shall be provided. Out of two (2) pumps, one (1) will be working and one (1) will be for standby / maintenance purposes.		
<b>4.05.05</b>	An oil water separator pit shall be provided near unloading header area to collect spilled over oil from unloading trench as well as pump house.		
<b>4.05.06</b>	Storage tanks shall be designed as per IS:803.		
<b>4.05.07</b>	Dyke size shall be as per OISD-118 guide lines.		
<b>4.05.08</b>	The velocity of oil in gravity flow lines shall be limited to 0.6-1.0 m/s. And that for pressurized lines it should be in the range of 1.0 to 1.5 m/s.		
<b>4.05.09</b>	The entire fuel oil handling installation shall have the approval of Chief Commissioner of Explosives, Nagpur.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-02 EQUIPMENT SIZING CRITERIA	PAGE 92 OF 92


# **FUEL OIL UNLOADING SYSTEM**


**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.	SCOPE OF SUPPLY AND SERVICES			
	<b>TANKS</b>			
1.00.00	<b>DESIGN AND CONSTRUCTION</b>			
1.01.00	<b>Fuel Oil (Heavy Oil) Storage Tanks, LDO Storage Tanks, Drain Oil Tanks</b>			
1.01.01	Tanks shall be designed, fabricated, erected and tested in accordance with the IS: 803, latest edition. Supporting framework wherever required, shall be in accordance with IS: 800, latest revision or equivalent.			
1.01.02	The tanks shall be "Non-pressure" fixed roof type with atmospheric vents and shall be designed for an internal pressure of 66 kgf/m <sup>2</sup> .			
1.01.03	Heavy oil, Light Oil Storage along with the associated facilities for the entire installation shall be in accordance with the requirements specified in the existing rules of Chief Controller of Explosives, Government of India.			
1.01.04	Tanks shall be made from IS: 2062 quality mild steel plates of tested quality. The plates shall be cold rolled through plate bending machine by several number of passes to true curvature. The tanks shall be of welded construction.			
1.01.05	Vessel seams shall be so positioned that they do not pass through vessel connections.			
1.01.06	<b>Tank Connections</b> <ul style="list-style-type: none"> <li>(a) All pipe material required for the tank connection shall be as specified.</li> <li>(b) Unless otherwise specified, for all flanged connections, Contractor shall furnish suitable counter flanges and necessary nuts, bolts and gasket materials. The flanges and counter flanges shall be fabricated by the Contractor from plates.</li> <li>(c) Flange faces of all nozzles shall be machined and shall be square with the vessel centerline.</li> </ul>			
1.01.07	All heavy oil storage tanks and drain oil tank shall be provided with insulation and cladding.			
1.01.08	For other salient technical data and test requirements, Refer Table M1 appended to this section.			
1.01.09	<b>Floor Coil Heater (Applicable to Heavy Oil storage and drain oil tanks)</b> <ul style="list-style-type: none"> <li>(a) Steam shall be used for heating of the Fuel Oil in the HFO/LSHS/HPS Storage Tanks and Drain Oil Tank. Steam at 15 kg/cm<sup>2</sup> (g) pressure shall be reduced to 3 kg/cm<sup>2</sup> (g) and this steam shall be utilized for all heating applications. The coils shall be designed to withstand this pressure and temperature conditions. Coil heat transfer area shall be calculated based on SATURATED condition of steam only (i.e. LMTD calculation shall be based on SATURATION TEMPERATURE corresponding to 3 kg/cm<sup>2</sup> (g).</li> <li>(b) The coils shall be laid in the bottom of the tank and shall be provided with steam inlet flanges and condensate outlet flanges, outside the tank.</li> <li>(c) The coils shall be made of 40 mm dia seamless tube as per ASTM-A-106. Gr.B.</li> <li>(d) The overall steam to oil heat transfer co-efficient (including dirt factor) for the floor coil heater shall be taken as 75 Kcal/Sq meter-hr.-deg.C.</li> </ul>			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 1 OF 22</b>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
	<p>(e) The arrangement of heating coil shall generally be as shown in tender drawing for the fuel oil storage tanks. For fuel oil storage tanks, the floor-heating coil shall be provided in twelve independent coil sections. Of these, six sections are for manual operation and the other six sections shall be self-controlled through the control valve operated by temperature indicating controller (ON-OFF type) by sensing oil temperature in Fuel oil storage tanks.</p> <p>(f) For other salient Technical Data and design specification for floor coil heater refer Table M1 appended to this section.</p> <p>(g) Heater design shall be adequate to raise the temperature of oil as specified in Table M1 and also maintain the required temperature taking care of heat loss from tank.</p> <p>(h) For the purpose of pressure reduction of the steam, 2 x 60% capacity pressure reducing station shall be provided. 100% capacity of the pressure reducing station shall correspond to the maximum steam requirement under the worst ambient condition for the following conditions put together.</p> <ul style="list-style-type: none"> <li>(i) One heavy oil storage tank in heating mode</li> <li>(ii) One heavy oil storage tank in 'Maintain' temperature mode.</li> <li>(iii) One suction heater in operation.</li> <li>(iv) Unloading of one full rake of railway wagons</li> </ul>			
1.01.10	<p><b>Suction Heater (Applicable to Heavy Oil Storage Tanks only)</b></p> <p>(a) Suction heaters shall be of shell and tube type with 'U' tubes. Seamless Steel tubes as per ASME-SA-179 (Tube for Heat Exchangers) shall be used for the tube bundle, which shall be of welded construction. Suction heater design and construction shall generally be in accordance with the technical specifications.</p> <p>(b) Each suction heater shall be mounted on the sidewall of the tank and shall be suitably supported.</p> <p>(c) The heater shall have oil in the shell side and steam in the tube side.</p> <p>(d) The temperature of oil at suction heater outlet is controlled automatically through control valves operated by temperature indicating controller as shown in the drawing.</p>			
1.01.11	<p>For other salient Technical Data and design specifications for Suction heater, refer Table M1 appended to this Section.</p>			
1.02.00	<p><b>Drain Oil Tank</b></p> <p>One drain oil tank shall be furnished to collect the oil drained from various pipes and from the equipments in the unloading pump house. The tank shall conform to IS: 800. The tank shall have accessories as indicated in tender drawing and shall have minimum liquid holding capacity of <b>10m<sup>3</sup></b></p> <p>The technical details and design specification for tank shall be as per Table -M1 appended to this Section.</p>			
<p><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>		<p><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p><b>PAGE 2 OF 22</b></p>

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
1.03.00	<p><b>Flash Tank</b></p> <p>A cylindrical tank of 2.0 m dia x 2.0 m height with dished ends shall be provided. Design, construction and testing of the tank shall be as per IS: 2825, Class - II or equivalent. The vent pipe shall be terminated at a height of 2.5 m (min.) above the tank top floor &amp; shall be routed suitably. For other technical details and design specifications, refer Table-M1 appended to this Section</p>			
1.04.00	<p><b>Vent Line</b></p> <p>(a) The vent for HFO/LSHS/HPS, Oil storage tanks, LDO tanks and drain oil tank shall be of proven design.</p> <p>(b) The design shall be such as to offer adequate areas for venting. Venting area shall be such that over pressure / vacuum is not created in the tank during maximum filling / draw-off rate.</p> <p>(c) The vent sizing shall be done as per API Standard.</p> <p>(d) The open end of the vent line shall be covered with two layers of fine copper wire gauge of not less than 11 meshes per cm. and fitted with hood.</p>			
1.05.00	<p><b>Lightning Protection</b></p> <p>Contractor shall install a lightning protection system conforming to the requirements of IS-2309 (Ref Clauses 14 for protection of vessel tanks containing flammable liquids). System shall constitute of suitable number of horizontal and vertical air terminals. All the air terminals shall be connected to the risers of underground earth mat provided 300 mm above ground.</p>			
2.00.00	<p><b>PRECAUTIONARY MEASURES</b></p>			
2.01.00	<p>No oil connection shall be made to any tank for any purpose until the tank is ready to be filled with oil.</p>			
2.02.00	<p>After oil connections have been made to a tank, no welding or any other hot work shall be carried out on the tank for repairs or any other purpose until all lines connected to the tank have been disconnected, the open ends of the pipelines blanked off and the tank and its vicinity tested and found gas free to the satisfaction of the Engineer / Employer.</p>			
2.03.00	<p>When a tank has once contained oil, no welding or other hot work shall be done on it for any purpose until in addition to the requirement of Clause 2.02.00 above, the tank has been completely emptied and the Engineer/Employer issues gas free and written authority for the work.</p>			
3.00.00	<p><b>CLEANING AND PAINTING</b></p>			
3.01.00	<p>After erection of tanks all surfaces shall be cleaned thoroughly by wire brushing and sand blasting to remove completely all loose dirt, rust, mill scales and any deleterious material. The surface shall then be prepared in accordance with manufacturers recommendations for applying an approved primer. After preparation of the surfaces in strict conformance to the specification the painting shall be applied. Further please refer separate painting chapter of Technical Specification Part-B, A-10- Surface preparation &amp; Painting.</p>			
<p><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>		<p><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p><b>PAGE 3 OF 22</b></p>

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES																								
3.02.00	Interior surface of the tanks shall be coated with the primer and finish paint as noted below: <ul style="list-style-type: none"> <li>i) HFO storage tank, LDO storage tank and Drain oil tank               <ul style="list-style-type: none"> <li>(a) Epoxy red oxide - zinc phosphate primer - 2 coats of 30 microns each</li> <li>(b) Epoxy high build - coating - 2 coats of 100 microns each</li> </ul> </li> <li>ii) <del>Flash Tank</del> <del>Epoxy red oxide zinc phosphate primer</del> - 2 coats of 30 microns each</li> </ul>																								
3.03.00	All external surfaces (non insulated) of the tanks shall be painted with primer coat of Epoxy resin based zinc phosphate (1 X 100 microns), one intermediate coat of epoxy resin based paint pigmented with titanium dioxide (1 X 100 microns) and finish coat of epoxy paint of approved shade (1 X 75 microns).																								
3.04.00	All insulated surfaces of tanks shall be painted with synthetic red oxide zinc chromate primer.																								
3.05.00	Outside surface of bottom plates of all tanks resting on ground shall be given one (1) coat of coal tar epoxy enamel.																								
3.06.00	All insulated piping and structures shall be finished with synthetic enamel paints after use of proper primer.																								
4.00.00	Test requirements for various equipments described in this sub-section are indicated in the enclosed specification sheets. The requirements indicated herein shall be included in the comprehensive inspection, testing and quality program to be submitted by the contractor and to be finalized with the Employer. <p style="text-align: center;"><b>TABLE - M1</b></p>																								
4.01.00	<b>TECHNICAL SPECIFICATION AND DATA-SHEETS FOR TANKS</b>																								
4.01.01	<b>I. HEAVY OIL STORAGE TANK, LDO STORAGE TANKS</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 35%; text-align: center;">HEAVY OIL STORAGE TANK</th> <th style="width: 35%; text-align: center;">LDO DAY OIL TANK</th> </tr> </thead> <tbody> <tr> <td>i) Type of Construction</td> <td colspan="2" style="text-align: center;">Vertical, Cylindrical, non-pressure, fixed roof type with atmospheric vents</td> </tr> <tr> <td>ii) Codes</td> <td colspan="2" style="text-align: center;">Design and construction as per IS: 803</td> </tr> <tr> <td>iii) Design pressure</td> <td></td> <td></td> </tr> <tr> <td>    a) Internal Pressure</td> <td style="text-align: center;">66 Kgf/m<sup>2</sup></td> <td style="text-align: center;">66 Kgf/m<sup>2</sup></td> </tr> <tr> <td>    b) Vacuum</td> <td style="text-align: center;">63.5 Kgf/m<sup>2</sup></td> <td style="text-align: center;">63.5 Kgf/m<sup>2</sup></td> </tr> <tr> <td>iv) Design Temperature</td> <td style="text-align: center;">120° C</td> <td style="text-align: center;">Ambient Temperature</td> </tr> </tbody> </table>				HEAVY OIL STORAGE TANK	LDO DAY OIL TANK	i) Type of Construction	Vertical, Cylindrical, non-pressure, fixed roof type with atmospheric vents		ii) Codes	Design and construction as per IS: 803		iii) Design pressure			a) Internal Pressure	66 Kgf/m <sup>2</sup>	66 Kgf/m <sup>2</sup>	b) Vacuum	63.5 Kgf/m <sup>2</sup>	63.5 Kgf/m <sup>2</sup>	iv) Design Temperature	120° C	Ambient Temperature	
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<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>		<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 4 OF 22</b>																					

	v)	Capacity m <sup>3</sup>	3000 m <sup>3</sup>	500/ 100 m <sup>3</sup>			
	vi)	*Dimensions (I.D x height)	18 m dia x 13.0 m ht. (minimum)	10 m dia x 8.5 m ht. (min.)/ 6 m dia x4.5 m ht. (min.) (for day oil tank)			
	vii)	Material of construction					
	a)	Tank Shell, roof and bottom	IS: 2062 Tested quality steel plates				
	b)	Structural	IS: 2062 Tested quality steel plates				
	* Note : Bidder has to offer the tanks as per the dimensions indicated at (vi) above. Height of the tank shall mean the vertical distance between tank bottom upto bottom of overflow nozzle.						
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<table style="width: 100%; border: none;"> <tr> <td style="width: 45%;"></td> <td style="width: 25%; text-align: center;"><b>HEAVY OIL STORAGE TANK</b></td> <td style="width: 30%; text-align: center;"><b>LDO STORAGE TANK/ DAY OIL TANK</b></td> </tr> </table>						<b>HEAVY OIL STORAGE TANK</b>	<b>LDO STORAGE TANK/ DAY OIL TANK</b>
	<b>HEAVY OIL STORAGE TANK</b>	<b>LDO STORAGE TANK/ DAY OIL TANK</b>					
-----							
	viii)	Corrosion Allowance (minimum)	----- 1.8 mm -----				
	ix)	Shell Joint efficiency factor	----- 0.85 -----				
	x)	Vent	Tank shall be provided with open and free flow type atmospheric vent, which allows unimpeded flow of vapors out of and allows air into tank and at the same time prevents rain and air-borne dust from getting into the tank.				
	xi)	Nominal Venting capacity	Shall be obtained by reference to API guide for tank venting (API-2000)				
	xii)	Tank Floor coil heaters					
	a)	Heating Steam Parameters	3 kg/cm <sup>2</sup> (g), 191 <sup>o</sup> C (however coil heat transfer area shall be calculated based on saturated condition of steam only)				
	b)	Design parameters					
		-	Initial temperature of oil				


CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
	i)	For HFO	10 <sup>o</sup> C	----
	ii)	For LSHS	30 <sup>o</sup> C	----
	iii)	For HPS	45 <sup>o</sup> C	----
	-	Final temperature of oil		
	i)	For HFO	50 <sup>o</sup> C	----
	ii)	For LSHS	70 <sup>o</sup> C	----
	iii)	For HPS	85 <sup>o</sup> C	----
	-	Time required for heating oil from initial temperature to final temperature	Entire contents in 36 hours	
	-	Specific heat of oil (Kcal/Kg <sup>o</sup> C)	0.65 below pour point for LSHS/ HPS and 0.5 for LSHS/HPS above pour point, 0.5 for HFO	
	-	Overall steam to oil heat transfer co-efficient (including dirt factor)	75 Kcal/sq.meter hr. <sup>o</sup> C	
	-	Ambient condition for heat loss calculations	10 <sup>o</sup> C and air velocity of 5 m/s ---	
	-	Coil Dia and Material	40mm seamless tube as per ASTM A-106 Gr.B sch 40 ---	
	NOTE : Contractor shall design the heater for the worst case.			
	c)	Number of section of heating coil for each tank	Twelve (12) (6 on automatic control and 6 on manual control) ---	
	d)	Type of control	One (1) no. Control valve each for the three (3) (open/close type) automatic control sections of ---	
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 6 OF 22</b>	





CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES	
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	<p>of tank</p> <p>Size 3 m x 3 m x 2 m (Minimum Dimensions to be adhered to)</p> <p>Material of construction IS: 2062 Tested Quality steel plates</p> <p>Testing requirements Hydraulically tested to a pressure of 0.7 bars Insulation As required as per approved calculations</p> <p>Tank heater</p> <p>Heating Medium Steam</p> <p>Quantity of oil to be heated 10 m3</p> <p>Heating time hrs. 4</p> <p>Initial temp of oil</p> <p>For HFO 10<sup>0</sup>C</p> <p>For LSHS 30<sup>0</sup>C</p> <p>For HPS 45<sup>0</sup>C</p> <p>Final temp. of oil</p> <p>For HFO 50<sup>0</sup>C</p> <p>For LSHS 70<sup>0</sup>C</p> <p>For HPS 85<sup>0</sup>C</p> <p>Overall heat Transfer Co-efficient of coil 75 Kcal/m<sup>2</sup>- hr-deg.C</p> <p>Specific heat of oil (Kcal/Kg<sup>0</sup>C) 0.5 for HFO 0.65 below pour point for LSHS/HPS 0.5 above pour point for LSHS/HPS</p> <p><b>III FLASH TANK</b></p> <p>Type of Construction Vertical, cylindrical with dished ends.</p> <p>Code IS: 2825 Class-2</p> <p>Dimensions of tank 2.0 m inside dia x 2.0 m shell height</p> <p>Material of construction IS: 2002, Gr. 2A plates</p> <p>Design pressure 16 Kg/cm<sup>2</sup> (g)</p>	
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<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p align="center"><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p align="center"><b>PAGE 8 OF 22</b></p>
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CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
	<p>Design temperature</p> <p>Corrosion allowance</p> <p>Joint efficiency factor</p> <p>Spot radiography</p> <p>Testing Requirements</p> <p>Vent</p> <p>Insulation thickness</p>	<p>210<sup>o</sup>C</p> <p>1.8mm</p> <p>0.85</p> <p>Shall be conducted on 10% of the total longitudinal and circumferential joints.</p> <p>a) As per IS:2825</p> <p>b) Dye penetration test shall be carried out on welds</p> <p>c) Hydraulic Test at 1.5 times the design pressure shall be carried out.</p> <p>Free vent pipe of 250 NB size and 2.5M Length</p> <p>As required as per approved calculations</p>		
	<b>PIPING, VALVES &amp; PUMPS</b>			
5.00.00	<b>Piping</b>			
5.01.01	Piping for 50 mm and larger size shall be butt-welded and small piping below 50 mm shall be socket welded.			
5.01.02	Piping shall be capable of withstanding the following minimum pressure (Or actual working pressure or as per clause 5.01.09, whichever is higher):			
	<p>a) Fuel oil pipe line</p> <p>b) Steam</p> <p>c) Instrument air</p>	<p>10kg/cm<sup>2</sup> (g) and 90 deg.C</p> <p>15 kg/cm<sup>2</sup> (g) and 215 deg.C where 15 kg/cm<sup>2</sup> (g) steam shall be used.</p> <p>6 kg/cm<sup>2</sup> (g) and 200 deg.C where 3 kg/cm<sup>2</sup> (g) steam shall be used.</p> <p>5-7 kg/cm<sup>2</sup> (g) and 40 deg.C</p>		
5.01.03	The minimum thickness of the pipe as detailed in this specification shall be adhered to.			
5.01.04	The steam pipe lines in the scope of Bidder are under the purview of IBR. As such it shall be the responsibility of the Bidder to obtain the necessary clearances for the statutory authorities. Bidder shall also carry out the necessary stress analysis of the piping and submit for Employer's approval.			
5.01.04	The hot lines shall be supported with flexible connections to permit axial and lateral movements without restraint or binding at any supported elements.			
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p align="center"><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p align="center"><b>PAGE 9 OF 22</b></p>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
5.01.05	Expansion loops shall be provided for steam, condensate and oil lines in order to restrict end forces and movements, and the necessary design calculations shall be furnished for Employer's approval.			
5.01.06	Outdoor support shall be provided with sliding movement of pipe over the support. All steel sliding support faces shall be covered with stainless steel plates with counter sunk screws on both top and bottom sliding faces of support.			
5.01.07	All guides anchors braces, dampers, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided by Contractor.			
5.01.08	<p>All heavy oil pipeline shall be steam traced. The minimum no. of tracers for heavy oil pipe line shall be as under:</p> <p>a) 350 NB and above pipe : 3 x 20 mm NB</p> <p>b) 150 to 300 NB pipe : 2 x 20 mm NB</p> <p>c) 100 mm NB &amp; below pipe : 1 x 20 mm NB</p>			
5.01.09	PIPING SPECIFICATION IS FOR INFORMATION ONLY. THIS SHALL BE FREE ISSUED TO VENDOR. E&C WILL BE IN BIDDER SCOPE	<p>The oil piping material shall conform to API-5L Grade B ERW pipe or site fabricated from min. 8 mm thick steel plates to IS:2062 Gr.B / IS:3589 Gr. Fe410 for size 450NB and above. For sizes 400 NB and below the pipe material shall be conforming to API-5L Gr.B ERW. The steam / condensate pipes shall be conforming to ASTM-A 106 Gr.B Sch.40. The pipe thickness (min.) for oil service shall be as under.</p> <p>450 NB : 7.14 mm (material as per API-5L Grade.B)</p> <p>400 NB : 6.35 mm</p> <p>350/300 NB : 6.35 mm</p> <p>250/200 NB : 5.56 mm</p> <p>150 NB : 4.78 mm</p> <p>100/80/65 NB : 3.96 mm</p> <p>50 NB : 3.91 mm</p> <p>40 NB : 3.68 mm</p> <p>25 NB : 3.38 mm</p> <p>20 NB : 2.87 mm</p> <p>15 NB : 2.77 mm</p>		
5.01.10	<p>The minimum pipe size for various applications is indicated in the tender drawings. Wherever the pipe size is not indicated, the same shall be selected as per following criteria of velocity of the fluid in the pipeline.</p> <p>a) Suction side of the pump for oil &amp; water application 0.6-1.2 m/s.</p> <p>b) Discharge side of the pump for oil &amp; water application 1.0-1.5 m/s.</p>			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>		<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 10 OF 22</b>

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
	c) Pipes for steam heating application 40 m/s. (max.).			
5.01.11	Fittings for oil service shall be Butt welded fittings, conforming to ANSI B16.9 and material to ASTM-A-234. Fittings of 50mm size and below shall be socket welded conforming to ANSI B16.11, material to ASTM-A-105. Fittings for steam and condensate service shall be Butt welded fittings, conforming to ANSI 16.9 and material to ASTM A.234 Gr. WPB (forging). Fitting of 50mm size and below shall be socket welded conforming to ANSI B-16.11, material to ASTM-A-105 (Forging).			
5.01.12	Steam traps shall be provided with strainers and each trap station shall be provided with isolating valve, by-pass arrangement and non-return valve.			
5.01.13	Vents at the highest point and drains at the lowest point shall be provided.			
6.00.00	<b>VALVES</b>			
6.01.00	All valves shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate. The valves shall be full bore and sizes of valves shall be the same as that of the parent pipe.			
6.02.00	All manually operated valves shall be provided with gear operator of proven quality, reputed make and conforming to internationally accepted standard, if the effort required to operate the valve exceeds 25 kgf.			
6.03.00	All valves shall be provided with hand wheels, extension spindles and floor stands or any other arrangement wherever required so that they can be operated manually with ease by a single operator from the nearest operating floors either at a lower or higher elevation as the case may be. Wherever necessary for safety purpose, locking devices shall be furnished with valves.			
6.04.00	<b>Gate Valves</b>			
6.04.01	Gate valves shall be used for isolation purpose for all sizes in steam and condensate lines and for sizes above 300 NB for oil lines. The gate valves shall be provided with hand wheel, position indicator and draining arrangement.			
6.04.02	Gate valves for sizes up to and including 40 NB shall be of class 800, forged carbon steel valves with solid wedge, OS & Y rising stem, bolted bonnet with deep stuffing box and lantern ring. Trim shall be of 13% chrome steel. Body material shall conform to ASTM A 105 and ends shall be socket welded.			
6.04.03	For sizes above 40 NB, valves shall be of class 150/300 (depending on service), Cast Carbon Steel gate valves. Face to face dimensions shall be as per ANSI B 16.10. Body material shall be ASTM A 216 Gr. WCB and ends shall be flanged to ANSI 150/300 lbs rating with raised face. Other particulars shall remain same as above.			
6.04.04	The valves shall conform to API-600/API-602 and shall be tested to API 598/IS: 6157 requirements. IBR certificates as necessary shall also be provided.			
6.05.00	<b>Globe Valves</b>			
6.05.01	Globe valves shall be used for regulation purpose for all sizes in steam condensate and oil lines. They shall be provided with hand wheel, position indicator and draining arrangement.			
6.05.02	Globe valves for sizes up to and including 40 NB shall be of class 800 forged carbon steel valves with plug type disc. Other particulars shall be same as 6.04.02 above.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2	SUB SECTION A-21 FO-UNLOADING SYSTEM	PAGE 11 OF 22	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
6.05.03	For sizes above 40NB, valves shall be class 150/300 (depending on service) Cast Carbon steel globe valves with plug or ball type disc. Other particulars shall be same as 6.04.03 above.			
6.05.04	The valve shall conform to BS: 1873/BS: 5352 and shall be tested to BS: 6755/ BS: 5146 requirements. IBR certificates as necessary shall also be provided.			
6.06.00	<b>Check Valves</b>			
6.06.01	Check valves shall be used for non return service for all sizes in steam, condensate and oil lines.			
6.06.02	For sizes up to and including 50NB, check valves shall be of class 800 forged Carbon Steel horizontal lift type, with bolted cover. Valves shall have 13% Chrome Steel trim and body material to ASTM A 105. Ends shall be socket welded.			
6.06.03	For sizes above 50NB, check valves shall be of class 150/300 (depending on service) Cast Carbon Steel valves of swing check type having bolted cover. Trim shall be of 13% Chromium Steel and body material to ASTM A 216 Gr. WCB. Ends shall be flanged to ANSI Class 150/300 lb rating with raised face.			
6.06.04	The valve shall conform to BS: 1868/BS: 5352/ANSI B16.34 and shall be tested to BS: 5146 / BS: 6755/API 598 requirements. IBR certificates as necessary shall also be provided.			
6.07.00	<b>Oil Line Plug/Ball Valves</b>			
6.07.01	Plug/Ball valves shall be used for isolation purpose in oil lines for sizes up to and including 300 NB. Valves shall be wrench or gear and hand wheel operated and shall have `port` position indicators with CLOSE/OPEN indications marked on valve body.			
6.07.02	Ball valves for sizes up to and including 300 NB shall be of class 150 full bore type. Body material for plug/Ball valves shall be ASTM-A-216 GR. WCB. The ball shall be of SS-AISI-316 quality and plug material (for plug valves) shall be hardened steel to ASTM-A-216 Grade WCB with suitable heat treatment. Plug valves shall be self lubricated taper type of proven design.			
6.07.03	FO storage tank Inlet/fill line shall be provided with remote operated valves. The details of valves shall be as per clause No.6.07.01 and 6.07.02. The actuator details shall be furnished by the bidder for Employer's approval.			
6.07.04	All ball valves shall conform to BS: 5351 and fire safe test shall conform to BS: 6755 part-2/ API 607. All plug valves shall conform to BS: 5353 and fire safe test shall meet the requirements of BS: 6755 part-2. Fire safe certificates shall be submitted to Employer for approval. In absence of the certificates, the fire test shall be carried out by valve supplier.			
6.08.00	<b>Control Valves</b>			
6.08.01	<b>Pressure Reducing Station</b>			
	Type	:	Self actuated pilot operated.	
	Steam pressure at inlet	:	15 kg/cm <sup>2</sup> (g)	
	Steam pressure at outlet	:	3 kg/cm <sup>2</sup> (g)	
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CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
6.08.02	<p>Material of Construction:</p> <p>i) Body : CS to ASTM A 216 Gr. WCB</p> <p>ii) Trim : SS 316 stellited</p> <p>Leakage : 0.01% of rated Cv</p> <p><b>For Suction Heater</b></p> <p>Type : Single seated, globe type</p> <p>Characteristics : Modulating duty</p> <p>Leakage : 0.01% of rated Cv</p>			
6.08.03	<p>Material of Construction:</p> <p>i) Body &amp; Bonnet : CS to ASTM A 216 Gr. WCB</p> <p>ii) Trim : SS 316 stellited</p> <p><b>For Floor Coil Heater</b></p> <p>Type : Single seated, globe type</p> <p>Characteristics : On-Off duty</p> <p>Leakage : 0.01% of rated Cv</p>			
7.00.00	<p>Material of Construction:</p> <p>i) Body &amp; Bonnet : CS to ASTM A 216 Gr. WCB</p> <p>ii) Trim : SS 316 stellited</p> <p><b>HOSES</b></p>			
7.01.00	<p>The hoses for HFO / HPS / LSHS / LDO shall conform to BS: 1435 (latest edition), type S-7. The design temperature of the oil is 105 deg.C. The length of the hose shall be 8000 mm and dia 75 NB. Both the end connections shall be galvanized in accordance with BS: 729/zinc sprayed as per BS: 2569, Part-1.</p>			
7.02.00	<p>The hoses for steam/condensate application shall be made of cold rolled steel strip electro-galvanized, double inter-locked with steel &amp; asbestos packed. The design temperature shall be 215 deg.C and design pressure shall be 10 kg./sq.cm(g). Both the end connections shall be galvanized in accordance with BS: 729/zinc sprayed as per BS: 2569, Part-1.</p>			
7.03.00	<p><b>Strainers:</b></p> <p>The strainers at the suction of various pumps shall be simplex type basket strainers. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least six (6) times the internal area of the connecting pipe lines. The strainer element shall be 40 mesh. Pressure drop across the strainers in new connection shall not exceed 1.5 MLC at full flow. The material of construction of various parts shall be as follows:</p>			
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p align="center"><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p align="center"><b>PAGE 13 OF 22</b></p>	



CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES							
8.00.00	(a) Body : MS to IS: 2062 (min. 8mm thk) or Pipe to IS:3589 (min. 6.35 mm thk) (b) Strainer Element : Stainless Steel (AISI 316) (c) End connection : Flanged <b>PUMPS</b>							
	<b>Sl. No.</b>	<b>Description</b>	<b>HFO</b>	<b>LDO Unloading Pumps</b>	<b>LDO Transfer Pumps (If applicable)</b>	<b>Drain Oil Pumps</b>	<b>Sump Pumps</b>	<b>Dirty Oil Pumps</b>
	1	2	3	4	5	6	7	8
	1.	Type of pump	Twin screw external bearing with Mechanical gear	Twin screw external bearing with Mechanical gear	Twin screw external bearing with Mechanical gear	Single Screw Vertical	Vertical Centrifugal Submersible Type	Single Screw Vertical
	2.	Type of fuel to be handled	HFO/LS HS/HPS	LDO	LDO	HFO OIL/ Sludge	OIL/ Sludge	Dirty Oil at Oil Water Separator pit
	3.	Design Viscosity	50-500 CST	2-20 CST	2-20 CST	50-500 CST	5-50 CST	50-500 CST
	4.	Pump design/ construction code	API 676	API 676	API 676			
	5.	Temperature of fluid	90°C	Ambient	Ambient	Ambient	Ambient	Ambient
	6.	No. of pumps	5	2	2	2	4*	2
	7.	Rated capacity in design viscosity range	100 m <sup>3</sup> /hr.	50 m <sup>3</sup> /hr	25 m <sup>3</sup> /hr	10 m <sup>3</sup> /hr	10 m <sup>3</sup> /hr	5 m <sup>3</sup> /hr
8.	Design temperature of fluid	90°C	Max. Ambient	Max. Ambient	Max. Ambient	Max. Ambient	Max. Ambient	
9.	Max. temperature to which the pump may be supplied	90°C	Max. Ambient	Max. Ambient	Max. AMBIENT	Max. Ambient	Max. Ambient	
10.	Pump speed	1500	1500	1500	1500	1500	1500	
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-21 FO-UNLOADING SYSTEM		PAGE 14 OF 22	




CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES							
SI. No.	Description	HFO	LDO Unloading Pumps	LDO Transfer Pumps (If applicable)	Drain Oil Pumps	Sump Pumps	Dirty Oil Pumps	
1	2 (max.)	3	4	5	6	7	8	
		* <del>[Two (2) Nos. pumps shall be installed at sump of unloading pump house and two (2) nos. at Water pit of Oil Water Separator pit]</del>						
11.	Drive Motor Type of Enclosure	<----- TEFC and Flame proof as per IS : 2148 ----->						
12.	Motor Rating at 50°C.	<-----Shall have minimum 10% margin over and above the maximum load ----> demand in the entire operating range of the pumps						
13.	Materials of construction							
a.	Casing	<-----Cast Iron to IS : 210 Gr. FG 260 ---->			Cl to IS:210 Gr. FG 260 / IS:1239(Heavy grade)	Cl to IS:210 Gr. FG 260	Cl to IS:210 Gr. FG 260 / IS:1239(Heavy grade)	
b.	Rotor/ Impeller	SS to AISI-431	SS to AISI-431	SS to AISI-431	SS to AISI-431	2-2.5% Ni Cast Iron	2-2.5% Ni Cast Iron	
c.	Shaft	SS to AISI-431	SS to AISI-431	SS to AISI-431	SS to AISI-431	EN-8	SS to AISI-304	
d.	Pump Motor base plate	Fabricated steel IS-2062	Fabricated steel IS:2062	Fabricated steel IS:2062	---	Fabricated steel IS:2062	---	
<p><b>THERMAL INSULATION, CLADDING &amp; LAGGING</b></p> <p><b>GENERAL</b></p> <p>Thermal insulation along with cladding shall be provided for all the equipment/surfaces having skin temperature more than 60°C. Insulation mattresses/section shall be supplied in thickness of 25, 40, 50 and 75mm. Insulation of higher thickness shall be made up in multiple layers using mattress/slabs of thickness above. The mattress/slabs in increment of 5mm shall be acceptable for outer layers. The minimum thickness however, shall not be less than 25mm and number of layers shall be minimum and innermost layer shall be the thickest. Hand made Mattresses is not acceptable. Insulation material shall be Mineral wool which shall either be Rock Wool (or) Glass Wool. Slag wool (or) Slag Wool Inclusion shall not be accepted. Lightly resin bonded Glass Wool Mattresses having density of 64 kg/cu.m. (Min) self stitched in shop can also be accepted for temperature less than 400 deg.C.</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-21 FO-UNLOADING SYSTEM		PAGE 15 OF 22	


**NOTES:**


i) Head / discharge pressure of the various pumps shall be decided during detailed engineering stage based on layout requirement & pressure drop. In addition to the head calculated, a margin of 1 kg/cm<sup>2</sup> to be considered while selecting unloading pump head.


ii) Pump to be selected shall have lowest NPSH requirement.


iii) For selection of pump head and motor rating, the criteria shall be as follows:  
 Pump head will have 10% margin over the calculated pump head. Motor rating will be arrived at by considering higher of the following. 15% margin over BHP at duty point (duty point means specifies discharge at 1.1 times the calculated head) RV set pressure (10% or 1 Kg/cm<sup>2</sup> higher than duty point pressure whichever is higher) BHP


CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES																																																
10.00.00	<p><b>INSULATION</b></p> <p>Contractor shall furnish heat insulation for all necessary equipment and piping supplied under the specification to efficiently prevent abnormal loss of heat from all exposed parts. Apart from preventing heat loss, insulation shall also be provided for all hot surfaces for the purposes of personnel protection. The thickness of pipe and equipment insulation shall be to meet the heating system requirements and to limit the insulation outer surface temperature to 60°C. Insulation thickness shall be as per the design calculations approved by the Engineer during detailed Engineering.</p>																																																
11.00.00	<p>The specifications and the design criteria of insulation and cladding is described in the following paragraphs.</p> <table border="1" data-bbox="343 672 1300 1948"> <thead> <tr> <th data-bbox="343 672 422 761">Sl. No.</th> <th data-bbox="422 672 1013 761">Description/Parameters</th> <th data-bbox="1013 672 1300 761">Design Criteria/ Requirements</th> </tr> </thead> <tbody> <tr> <td data-bbox="343 761 422 828">1.</td> <td data-bbox="422 761 1013 828">Design Ambient Temp.</td> <td data-bbox="1013 761 1300 828">50°C</td> </tr> <tr> <td data-bbox="343 828 422 896">2.</td> <td data-bbox="422 828 1013 896">Surface wind velocity</td> <td data-bbox="1013 828 1300 896">0.25m/s.</td> </tr> <tr> <td data-bbox="343 896 422 963">3.</td> <td data-bbox="422 896 1013 963">Emissivity of Aluminum</td> <td data-bbox="1013 896 1300 963">0.2</td> </tr> <tr> <td data-bbox="343 963 422 1030">4.</td> <td data-bbox="422 963 1013 1030">Cladding surface temperature</td> <td data-bbox="1013 963 1300 1030">60°C</td> </tr> <tr> <td data-bbox="343 1030 422 1220">5.</td> <td data-bbox="422 1030 1013 1220">Thermal conductivity of Insulation material</td> <td data-bbox="1013 1030 1300 1220">As per IS: 8183 (lightly resin bonded mineral wool of best grades) (or) As per IS: 9842 (Preformed Pipe Section)</td> </tr> <tr> <td data-bbox="343 1220 422 1288">6.</td> <td data-bbox="422 1220 1013 1288">Pipe/equipment wall temperature</td> <td data-bbox="1013 1220 1300 1288">Max. fluid design temperature</td> </tr> <tr> <td data-bbox="343 1288 422 1366">7.</td> <td data-bbox="422 1288 1013 1366">Overall heat transfer coefficient and insulation thickness</td> <td data-bbox="1013 1288 1300 1366">As per ASTM C 680-89 or as per IS 8183</td> </tr> <tr> <td data-bbox="343 1366 422 1478">8.</td> <td data-bbox="422 1366 1013 1478">Bulk density of lightly resin bonded mineral wool mattresses</td> <td data-bbox="1013 1366 1300 1478"></td> </tr> <tr> <td data-bbox="343 1478 422 1534">a)</td> <td data-bbox="422 1478 1013 1534">For use up to 400°C</td> <td data-bbox="1013 1478 1300 1534">100 Kg/cu.m.</td> </tr> <tr> <td data-bbox="343 1534 422 1601">b)</td> <td data-bbox="422 1534 1013 1601">For use above 400°C</td> <td data-bbox="1013 1534 1300 1601">150 Kg/cu.m.</td> </tr> <tr> <td data-bbox="343 1601 422 1668">9.</td> <td data-bbox="422 1601 1013 1668">Pipe Insulation</td> <td data-bbox="1013 1601 1300 1668"></td> </tr> <tr> <td data-bbox="343 1668 422 1724">a)</td> <td data-bbox="422 1668 1013 1724">Rock wool Mattress</td> <td data-bbox="1013 1668 1300 1724">100 kg/cu.m.</td> </tr> <tr> <td data-bbox="343 1724 422 1780">b)</td> <td data-bbox="422 1724 1013 1780">Glass wool Mattress</td> <td data-bbox="1013 1724 1300 1780">64 kg/cu.m.</td> </tr> <tr> <td data-bbox="343 1780 422 1948">c)</td> <td data-bbox="422 1780 1013 1948">Mineral wool Preformed Pipe Section</td> <td data-bbox="1013 1780 1300 1948">140-150 kg/cu.m.</td> </tr> </tbody> </table>				Sl. No.	Description/Parameters	Design Criteria/ Requirements	1.	Design Ambient Temp.	50°C	2.	Surface wind velocity	0.25m/s.	3.	Emissivity of Aluminum	0.2	4.	Cladding surface temperature	60°C	5.	Thermal conductivity of Insulation material	As per IS: 8183 (lightly resin bonded mineral wool of best grades) (or) As per IS: 9842 (Preformed Pipe Section)	6.	Pipe/equipment wall temperature	Max. fluid design temperature	7.	Overall heat transfer coefficient and insulation thickness	As per ASTM C 680-89 or as per IS 8183	8.	Bulk density of lightly resin bonded mineral wool mattresses		a)	For use up to 400°C	100 Kg/cu.m.	b)	For use above 400°C	150 Kg/cu.m.	9.	Pipe Insulation		a)	Rock wool Mattress	100 kg/cu.m.	b)	Glass wool Mattress	64 kg/cu.m.	c)	Mineral wool Preformed Pipe Section	140-150 kg/cu.m.
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CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
	10. Tank and Equipment Insulation  a) Rock wool Mattress  b) Glass wool mattress  11. Sheathing (cladding) material  a) For a dia of insulated surfaces of 450 mm and above for flat surfaces  b) For a dia of insulated surfaces up to 450 mm  c) For a dia of insulated surfaces up to 450 mm  12. Binding and Lacing Wires, Up to 400 deg. C  13. Straps and Bands, Up to 400 deg. C  14. Hexagonal wire mesh, Up to 400 deg. C  15. Mineral wool testing	100 kg/cu.m.  64 kg/cu.m.  As per ASTM B-209-1060 TEMPER-H-14 (or) As per IS 737 Gr.19000/H2  16 SWG (with lightly Bonded Mattress)  20 SWG (with lightly Bonded Mattress)  20 SWG (with Preformed Pipe Sections)  20 SWG of Galvanized steel  Galvanized steel (Bands shall be of 20mm wide and 0.6mm thick)  Galvanized steel of 10-13 mm aperture and 0.71 mm diameter  As per ASTM C-457		
12.00.00	<p><b>APPLICATION OF INSULATION:</b></p> <p>a) All surfaces to be insulated, shall be cleaned of all foreign materials such as dirt, grease, rust etc., and shall be dry before the application of insulation.</p> <p>b) Before applying the insulation, the contractor shall check that, all instrument tapping, clamps, lugs and other connections on the surface to be insulated have been properly installed as per the relevant erection drawing.</p> <p>c) All flanged joints shall be insulated, only after the, final tightening and testing.</p> <p>d) The insulation shall be applied to all surfaces when they are at ambient temp. Ample provision shall be made for the maximum possible thermal movement and the insulation shall be applied so as to avoid breaking/telescoping due to alternate periods of expansion and contraction.</p> <p>e) All cracks, voids and depressions shall be filled with finishing cement, suitable for the equipment operating temp. so as to form a smooth base for the application of cladding.</p>			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 17 OF 22</b>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
13.00.00	<p><b>APPLICATION ON PIPING</b></p> <p>a) All vertical pipes shall be provided with the suitable insulation supports to prevent collapsing/crushing of insulation due to its self weight. Support rings shall be provided on all vertical piping with a difference in elevation of 4 meter or above, and there shall not be more than 3m straight length between support rings.</p> <p>b) Longitudinal joints of insulation mattress sections of horizontal piping shall be on the bottom or at the sides of the pipe.</p> <p>c) When more than one layer of insulation mattress/section is required on piping the circumferential joints on adjacent layers shall be staggered by atleast 150 mm and longitudinal joints shall be staggered by atleast 50mm.</p> <p>d) The mattress type insulation shall be formed to fit the pipe and applied with the mattress edges drawn together at the longitudinal joints and secured by lacing wire. Pipe section insulation shall be fitted on pipe using binding wires.</p> <p>e) Where insulation is applied, in two or more layers each layer of mattress shall be backed with hexagonal wire mesh. For the first layer of insulation and in case of single layer insulation, hexagonal wire mesh shall be provided on both the surface of the mattress. For pipe sections, the sections shall be held in place by binding wires without any wire mesh.</p> <p>f) The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation. Any gap in the insulation shall be filled with loose mineral wool (or) finishing cement.</p> <p>g) Insulation mattress/section ends shall be terminated at a sufficient distance from the flanges to facilitate removal of bolts.</p> <p>h) The insulation shall be held in place by fastening over with binding wire for insulation surface with diameter up to and including 550 mm and with metal bends for insulation surfaces with diameter over 550 mm. The fastening shall be done at intervals of 250 mm except where specified otherwise. The ends of the binding wires shall be hooked and embedded in the insulation. The straps shall be mechanically stretched and fastened with metallic clamping seals of the same materials as the strap.</p> <p>i) Insulation for application on bends and elbows shall be cut into mitered segments, sufficiently short to form a reasonably smooth internal surface. After the application of insulation material place, insulating cement shall be applied as required to obtain a smooth surface.</p> <p>j) Weather hoods shall be provided for insulated piping passing through floors/walls</p> <p>k) All pipe attachments coming on horizontal pipes, inclined pipes and bends shall be insulated along with pipe such that there will be no insulation applied to hanger rod and the component connecting hanger rod to pipe attachment. All pipe attachments exposed to weather shall be provided with weather proof covering.</p> <p>l) Upstream of all drain lines and the lines connected to steam traps, shall be insulated up to and including first isolating valve for heat conservation. Rest of such lines such as downstream of the drain valves, traps etc., and other lines such as safety valve discharges, vents, etc., shall be insulated for personnel protection.</p>			
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p align="center"><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p align="center"><b>PAGE 18 OF 22</b></p>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
14.00.00	<p><b>APPLICATION ON VALVES &amp; FITTINGS:-</b></p> <p>a) All valves fittings and specialties shall be insulated with the same type and thickness of insulation as specified for the connected piping with the special provisions and or exceptions as given below:</p> <p>b) All valves and flanges shall be provided with removable box type of insulation covered with box fabricated from aluminum sheets of thickness same as the connected pipe cladding. Adjoining pipe insulation shall be beveled back to permit removal bolts and nuts or bands. The portion of the valve which cannot be covered by box type insulation shall be filled by loose insulating material of packing density at least equal to that of the insulating material of adjoining pipe. The insulation for valves/flanges shall be applied after the finishing has been applied over the connected piping. The cladding shall be applied in such a manner that the bonnet flange can be exposed easily without disturbing the complete insulation and cladding.</p> <p>c) Flanges on lines having temperature up to and including 150 deg. C shall not be insulated.</p> <p>d) Unions shall not be insulated.</p> <p>e) Expansion joints, metallic (or) rubber, shall not be insulated unless otherwise specifically indicated.</p> <p>f) Safety valves shall be insulated.</p>			
15.00.00	<p><b>APPLICATION OF METAL CLADDING: -</b></p> <p>a) All surfaces of fuel oil and other tanks, pipe line etc., where thermal insulation has been applied shall be covered with Aluminum cladding of 16 or 20 SWG as specified elsewhere.</p> <p>b) Weather proof flushing shall be installed where the panels intersect with columns and other similar joints.</p> <p>c) All openings and joints in outdoor cladding for piping connections, supports of access shall be suitably flashed and weatherproofed. Where such flushing or weather-proofing can't effectively control the entry of moisture, then such openings and joints shall be weather-proofed by application of aluminum pigmented sealer.</p> <p>d) All insulation shall be protected by means of an outer covering of aluminum sheathing. All insulation/cladding joints shall be sealed and made effectively weatherproof and waterproof. All flat surfaces shall be given suitable slope to prevent collection of pools of water on the cladding surface. All sheathing shall be protected internally by the application of two coats of Bitumastic Paint.</p> <p>e) All longitudinal joints shall have a minimum overlap of 50 mm and shall be located at 45 degree (or) more below the horizontal for horizontal equipment. Joints shall be made with cheese headed self tapping galvanized steel screws at 150 mm centers.</p> <p>f) All circumferential joints shall have a minimum overlap of 100 mm and shall be held in position by stainless steel (or) anodized aluminum bands, stretched and clamped.</p>			
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CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
16.00.00	<p>g) Removable box type cladding for valves and flanges shall be fitted on the connected pipe cladding, with bands.</p> <p>h) Aluminum cladding shall not come directly into contact with either the equipment surface (or) with the supporting arrangement on the equipment surface.</p> <p>i) For bends, fittings etc., the cladding shall be provided in segments as to ensure a smooth finish of the cladding.</p> <p>j) For cladding on vertical pipes/equipment, provision for load take up shall be made at every 2 to 4 meters along pipe/equipment axis.</p> <p>k) All joints shall be sealed with Acrylic Emulsion Weather barrier.</p> <p>l) Galvanic corrosion shall be prevented by carefully avoiding permanent contact of aluminum cladding with copper, copper alloys, tin, lead, nickel or nickel alloys including Monel metal.</p> <p><b>INSULATION ON WALLS:-</b></p> <p>a) The surface of the tanks shall be cleaned to remove dirt, grease etc.</p> <p>b) MS rings of 25 mm width and 6mm thickness shall be provided on the tank walls at a vertical pitch of 600 mm and all the rings shall be connected to each other through vertical strips placed at suitable intervals. The MS rings should be in segments and shall be attached together by draw bolts and compression springs to allow for tank expansion. On the flat iron rings studs of 6 mm dia each of length 100 mm placed at a pitch of 300 mm shall be welded.</p> <p>c) Required thickness of Resin bonded Mineral Wool Mattresses shall be applied on the entire surface (walls) of the tank. The insulation shall be pressed against tank surface and shall be retained in position by the use of washer and nuts, tightened on the projected ends of studs.</p> <p>d) Over the insulation, Aluminum sheet shall be provided. This sheet shall have 10 mm dia hole, so that there is no contact between sheet and studs. The sheeting should have vertical overlap of 25 mm and horizontal overlap of 75 mm and will be fixed in such a way that the rain water is drained off effectively.</p> <p>e) Roof of the heavy oil storage tanks shall not be insulated.</p> <p><b>CONTROL PHILOSOPHY</b></p>			
17.00.00	<p>The basic control philosophy of the fuel oil handling and storage system is described in the succeeding paragraph. The contractor shall provide all the features as specified herein including other features as required for safe and efficient operation of the system.</p>			
18.00.00	<p>The plant is broadly classified in the following categories.</p>			
18.01.00	<p>Heavy Oil Unloading and Storage.</p>			
18.02.00	<p>Light Oil Unloading and Storage.</p>			
18.03.00	<p>Light oil transfer to day oil tank (If applicable).</p>			
<p><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p><b>PAGE 20 OF 22</b></p>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
19.00.00	<b>Heavy Oil Unloading and Storage and Light Oil Unloading and Storage</b>			
19.01.00	Out of the two (2) tanks, one tank shall be selected manually for filling operations. The other tank shall be in use. After the desired tank is selected the inlet/outlet valves of the selected tank and the tank under use shall be opened/closed automatically.			
19.02.00	After the selected tank level reaches High there shall be an alarm followed by tripping of all the unloading pumps when the tank level reaches High-High.			
19.03.00	Control interlocks for safe operation of various pumps shall be provided in DDCMIS.			
19.04.00	Similar operations and controls shall be provided for inter tank transfer system also.			
20.00.00	For LDO transfer to day oil tank(if applicable) separate set of pumps are provided for transfer of LDO to day oil tank of Auxiliary boiler. For this system, there shall be an alarm on tank level reaching HIGH and the transfer pump shall trip on level reaching HIGH/HIGH.			
20.01.00	In case of low level the signal shall be utilized for tripping of auxiliary boiler pressurizing pumps.			
20.02.00	In case the running LDO transfer pump trips there shall be an alarm and the standby pump will be started manually from local push button.			
21.00.00	Control of steam flow through suction heaters in FO storage and day tanks shall be through Control system as shown in the P&ID. Temperature element is provided at oil outlet of suction heater which transmit signal to the Control system. From Control system, the signal is transmitted to E/P converter in the field which converts electrical signal to pneumatic and transmits the same to the control valve for modulating control of steam flow through the valve. Feedback signal from position transmitter of modulating control valve shall be taken to Control system.			
21.01.00	The steam flow control to floor oil heaters through ON-OFF type pneumatic operated control valve will be made in the HFO storage and Drain oil tank. Temperature element provided in tanks will transmit signal to Control system which in turn energizes or de-energizes solenoid valve to open/close control valve.			
21.02.00	Signals shall be provided to achieve Control & Operation philosophy as required by the equipment.			
21.03.00	Signals from pressure transmitters on the downstream of PRS required for monitoring the pressure from the central control room shall be processed through Control System.			
22.00.00	<b>DRAIN OIL / OIL RECOVERY/SUMP PUMPS AND PUMPS IN OIL WATER SEPARATOR</b>			
22.01.00	In case of drain oil pumps and sump pumps there shall be an alarm on level reaching High.			
22.02.00	On alarm for HIGH level, or if physically the level is found to be HIGH, respective pumps will be started manually from local push buttons.			
22.03.00	In case of low level the pump will trip automatically with provision of low level contacts.			
22.04.00	In case the running pump trips due to any other reason the standby pump will be started manually only from local push button.			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b>	<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b>	<b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b>	<b>PAGE 21 OF 22</b>	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
22.05.00	<p>In case of pumps in oil water separator system both the pumps will be started from the local push button manually or if physically the level is found to be high or there is HIGH level alarm.</p>			
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:cs-9585-001-2</b></p>	<p align="center"><b>SUB SECTION A-21 FO-UNLOADING SYSTEM</b></p>	<p align="center"><b>PAGE 22 OF 22</b></p>	

**AMENDMENT NO. 1 TO TECHNICAL SPECIFICATION (SECTION VI)**

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
					tight double multilouver (Bi-plane) damper before and after of each RAPH on air side.	the mills. Gas tight double multilouver (Bi-plane) damper before and after of each RAPH on air side.
6.	VI/A	IIA-01	17 of 25	2.18.01 (3)	Three (3) steam jacketed/electrically traced duplex coarse filters at heavy fuel oil pumps suction , three (3) duplex fine filters at fuel oil heater(s) discharge and one duplex fine filter in the supply line to each steam generator.	Three (3) duplex coarse filters at heavy fuel oil pumps suction , three (3) duplex fine filters at fuel oil heater(s) discharge and one (1) duplex fine filter in the supply line to each steam generator. All these filters shall be steam jacketed/electrically traced.
7.	VI/A	IIA-01	18 of 25	2.18.01 (12)	Three (3) no. HFO coolers on common fuel oil return line along with 100% bypass line to each cooler, located in FOPH area with necessary automatic oil temperature control system to cool the return oil from the Steam Generators to the temperature of HFO in the storage tank with necessary cooling water piping <b>from Employer's terminal point</b> complete with all necessary valves, control valves & fittings, etc. Control of the same shall be implemented in FOPH control system. The hot water from HFO cooler shall be taken to an oil/water separator pit.	Three (3) no. HFO coolers on common fuel oil return line along with 100% bypass line to each cooler, located in FOPH area with necessary automatic oil temperature control system to cool the return oil from the Steam Generators to the temperature of HFO in the storage tank with necessary cooling water piping complete with all necessary valves, control valves & fittings, etc. Control of the same shall be implemented in FOPH control system. The hot water from HFO cooler shall be taken to an oil/water separator pit.
8.	VI/A VI/A VI/B	IIA-01 IIA-13 A-03	18 of 25 2 of 4	2.18.01 2.01.01 11.00.00	-	Note: Alternatively, Bidder at its options may also provide common building for Fuel Oil Unloading and Fuel Oil Pressurizing system with
PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW) EPC PACKAGE BIDDING DOCUMENT NO.: CS-9585-001-2					AMENDMENT NO. CS-9585-001-2-AMDT-09	Page 2 of 171

**AMENDMENT NO. 1 TO TECHNICAL SPECIFICATION (SECTION VI)**

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
			37 of 74			<p>1. One no. of common Drain Oil tank of 10 m<sup>3</sup> capacity (in place of drain oil tank of 10 m<sup>3</sup> capacity in fuel oil pressurizing pump house and drain oil tank of 6 m<sup>3</sup> capacity in fuel oil unloading pump house)</p> <p>2. Two nos. (1W+1S) of common Drain Oil Pumps of 10 m<sup>3</sup>/hr capacity (in place of one no. drain oil pump of 4 m<sup>3</sup>/hr capacity in fuel oil pressurizing pump house and two nos. of drain oil pumps of 10 m<sup>3</sup>/hr capacity in fuel oil unloading pump house). Type of the pumps shall be Rotary, positive displacement, horizontal pumps fitted with relief valves.</p> <p>3. <del>One no. of common Condensate Flash tank of 6 m<sup>3</sup> capacity (in place of one no. condensate flash tank of 6 m<sup>3</sup> capacity in fuel oil pressurizing pump house and one no. condensate flash tank of 2 m<sup>3</sup> capacity in fuel oil unloading pump house)</del></p> <p>4. Two nos. (1W+1S) of common Sump Pumps of 10 m<sup>3</sup>/hr capacity (in place of two nos. of sump pumps of 10 m<sup>3</sup>/hr capacity in fuel oil pressurizing pump house and two nos. of sump pumps of 10 m<sup>3</sup>/hr capacity in fuel oil unloading pump house)</p> <p>Other specifications shall be as per the respective clauses of the corresponding item.</p>

<p><b>PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW) EPC PACKAGE BIDDING DOCUMENT NO.: CS-9585-001-2</b></p>	<p><b>AMENDMENT NO. CS-9585-001-2-AMDT-09</b></p>	<p><b>Page 3 of 171</b></p>
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# *NTPC Limited*

(A Government of India Enterprise)



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

**GENERAL TECHNICAL REQUIREMENTS**

**TECHNICAL SPECIFICATION**

**FOR**

**EPC PACKAGE**

**BIDDING DOCUMENT NO.: CS-9585-001-2**

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# **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**


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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
1.00.00	<p><b>INTRODUCTION</b></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><b>BRAND NAME</b></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><b>BASE OFFER &amp; ALTERNATE PROPOSALS</b></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><b>COMPLETENESS OF FACILITIES</b></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	<b>CODES &amp; STANDARDS</b>			
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"> <li>a) Indian Electricity Act</li> <li>b) Indian Electricity Rules</li> <li>c) Indian Explosives Act</li> <li>d) Indian Factories Act and State Factories Act</li> <li>e) Indian Boiler Regulations (IBR)</li> <li>f) Regulations of the Central Pollution Control Board, India</li> <li>g) Regulations of the Ministry of Environment &amp; Forest (MoEF), Government of India</li> <li>h) Pollution Control Regulations of Department of Environment, Government of India</li> <li>i) State Pollution Control Board.</li> <li>(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).</li> <li>(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996</li> <li>(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998</li> <li>(m.) Explosive Rules, 1983</li> <li>(n.) Petroleum Act, 1984</li> <li>(o.) Petroleum Rules, 1976,</li> <li>(p.) Gas Cylinder Rules, 1981</li> </ul>			
<b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</b>		<b>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</b>	<b>GENERAL TECHNICAL REQUIREMENTS</b>	<b>PAGE 2 OF 111</b>

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>			
<p align="center"><b>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800MW)</b></p>	<p align="center"><b>TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-9585-001-2</b></p>	<p align="center"><b>GENERAL TECHNICAL REQUIREMENTS</b></p>	<p align="center"><b>PAGE 3 OF 111</b></p>	