

1X500 MW FG UNCHAHAAR TPP (NTPC LTD)

VOLUME –IIB

**TECHNICAL SPECIFICATION
FOR
PLATE HEAT EXCHANGERS**

Specification No. : PE-TS-401-179-N001 (Rev 0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301**



TITLE :
**TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS
PREAMBLE**

SPEC. NO.: PE-TS-401-179-N001

VOLUME II B

SECTION

REV. NO. 0

DATE 30.09.2014

The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 Volume -I CONDITIONS OF CONTRACT

This consists of four parts as below:

Volume - I A: This part contains instructions to bidders for making bids to BHEL.

Volume - I B: This part contains general commercial conditions of the tender and includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C: This part contains special conditions of contract.

Volume - I D: This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 Volume - II TECHNICAL SPECIFICATIONS Technical requirements are stipulated in Volume II which comprises of :

Volume - II A: General Technical Conditions

Volume - II B: Technical specification including drawings, if any.

1.2.1 Volume - II B : This volume is sub-divided into following sections:

Section – A: This section outlines the scope of enquiry.

Section – B: This section provides “Project Information”

Section – C: This section indicates technical requirements specific to the contract, not covered in Section-D.

Section – D: This section comprises of technical specifications of equipment's complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 Volume - III: TECHNICAL SCHEDULES - This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Volume-III.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D



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D	STANDARD TECHNICAL SPECIFICATIONS OF PHE'S ALONGWITH <ul style="list-style-type: none">▪ DATA SHEET – A▪ QUALITY PLAN



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SPECIFICATION NO. PE-TS-401-179-N001

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SECTION A

REV. NO. 0 DATE 30.09.2014

SHEET 1 OF 1

1.00.00 **SCOPE**

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/ or his sub-contractors works, painting, proper packing & delivery of the item namely **PLATE HEAT EXCHANGERS** complete with all accessories, commissioning spares (if any), counter flanges with nuts, bolts, gaskets and coatings (wherever necessary), including special tools & tackles (if any), including site PG test as mentioned in this specification for the 1x500 MW FG UNCHAHAR TPP.

2.00.00 **GENERAL TECHNICAL INSTRUCTIONS**

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.02.00 The omission of specific reference to any component/ accessories necessary for the proper performance of Plate Heat Exchangers shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of heat exchangers at quoted prices.

2.03.00 Design/ drawings/ data sheets etc. shall be subject to approval of BHEL as per specification, in the event of order.

2.04.00 BHEL's / customer's representative shall be given access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.

2.05.00 The equipment covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL.



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VOLUME II B

SECTION C

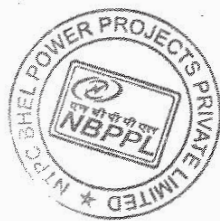
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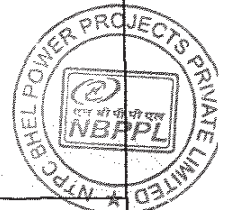
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ANNEXURE - IB

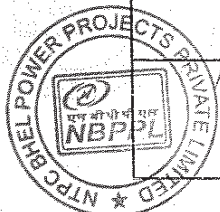


CLAUSE NO.	PROJECT INFORMATION 11748		
1.00.00	<p>BACKGROUND</p> <p>Feroze Gandhi Unchahar Thermal Power Station, FGUTPS was conceived as a Load Centre coal based Power Station of 1050 MW capacity by UPSEB. The land for the project was acquired and stage-I (2x210MW) was implemented by UPSEB. The 2x210 MW Unchahar station was taken over by NTPC from Uttar Pradesh Rajya Vidyut Utpadan Nigam of Uttar Pradesh in 1992. Thereafter, NTPC implemented Stage- II (2x210 MW) and Stage-III (1X 210 MW).</p> <p>The present expansion proposal is to install one additional unit of 500 MW under Stage-IV thus making the ultimate capacity of the FGUTPP 1550 MW.</p>		
1.01.00	<p>LOCATION AND APPROACH</p> <p>The plant is located in Raebareli district of Uttar Pradesh, having latitude and longitude of 25°54'50"N and 81°19'50"E respectively. It is bounded by villages Khnapur, Faridpur and Khaliqpur Khurd. Mustafabad town is located at a distance of about 3 Kms from the plant. Unchahar railway station on Allahabad-Raebareli broad gauge (BG) section of Northern Railway (NR) is 2 Kms away. The nearest airport is located at Lucknow a distance of approximately 110 km from the project site.</p> <p>Vicinity Plan of the project is placed at Annexure-I</p>		
1.02.00	<p>LAND REQUIREMENT</p> <p>During the implementation of FGUTPS, Stage-I, II & III total area of about 2203 acres of land was acquired. The plant facilities, ash disposal and township for this expansion Stage-IV (1x500 MW) would be accommodated within the available land with dismantling and relocation of some buildings. No additional land has been envisaged to be acquired for this expansion project.</p>		
1.03.00	<p>WATER</p> <p>As per agreement between NTPC & Irrigation department, 105 Cusec of water is supplied through S.S Canal to NTPC-Unchahar. The Stage-IV (500MW) consumptive water requirement shall be accommodated within the existing commitment of water to FGUTPP. Sharda sahayak canal and Dalmau Pump House (DPH) on Purwa Branch Canal are available sources of water for the project and therefore, the make up water requirement for the plant is proposed to be drawn from these sources.</p>		
1.04.00	<p>COAL AVAILABILITY AND TRANSPORTATION</p>		
1.04.01	<p>Coal Availability</p>		
<p>FGUTPP STAGE-IV (1X500 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI PART-A</p>	<p>SUB-SECTION-II PROJECT INFORMATION</p>	<p>PAGE 1 OF 12</p>



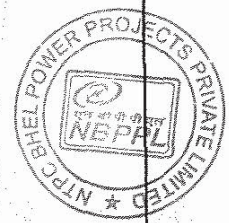
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1.04.02	<p>The coal requirement shall be about 2.7 Million tonnes per year.</p> <p>The matter has been taken up with Ministry of Coal, Govt. of India for Long Term Coal Linkage for Stage-IV (1x500 MW)..Coal requirement for FGUTPP, Stage-I ,II & III is being met from North Karanpura Coal fields of CCL. For FR purposes, coal from North Karanpura Coal fields of CCL has been considered.</p> <p>Coal Transportation</p> <p>The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways rakes. The rakes shall be unloaded at the track hopper.</p>												
1.04.03	<p>Coal Quality Parameters and Fuel Oil Characteristics</p> <p>The Coal quality parameters and Fuel Oil Characteristics are enclosed as Annexures-II-1 and II-2 to this subsection.</p>												
1.05.00	<p>CAPACITY & POWER EVACUATION</p> <table border="0"> <tr> <td>Stage-I</td> <td>: 2x210 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>Stage-II</td> <td>: 2x210 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>Stage-III</td> <td>: 1x210 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>Stage-IV</td> <td>1x 500 MW</td> <td>Present proposal</td> </tr> </table> <p>The existing capacity of plant is 1050 MW Step up/ power evacuation voltage for station is 220 KV. Presently 1000 MW is already being evacuated at 220 KV, addition of another 500 MW at 220 KV may cause overloading of 220 KV systems and lead to increase in fault levels at 220 KV system. Considering this 400 KV has been considered as step-up/power evacuation voltage for Stage-IV. Power Generated from FGUTPP- Stage IV, 500 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer.</p> <p>The power generated from Stage-IV is envisaged to be absorbed by Northern Region beneficiaries. For finalisation of Associated Transmission System (ATS) of the project, the matter would be taken up with Power Grid Corporation of India Ltd. (PGCIL)/CEA/appropriate authority depending on the various routes/options of power sale envisaged for the project.</p>	Stage-I	: 2x210 MW	Under Commercial Operation	Stage-II	: 2x210 MW	Under Commercial Operation	Stage-III	: 1x210 MW	Under Commercial Operation	Stage-IV	1x 500 MW	Present proposal
Stage-I	: 2x210 MW	Under Commercial Operation											
Stage-II	: 2x210 MW	Under Commercial Operation											
Stage-III	: 1x210 MW	Under Commercial Operation											
Stage-IV	1x 500 MW	Present proposal											
1.06.00	<p>METEOROLOGICAL DATA</p> <p>Important meteorological data from nearest observatory at Allahabad is placed at Annexure - III.</p>												
1.07.00	<p>PLANT WATER SCHEME</p>												



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	<p>The Plant water scheme is described below.</p>		
1.07.01	Source of Water	<p>The source of water for the project is normally from the Allahabad branch canal of the Sharda Sahayak link canal. During the canal closure period, water will be drawn from the Dalmau canal.</p>	
1.07.02	Water Requirement	<p>Normal Make up water requirement for this project would be about 2000 Cu.M/hr with ash water re-circulation system in operation. However, whenever ash water system needs to be operated in once thru mode, water drawl shall be of the order of 3300 cum/hr.</p>	
1.07.03	Raw Water System	<p>Raw water shall be drawn from the source by a gravity channel upto raw water pump house located inside the plant. It is envisaged to provide three (3) numbers (3 x 50 % Capacity) of raw water pumps for supplying water to Water PT Plant in the raw water pump house. In addition two (2) numbers (2 x 100% capacity) of pumps shall be provided to supply raw water for ash handling plant which shall be operated as and when required. Separate set of pipelines of carbon steel construction shall be provided from respective raw water pumps to Water treatment plant and Ash Water tanks.</p>	
1.07.04		<p>The quality of Raw water and Clarified water is enclosed with this sub-section</p>	
1.08.00	Criteria for Wind Resistant Design of Structures and Equipment	<p>All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p>	
1.09.00	Criteria for Earthquake Resistant Design of Structures and Equipment	<p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p>	



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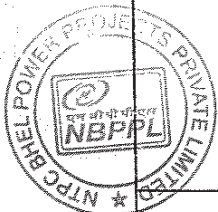
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PROJECT INFORMATION



DESIGN RAW WATER ANALYSIS

S.No	Constituent	As	mg/l
1	Calcium	CaCo3	110
2	Magnesium	CaCo3	95
3	Sodium+ Potassium	CaCo3	130
4	Total cations	CaCo3	335
5	Bicarbonates	CaCo3	250
6	Chloride	CaCo3	50
7	Sulphate	CaCo3	35
8	Total Anions	CaCo3	335
9	Silica	As SiO2	12
10	Iron	Fe	1
11	pH Value	-	7.7-8.3
12	Turbidity (NTU)	NTU	Upto 700
13	Organic Matter(As per KMnO4 method)	Number	7.2



FGUTPP STAGE-IV
(1X500 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION - VI
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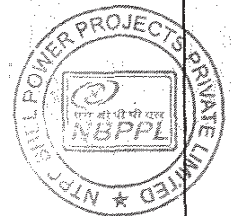
PROJECT INFORMATION

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DESIGN CLARIFIED WATER ANALYSIS FOR DM PLANT

S.No	Constituent	As	mg/l
1	Calcium	CaCo3	135.2
2	Magnesium	CaCo3	95
3	Sodium+ Potassium	CaCo3	130
4	Total cations	CaCo3	360.2
5	Bicarbonates	CaCo3	245.7
6	Chloride	CaCo3	57
7	Sulphate	CaCo3	57.5
8	Total Anions	CaCo3	360.2
9	Silica	As SiO2	12
10	Iron	Fe	0.3
11	pH Value	-	7.0-8.2
12	Turbidity (NTU)	NTU	10



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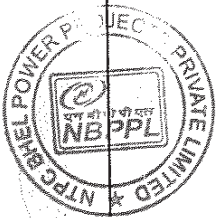
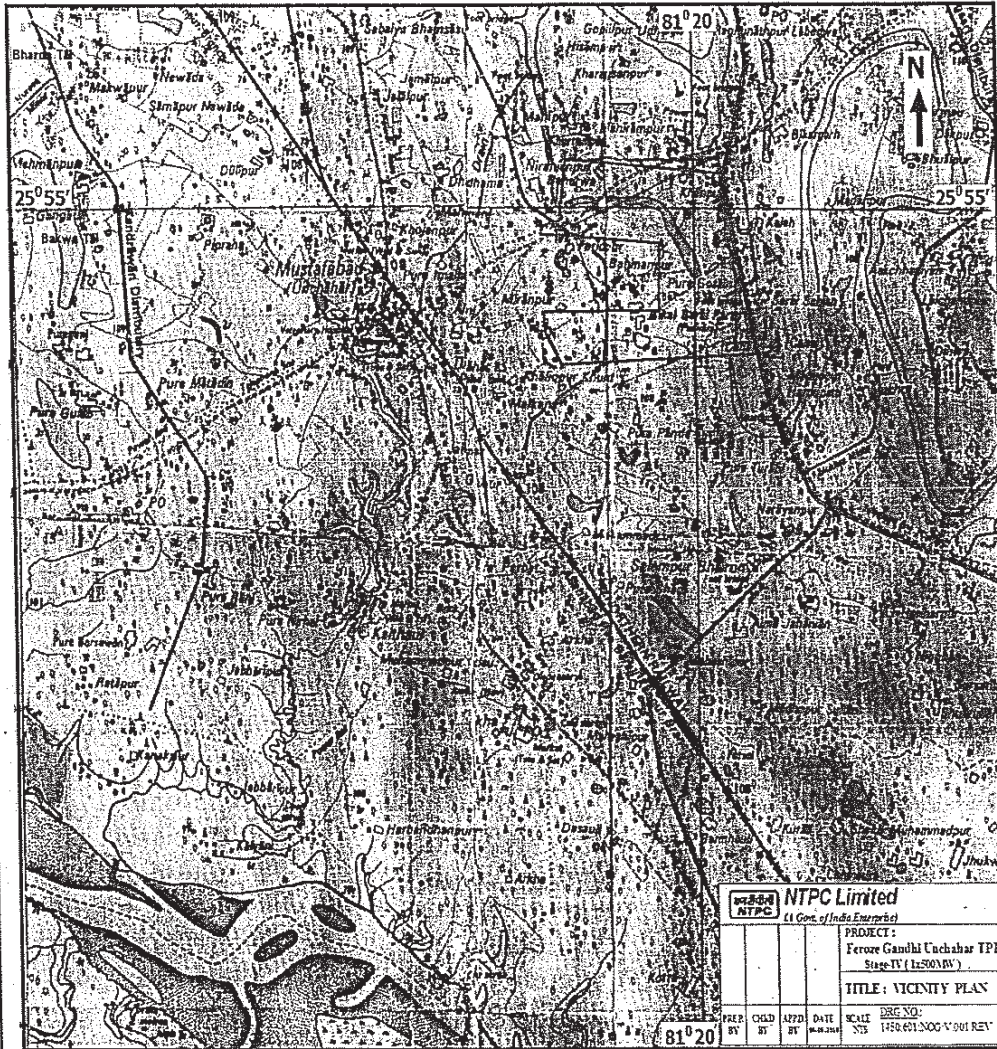
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PROJECT INFORMATION



VICINITY PLAN

ANNEXURE- I



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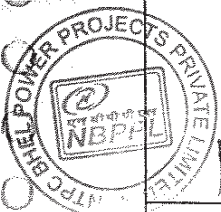
PROJECT INFORMATION **11754**



ANNEXURE-II-1 (PAGE 1 OF 2)

TABLE - 1 COAL CHARACTERISTICS.

Sl. No.	Description	Unit	Range of 95% coal Supplies			Range of Adequacy
			Design Coal	Worst Coal	Best Coal	
1	2	3	4	5	6	7
A. PROXIMATE ANALYSIS (As received basis)						
1.	Total Moisture	%	13.00	15.00	10.00	16 - 9
2.	Ash	%	40.00	45.00	38.00	46 - 37
3.	Volatile matter	%	22.00	19.00	25.00	18 - 26
4.	Fixed carbon	%	25.00	21.00	27.00	20 - 28
B. ULTIMATE ANALYSIS (As received basis)						
1.	Carbon	C%	34.6	30.00	40.39	29-41.39
2.	Hydrogen	H2%	3.1	2.42	3.2	2.32-3.3
3.	Nitrogen	N2%	1.2	0.47	0.63	0.37 - 0.73
4.	Oxygen	O2%	7.31	6.25	7.23	6.15 - 7.33
5.	Sulphur	S%	0.4	0.6	0.36	0.6 - 0.36
6.	Carbonates	CO3%	0.2	0.21	0.1	0.21 - 0.1
7.	Phosphorous	P2%	0.19	0.05	0.09	0.05 - 0.09
8.	Total Moisture	H2O%	13	15	10	15.3 - 9.7
9.	Ash	%	40	45	38	46-37
10.	Total	%	100	100	100	
11.	Gross Calorific Value	KCal/Kg	3400	3000	4000	2800 - 4200
12.	Hard grove index		55	50	60	48 - 62
C. ASH ANALYSIS						
1.	Silica	(SiO2)%	58.58	59.15	58.1	59.15-58.1
2.	Alumina	(Al2O3)%	28.87	28.95	28.2	28.95-28.2
3.	Iron Oxide	(Fe2O3)%	5.5	6.9	4.5	6.9-4.5
4.	Titania	(TiO2)%	1.8	1.1	2.2	1.1 - 2.2



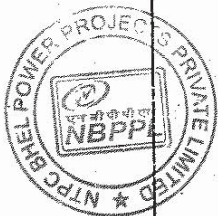
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Sl. No.	Description	Unit	Range of 95% coal Supplies			Range of Adequacy
			Design Coal	Worst Coal	Best Coal	
1	2	3	4	5	6	7
5.	Phosphoric Anhydride	(P2O5)%	0.7	0.5	1.2	0.5-1.2
6.	Lime	(CaO)%	1.5	1	2.35	1.0 - 2.35
7.	Magnesia	(MgO)%	1.3	1.1	1.4	1.1-1.4
8.	Sulphuric Anhydride	(SO3)%	0.5	0.4	0.6	0.4 - 0.6
9.	Alkalies (By diff.)	Na2O + K2O%	1.25	0.9	1.45	0.9 - 1.45
D. ASH FUSION RANGE (Under reducing atmosphere)						
a)	Initial Deformation Temperature	(IDT) °C	1100	1100	1100	1100
b)	Hemispherical temperature	°C	1300	1300	1300	1300
c)	Fusion temperature	°C	1400	1400	1400	1400
E. ASH FUSION RANGE (Under oxidising atmosphere)						
a)	Initial Deformation Temperature	(IDT) °C	1100	1100	1100	1100
b)	Hemispherical temperature	°C	1300	1300	1300	1300
c)	Fusion temperature	°C	1400	1400	1400	1400-1450



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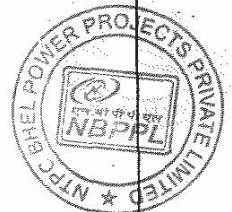
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ANNEXURE-II-2 (PAGE 1 OF 2)

FUEL OIL CHARACTERISTICS

Sl. No.	Characteristics	Heavy Furnace Oil Grade HV 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	66 deg C	72 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 at - (Max)	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	25 ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65	



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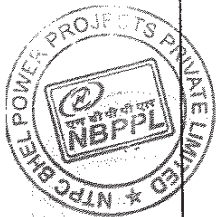


ANNEXURE-II-2 (PAGE 2 OF 2)

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 1460-2000

Characteristics	LDO
1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively
2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7
3. Sediment percent by mass (max)	0.10
4. Total sulphur percent by mass (max)	1.8
5. Ash percentage by mass (max)	0.02
6. Carbon residue (Rans 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





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SECTION C
SPECIFIC TECHNICAL REQUIREMENTS



TITLE :
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SHEET 1 OF 1

1.0 GENERAL :

The Plate heat Exchangers complete with all accessories including special tools and tackles (if any) shall conform to the standard technical specifications and Data Sheet-A of Section-D. In addition, the requirements of this Section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet - A shall prevail. Similarly in the event of contradictions between Section - C & Section - D/ Data Sheet-A, Section-C shall prevail.

Number of Plate Heat Exchangers to be supplied for 1x500 MW FG Unchahar TPP shall be as under:

Total Three (3) nos. PHE for TG Aux's,
Total Two (2) nos. PHE for SG Aux's

2.0 SYSTEM DESCRIPTION :

- 2.1 The Plate Heat Exchanger are intended to be used in closed circuit DM cooling water circuit for Cooling Hot passivated DM Water by Auxiliary Cooling Water (Clarified Water).
- 2.2 Passivated DM Water is circulated through various auxiliary coolers of TG, in closed loop by means of pumps. This DM water picks up heat from different cooling equipment's. Heat from DM water is transferred to auxiliary cooling water (Secondary side) thru' the Plate Heat Exchangers covered under this specification.
- 2.3 The analysis of DM Water, Clarified Water (Auxiliary cooling water) to be handled by the Plate Heat Exchangers are given in Data Sheet-A.
- 2.4 A strainer of 2 mm size at ACW inlet lines of PHE is provided and backwashing of PHE's is not envisaged.

3.0 SCOPE OF SUPPLY :

- 3.1 Number of Plate Heat Exchangers to be supplied shall be as under. For design parameters etc. refer Data Sheet-A enclosed herewith.

Total Three (3) nos. PHE for TG Aux's,
Total Two (2) nos. PHE for SG Aux's

- 3.2 Each Plate Heat Exchanger (quantity and other details specified in Data Sheet-A) shall be complete with the following accessories and auxiliaries.

- (i) Suitable drain and vent connections for both primary (DMCW) and Secondary Water (Clarified Water) streams complete with isolation valves.
- (ii) Supporting arrangement complete with foundation plate channels, anchor bolts, nuts, sleeves, inserts etc.
- (iii) Lifting arrangement i.e., lifting lugs, eye bolts etc.
- (iv) Matching counter flanges with necessary bolts, nuts, and gaskets for all flanged terminal points, including for DMCW and ACW inlet/outlet nozzles.
- (v) Inspection ports at the End plates of the PHE.
- (vi) Other accessories as required to make PHE's complete in all respects.



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- (vii) Commissioning spares, if any.
- (viii) One Ratchet spanner per PHE is included in bidder's scope of supply.
- (ix) Matching piece (Reducer/Expander), with coatings (as required), to match the PHE nozzle connection with connecting pipe size as indicated in Data Sheet.
- (x) Mandatory spares as applicable as per data sheet A.

3.3 Finish paints for touch-up painting of equipment after erection at site in sealed containers.

3.4 Various drawings, datasheets, test reports/ certificates, instruction manuals for erection, operation and maintenance etc., as specified in Data Sheet-C.

3.5 Based on the layout requirement, the nozzle orientation shall be for parallel flow viz. The inlet and outlet of DMCW flow shall be on the same side (vertically). And also the inlet and outlet of ACW flow shall be on same side (vertically).

3.6 Based on the layout requirement, maximum length of PHE shall be restricted to 4.5 m.

4.0 INSPECTION REQUIREMENTS

4.1 Inspection for "Single pressing of plates to form whole corrugation of the heat transfer plate" shall be from third party like TUV/Lloyd and certificate shall be submitted for review of BHEL.

4.2 DP Test shall be conducted for 10% of HT plates.
BHEL envisage witness of D.P. Test as follows:

- a. 1% witness by Customer.
- b. 2% witness by BHEL.

However during Contract Stage above percentage may vary from 1% to 10% for Customer & from 2% to 10% for BHEL without any commercial implication. However, in case of defect, entire lot shall be tested & only defect free plates shall be accepted.

4.3 10% of Light Box test or equivalent test (Vacuum test / Air Chamber test) shall be witnessed by BHEL/Customer/Third party (TUV/Lloyd or equivalent). However during Contract stage above percentage may vary from 10 to 100 % for BHEL/Customer without any cost implication to BHEL.

4.4 Minimum requirement for quality Plan shall be as per quality plan attached in the Section D of the Vol. IIB. Manufacturing Quality Plan for PHE shall be subject to approval during detail engineering. No price implication shall be admissible to QP approval by BHEL/Customer.

4.5 Hydraulic test for PHE's shall be performed at 1.5 times the design pressure with 30 minutes holding time for each side as per quality plan attached in the Section D of the Vol. IIB.

4.6 100% PMI Inspection for material grade of PHE Heat Transfer plates shall be from third party like TUV/Lloyd & certificate shall be submitted for review of BHEL.



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4.7 BHEL reserves the right to conduct random & independent PMI inspection on PHE's Heat Transfer plates to ascertain the plate material.

4.8 Heat transfer area for the PHE as offered by bidder with technical offer shall be measured by White light scanning method during contract stage to ascertain the correctness of heat transfer area as offered by bidder.

Inspection of plate area measurement for one heat transfer plate per PHE by White Light Scanning shall be from third party like TUV/Lloyd , same shall also be witnessed by BHEL. No type test certificates are acceptable to BHEL for same.

Bidder shall furnish the procedure for White Light Scanning method during detailed engineering viz. after award of contract which shall be subjected to BHEL/Customer approval. The Minimum requirement for White Light Scanning procedure is as per the Annexure-A of the quality plan attached in the Section D of the Vol. IIB.

Bidder to note that Heat Transfer Area measured by White Light Scanning during contract stage should not have negative tolerance more than 3% w.r.t to the heat transfer area indicated by bidder against the offered model of PHE. However in the case of negative tolerance (limited to maximum 3 percent) , bidder has to provide additional plates proportionately, as free issue, assembled into all the applicable PHE's before the Final inspection and "As built Certificate" shall be issued by the bidder accordingly. Bidder to note that negative tolerance beyond three percent shall not be accepted, however no credit shall be given to the bidder for positive tolerance of the plate area measurement.

5.0 PERFORMANCE GUARANTEE AND TESTING:

5.1 The PHE shall be guaranteed to meet the performance requirements specified in Section-D and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume-III) duly filled and signed shall be furnished with the bid.

5.2 PG test After commissioning of PHE's at site, performance test of all PHE's for each unit individually will be conducted by bidder at project site to ensure that the PHE's meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site with no additional cost to BHEL. All duly calibrated instruments required for PG testing including for flow measurements shall be arranged by the bidder and taken back after the Test. The computation of flow by characteristics curve of Pumps for PG Testing of PHE's shall not be permitted.

5.3 It is clarified that pressure gauges and temperature gauges are provided at each PHE inlet / outlet on both primary / secondary sides and bidder can install their calibrated instruments on these locations. It is further clarified that due to layout constraints flow measuring instruments installation on pipe is not feasible. Bidder shall arrange the Ultra-sonic flow meter / similar type of instrument for PG testing.

5.4 At the time of performance testing, cleaning of the plates (if required) and instruments like pressure gauges, temp. Gauges, flow measuring instruments etc. shall be arranged by the bidder and no instruments shall be provided by BHEL for performance



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testing.

6.0 SPARES :

6.1 **Mandatory Spares:** Shall be as per data sheet A [Table A] [Table B].

7.0 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER:

No document other than the following is required to be submitted by bidder with the offer unless bidder considers it absolutely necessary.


- a) Compliance certificate as enclosed in Volume III
- b) Schedule of Deviations if any.
- c) Guarantee Schedule.
- d) Thermal sizing calculations.
- e) Schedules of Price & Unit Price as per NIT format.
- f) GA Drg. of PHE indicating all-important details for Layout purpose, withdrawal space required for plates, weight of assembly, nozzle & matching piece details etc.
- g) Confirmation of plate area of the offered model, duly endorsed from the Head of Engg./R&D of Principal supplier of the plate.
- h) Schedule of declaration.

7.1 Other Drawings/ documents etc. shall be submitted by successful bidder after the award of contract as per NIT.

8.0 EXCLUSIONS :


The following are excluded from the bidder's scope:

- 8.1 Civil foundation works required for installation of the heat exchangers.
- 8.2 Piping, valves etc., on the external circuit of both primary and secondary water streams.
- 8.3 Erection & Commissioning of equipment at site.

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SECTION - D
PLATE HEAT EXCHANGER
STANDARD TECHNICAL SPECIFICATION
DATA SHEET C
STANDARD QUALITY PLAN

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1.00.01 GENERAL

This specification covers the Design, Performance requirements, Constructional Features, Materials requirements, manufacture, assembly, Inspection and Testing at Manufacturer's and/ or his subcontractor's works and Painting requirements for delivery of Plate Heat Exchanger complete with all accessories as specified herein-after.

2.00.00 CODES AND STANDARDS:

2.01.00 The design, manufacture and testing of the plate heat exchanger complete with all accessories, shall generally conform to the latest editions of the following appropriate standards.

2.01.01 IS/BS/DIN/US Standards regarding pressure vessels, pressure piping, pipes, valves, flanges and other as necessary.

2.01.02 IS/ BS/ DIN/ ASTM for material specification and testing procedures.


2.02.00 In case of any conflict between the above codes/ standards and this specification, the latter shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding

3.00.00 DESIGN AND CONSTRUCTION:

3.01.00 General Requirements:

3.01.01 Unless otherwise necessary, manufacture's standard and proven models of the plate heat exchanger shall be supplied.

3.01.02 The equipment shall be capable of safe, proper and continuous operation at all heat loads and water from up to those corresponding to the operating conditions mentioned in Data Sheet – A furnished a/w project enquiry. Vibration, noise, mechanical and thermal stresses shall be kept

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within allowable units specified by relevant codes/ standards in design. Due attention shall be given to *case of maintenance, repair and cleaning*.

3.01.03 Suitable corrosion allowance shall be provided wherever necessary. The corrosion allowance for the heat exchanger parts such as pressure plates (support plates), nozzles, sliding channels and frame shall be 1.6 mm (minimum).

3.01.04 Each heat exchanger shall be capable of passing a flow of at least 1.1 times the design flow rate on both primary and secondary water sides. Bidder shall indicate maximum pressure drop through the heat exchanger under this condition.

3.01.05 For the purpose of calculating dirty overall heat transfer coefficient, a total fouling factor as given in Data Sheet-A furnished a/w project enquiry shall be assumed. It is expected that the cleaning frequency shall be once in a year with the above fouling factor.

3.01.06 No back wash for the heat exchangers is envisaged.

3.02.00 Performance Requirements:


3.02.01 The pressure drop across plate heat exchanger from inlet to outlet in fouled conditions for primary and secondary sides, shall not be more than those specified in Data Sheet-A furnished a/w project enquiry, for the specified flow rates.

3.02.02 For the specified flow rate and inlet temperature, the primary side (hot fluid) outlet temperature shall not be more than that specified in Data Sheet-A furnished a/w project enquiry.

3.02.03 In the event of failure to meet the above stipulated performance requirements, the equipment will be out rightly rejected.

3.03.00 Construction of Heat Exchanger:

3.03.01 Heat transfer plates shall be packed in a frame consisting of fixed frame plate and movable pressure plate and aligned at top and bottom of carrying bars. Design shall be such that cleaning is possible without dismantling the piping.

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3.03.02 Heat transfer plates shall be sealed at their outer edges and around the ports by gaskets in order to prevent leakage and inter-mixing of fluids.

Double sealing arrangement shall be provided at outer edge and around ports. The inter space between the seals shall be vented to atmosphere in order to avoid inter-mixing of liquids in case of gaskets failure.

The gasket arrangement shall be such that it receives continuous support to ensure a long gasket life. The gasket should be able to retain their properties and shape over a life period of 10 years.

3.03.03 Heat transfer plates shall be provided with sufficient thickness in order to impart sufficient rigidity to the plates particularly from handling considerations. Plates shall have contact points in order to provide inter-plate supports. The recesses on the plates are suitably strengthened by a reinforcement plate.


Plate thickness shall be adequate to withstand all operating conditions as specified in data sheet A furnished a/w project enquiry.. Flanges shall be as per ANSI 16.5 or equivalent. Thickness of pressure and frame plates shall be as per ASME Sect. VIII div.1.25% extra capacity for additional plates shall be provided in frame.

Each Plate shall be numbered in sequence. The number shall be marked by indelible ink on the plate to permit easy reassembly. The plates shall be pressed from one piece. They shall be pressed in single/ progressive manner.

The corrugation shall be smooth, uniform and identical for every plate. The PHE bottom frame plate and support should have fixing lugs and cleats to keep provision for enabling to fit trough with outlet nozzle fitted underneath to collect and drain out water in the event of leakages.

3.03.04 Frame for each heat exchanger shall have extra capacity to accommodate the additional plates, if required in future because of any reason whatsoever. The extra capacity to be provided is indicated in Data Sheet-A furnished a/w project enquiry.

The upper carrying bar and lower guide bar shall be rigid in construction

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without any risk of sagging or buckling, and shall facilitate easy guiding of the plates.

3.03.05 All inlet, outlet and other nozzles shall be flanged type and shall be as specified in Data Sheet-A. Counter flanges complete with gaskets, bolts, nuts and coatings (wherever necessary) shall be supplied for the nozzle connections. The nozzle sizes of primary/ secondary streams of PHE's shall be of adequate size within acceptable range of velocity. The size selection shall be subject to approval in the event of order.

3.03.06 If necessary, relief valves shall be provided on both the streams.

3.04.00 **Materials of construction:**

Material of the heat transfer plates and gaskets shall be consistent with the fluid handled. However, material specification for various parts shall be equal or superior to those specified in Data Sheet - A furnished a/w project enquiry.

4.00.00 **FOUNDATION AND LIFTING ARRANGEMENTS:**

4.01.00 Plate heat exchanger shall be supplied with necessary foundation plates, anchor bolts, sleeves, nuts, inserts etc.


4.02.00 Plate heat exchanger shall be equipped with suitable lifting lugs/ eyebolts to facilitate handling during erection and maintenance.

5.00.00 **PAINTING:**

5.01.00 The surface preparation of all exterior and interior surfaces of plate heat exchanger shall include the following:

- a) Removal of oil, grease, dirt and swarf etc
- b) Removal of rust and scale etc.,
- c) Sand blasting/ shot blasting.

5.02.00 All exterior surfaces of PHE's shall be sand/ shot blasted, painted with

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primer and finish coated with coal tar based epoxy coating of min. 250 microns thickness. Color shade etc. shall be subject to BHEL/ Customer approval.

6.00.00 **SHOP INSPECTION AND TESTS:**

6.01.00 **General:**

6.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the plate heat exchanger shall conform to the requirements of this specification and of the applicable codes/ standards.

6.01.02 All materials used for manufacture/ fabrication of the plate heat exchanger components shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests required as per approved quality plan and applicable codes at his cost, for which samples shall be identified by BHEL's representative.


6.01.03 All shop tests shall be conducted in the presence of BHEL's representative and test certificates for the same shall be furnished to BHEL for approval.

6.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV Code, Section-IX/applicable code.


6.02.00 **Heat Transfer Plates:**

6.02.01 Plate material used for pressing shall be furnished with mill test report showing chemical and physical properties and heat treatment records. Suitable correlating mark shall be available, so that BHEL's inspector can identify the material with test certificates before pressing the plates.

6.02.02 After pressing visual and dimensional checks on the plates shall be made in the presence of BHEL's inspector, on sampling basis.

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- 6.02.03 The heat transfer plates from each lot of the plates shall be tested by liquid/ dye penetrant test in order to check for cracks and other surface defects in presence of BHEL/customer's representative/Third party (Llyods, TUV or equivalent). If any defect is detected in any of these plates, the whole lot shall be tested and plates without defects only shall be accepted. Plate cleaning agent, liquid penetrant and developer shall not contain any halogen .Procedure for light box test and DP test shall be submitted to purchaser's approval. For Quantum of check , Refer Section C.
- 6.02.04 The heat transfer plates shall be tested by light box test in order to check for cracks and other surface defects in presence of BHEL/customer's representative/Third party (Lloyds', TUV or equivalent). The plates without defects only shall be accepted. For Quantum of check , Refer Section C.
- 6.03.00 **Gaskets:**
- 6.03.01 Certificate on Chemical composition of the gasket material shall be furnished to prove the quality. Sample testing in presence of BHEL's inspector shall also be conducted, if desired.
- 6.03.02 Shore hardness test shall be conducted on the gasket and certificate shall be furnished. Sample tests shall also be done in presence of BHEL's inspector.
- 6.03.03 Visual and dimensional check on a sampling basis shall be done. Plates and gaskets assembled together will be inspected for proper assembly.
- 6.04.00 **Frame Assembly:**
- 6.04.01 All materials for various components of frame assembly viz. frame plate, pressure plate, carrying bar, guide bar, tightening/ clamping bolts and nuts etc., shall be of tested quality and test certificates for chemical composition and physical properties shall be furnished.
- 6.04.02 If the thickness of the plates used for frame and pressure plates is 40 mm or more the same shall be checked ultrasonically to demonstrate the absence of lamination and lack of fusion etc.
- 6.05.00 All weld joints used for Fabrication of Heat exchangers shall be subjected to suitable non destructive examination. This shall include 100 % magnetic particle examination or other suitable NDT of all welds.

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7.00.00 **Document submission:**

7.01.00 The tenderer shall submit during contract stage a curve showing expected DM Water (Primary side) temperature at heat exchanger outlet for each one degree centigrade variation in ACW (Secondary side) temperature, all other parameters remaining unchanged. Similar curve for expected DM Water outlet temperature for variation of ACW flow rate with ACW inlet temperature remaining unaltered shall also be furnished. The bidder shall also furnish various curves to enable, apply corrections during site PG testing in the event of any data variation from the stipulated design parameters.

7.02.00 Bidder shall also furnish thermal design calculations at contract stage to justify the no. of plates offered.

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	TECHNICAL SPECIFICATION PLATE HEAT EXCHANGER			Technical	PE-TS-401-179-N001
	DATASHEET - A			Vol/Section	IIB/D
				Rev	0
				Date	30.09.2014
	PROJECT			1x500 MW FG UNCHAHAHAR TPP	
1.0	General			(TG AUX.)	(SG AUX.)
1.1	Number of Plate Heat Exchanger	Nos		Total Three (3) nos [2W+1S]	Total Two (2) nos [1W+1S]
1.2	Arrangement			3 x 50% per unit	2 x 100% per unit
1.3	Location			Indoor	Indoor
1.4	Primary side (Hot) Fluid			Passivated DM water (Refer enclosed water analysis)	Passivated DM water (Refer enclosed water analysis)
1.5	Secondary side (Cold) fluid			Cooling Water (Refer enclosed water analysis)	Cooling Water (Refer enclosed water analysis)
1.6	Connecting Pipe size	(Primary Side)	NB	400	400
		(Secondary Side)	NB	400	400
2.0	Design				
2.1	Design Pressure		Kg/cm ² (g)	10	12
2.2	Operating Pressure	(Primary Side)	Kg/cm ² (g)	About 6.0 Kg/sq. cm(g)	About 7.5 Kg/sq. cm(g)
		(Secondary Side)	Kg/cm ² (g)	About 3.5 Kg/sq. cm(g)	About 3.5 Kg/sq. cm(g)
2.3	Mechanical Design Temp.		°C	60	60
2.3	Heat Transfer per Sq.Mtr. Of Heat Transfer Plate		Kcal/Hr./m ²	6500 (Max.)	6500 (Max.)
2.4	Minimum Heat Transfer Area		Sq. M.	-	-
2.5	Specific Heat of Fluid	(Primary Side)	Cal/gmDeg. C	1.0	1.0
		(Secondary Side)	Cal/gmDeg. C	1.0	1.0
2.6	Density of Fluid	(Primary Side)	gm/cc	1.0	1.0
		(Secondary Side)	gm/cc	1.0	1.0
3.0	Guaranteed Performance Requirements for each Heat Exchangers in fouled condition:				
3.1	Flow rate	(DMCW Side)	M ³ /hr	1000	900
		(ACW Side)	M ³ /hr	1000	900
3.2	Inlet temperature	(DMCW Side)	°C	43.7	45.5
		(ACW Side)	°C	36	36
3.3	Outlet temp	(DMCW Side)	°C	38	38
		(ACW Side)	°C	41.7	43.5
3.4	* Allowable pressure drop across heat exchanger from inlet to outlet in fouled conditions at design flow	(DMCW Side)	MWC	7	7
		(ACW Side)	MWC	7	7
* High pressure drop than the specified figure will not be accepted, no credit shall be, however, given for lower pressure drop in bid evaluation. Pressure drop mentioned shall be calculated against flow mentioned at S. No 3.1					
4.0	Additional HT plates on Design Plates		%	NIL	NIL
5.0	Heat Transfer Coefficient/Margin				
5.1	Overall fouling resistance (minimum)	Hr m ² deg C/Kcal		0.00008	0.00008
5.2	Minimum corrosion allowance (refer note 1)		mm	1.6	1.6
6.0	Material of Construction :				
6.1	Heat Transfer Plates (Minimum acceptable plate thickness 0.6 mm). Refer Note no. 3			SS-AISI-316	SS-AISI-316
6.2	Plate Gasket			Nitrile Rubber	Nitrile Rubber

	TECHNICAL SPECIFICATION		Technical	PE-TS-401-179-N001
	PLATE HEAT EXCHANGER		Vol/Section	IIB/D
	DATASHEET - A		Rev	0
			Date	30.09.2014
	PROJECT		1x500 MW FG UNCHAHAHAR TPP	
6.3	Compression/Fixed/Frame/Movable Pressure plates		Carbon steel to IS-2062 Gr. B Epoxy painted	
6.4	Guide Rails		Carbon steel to IS-2062 with stainless steel cladding	
6.5	Support Beam/ column		Carbon steel to IS-2062 Gr. B Epoxy painted	
6.6	Nozzle		Carbon steel	
6.7	Nozzle flanges		Carbon steel	
6.8	Flange/ Counter flanges		Carbon Steel as per IS 2062 Gr. B (Confirming to ANSI B 16.5 class, Min.-150 lb)	
6.9	Tightening Bolts/Rods & Nuts		IS-1367 Gr. 8.8 or equivalent	
6.10	Nozzle flange bolt and nut		SA 193 B7/ SA 194 2H	
6.11	Nozzle flange gasket		3mm wire inserted Red Rubber	
6.12	Name Plate		SS- AISI-316	
6.13	Painting			
	External Surface			
	a.) Surface Preparation		All surface other than stainless steels shall be painted. The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by shotblasting etc as agreed. For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primer of min thickness of 50 microns followed up with undercoat of synthetic enamel paint of min thickness of 50 microns shall be applied. The top coat shall consist of two coats each of min 50 microns thickness of synthetic enamel paint. Thus total thickness shall be minimum 200 microns.	
	b.) Primer			
	c.) Final Paint			
7.0	Extra Carrying capacity to be provided on frame assembly.	%	25	
8.0	Mandatory Spares		NIL	
8.5	Definitions Regarding % & Set	-	The quantity shall be calculated for % of supply for total quantity for 2 units of 2 x 500 MW (if in fraction, the quantity to be reckoned for % indicated shall be rounded off to the next higher whole number). In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.	
9.0	Available space (L x W x H)	mm	----- Bidder to indicate -----	
10.0	Weight of Assembly	Kg	----- Bidder to indicate -----	
11.0	Performance Testing		All supplied PHE's to be tested by vendor at Site to demonstrate guaranteed performance.	
12.0	Performance curves and figures to be furnished during contact stage			
12.1	Primary side water outlet temperature vs. Secondary side water inlet temperature.			
12.2	Primary side water flow (80% to 115%) vs. Pressure drop and outlet temperature (Secondary side flow – 100%)			
12.3	Secondary side water flow (80% to 115%) vs. Secondary side pressure drop and primary side outlet temp (Primary side flow)			
12.4	Primary side water outlet temperature vs. Primary side inlet temp.			
12.5	Film heat transfer coefficient curve			
12.6	Correction Curves.			
Note: 1	Minimum Corrosion allowance on thickness (as per ASME Sec. VIII Div. I)			
2	Metallurgy shall be suitable for type of water handled for various plates.			
3	Minimum plate thickness of 0.6 mm is without any negative tolerance.			

DM Water analysis:

• Conductivity	Less than 0.1 microS/cm
• Total silica	Less than 0.02 ppm
• pH	pH 8.5 to 9.5

CLAUSE NO.

PROJECT INFORMATION

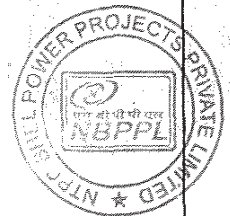
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DESIGN CLARIFIED WATER ANALYSIS FOR DM PLANT

S.No	Constituent	As	mg/l
1	Calcium	CaCo3	135.2
2	Magnesium	CaCo3	95
3	Sodium+ Potassium	CaCo3	130
4	Total cations	CaCo3	360.2
5	Bicarbonates	CaCo3	245.7
6	Chloride	CaCo3	57
7	Sulphate	CaCo3	57.5
8	Total Anions	CaCo3	360.2
9	Silica	As SiO2	12
10	Iron	Fe	0.3
11	pH Value	-	7.0-8.2
12	Turbidity (NTU)	NTU	10

Cycle of Concentration = 5



	STANDARD QUALITY PLAN	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NO. :
		BIDDER/VENDOR:	QUALITY PLAN NO.:	SPECIFICATION TITLE :
		SYSTEM:	ITEM: PHE	SECTION :
SHEET OF				

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					2/3	1				D*	P	W	V	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	

1.0 RAW MATERIAL INSPECTION														
1.1	Frame Plates & Pressure Plates, Counter Flanges, Connection Lining Material. Top And Bottom Carrying Bar.	Physical Properties	MA	Physical Test	1/ Heat/He -at Batch	1/ Heat/He -at Batch	App. Drg / Data Sheet	Relevant material spec.	Mill TC Or Lab Test Report	√	2,3	-	1	If co-related mill TCS are not available then check testing carried out by reputed lab
		Chemical Properties	MA	Chemical Analysis	1/ Heat/He -at Batch	1/ Heat/He -at Batch	-do-	-do-	-do-	√	2,3	-	1	-do-
		Dimensions	MA	Measurement	100%	100%	Approved Drawings		Inspection Reports	√	2,3	-	1	
		Workmanship And Finish	MA	Visual	100%	100%	-do-	-do-	-do-		2,3	-	1	
		Lamination (Applicable For Frame And Pressure Plate Only)	CR	Ultrasonic Test	100%	100%	SA 435	SA 435	-do-	√	2,3	-	1	Applicable for plate thickness more than 25 mm only
1.2	Heat Transfer Plates	Physical Properties	MA	Physical Test	1/ Heat	1/ Heat	App. Drg. / Data Sheet	App. Drg. / Data Sheet	Mill TC Or Lab Test Report	√	2,3	-	1	Co-related mill TCS to be provided See Remark 1
		Chemical Properties	MA	Chemical Analysis	1/ Heat	1/ Heat	-do-	-do-	-do-	√	2,3	-	1	-do-
		Dimensions	MA	Measurement	100%	Sample	Approved Drawings		Inspection Reports	√	2,3	-	1	
1.3	Gaskets	Dimensions	MA	Measurement	100%	Sample	Approved Drawings		Inspection Reports		2,3	-	1	Co-related mill TCS to be provided See Remark 1
		Workmanship And Finish	MA	Visual	-do-	-do-	No damage, No Surface defects.		-do-		2,3	-	1	
		Contour	MA	Visual	-do-	-do-	Mfg. Drgs / specification		-do-		2,3	-	1	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** 1: BHEL 1* SHALL BE CLEARED BY BHEL 2: VENDOR, 3: SUB VENDOR P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE CHP: CUSTOMER SHALL IDENTIFY IN COLUMN "N" AS 'W'	Cust. Logo	DOC. NO.:		REV.	CAT.-
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE			FOR CUST. USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL	

	STANDARD QUALITY PLAN	CUSTOMER:		PROJECT TITLE:		SPECIFICATION NO. :					
		BIDDER/VENDOR:		QUALITY PLAN NO.:		SPECIFICATION TITLE :					
		SYSTEM:		ITEM: PHE		SECTION :					
SHEET OF											

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					2/3	1				P	W	V		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	
		Hardness	CR	Measurement	-do-	-do-	Approved Drawings	-do-	√	2,3	-	1		
1.4	Tightening Bolts & Nuts. (Tie Rod)	Physical Properties	MA	Physical Test	1/ Heat	1/ Heat	App. Drg / data sheet	Relevant Material Spec.	Mill TC Or Lab Test Report	√	2,3	-	1	Manufacturer test certificate will be submitted for review.
		Chemical Properties	MA	Chemical Analysis	1/ Heat	1/ Heat	-do-	-do-	-do-	√	2,3	-	1	-do-
		Dimensions	MA	Measurement	100%	100%	Approved Drawings		IR	√	2,3	-	1	
		Workmanship and Finish	MA	Visual	100%	100%	-do-	-do-	-do-		2,3	-	1	
		Internal Soundness (For diameter >= 40 mm)	CR	UT	100%	100%	ASTM A 388	See Remark - 3	-do-	√	2,3	-	1	UT will be carried on raw material stage.
2.0	IN PROCESS INSPECTION													
		Area Measurement	NA	White Light Scanning	1 per Type	1 per Type	Approved drawing/ data sheet	Approved drawing/ data sheet	IR	√	2,3	-	1	Refer Point No. 3 of remarks
	HT PLATES	Physical Properties	MA	Physical Test	1 Sample per Heat	1 Sample per Heat	Approved drawing/ data sheet	Relevant Material Spec.	Mill TC or Lab Test Report	√	2,3	-	1	Manufacturing test certificates will be submitted for review.
		Chemical Properties	MA	Chemical Analysis	1 Sample per Heat	1 Sample per Heat	Approved/ drawing/ data sheet	Relevant Material Spec.	Mill TC or Lab Test Report	√	2,3	-	1	Manufacturing test certificates will be submitted for review.
		Dimension	MA	Measurement	1 Sample per Heat	1 Sample per Heat	Approved drawing/ data sheet	Approved drawing/ data sheet	Inspection Report	√	2,3	-	1	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** 1: BHEL 1* SHALL BE CLEARED BY BHEL 2: VENDOR, 3: SUB VENDOR P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE CHP: CUSTOMER SHALL IDENTIFY IN COLUM "N" AS ' W"	Cust. Logo	DOC. NO.:		REV.	CAT.-
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				FOR CUST. USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

	STANDARD QUALITY PLAN	CUSTOMER:		PROJECT TITLE:		SPECIFICATION NO. :		
		BIDDER/VENDOR:		QUALITY PLAN NO.:		SPECIFICATION TITLE :		
		SYSTEM:		ITEM: PHE		SECTION :		
SHEET OF								

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					2/3	1				P	W	V		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	
		Workmanship And Finish	MA	Visual	100%	100%	Approved drawing/ data sheet	No scratches, cracks etc.	-do-	√	2,3	-	1	
		Surface Defects And Cracks	CR	DP test	Refer Sect. C , Clause No. 4.2	Refer Sect. C , Clause No. 4.2	Manufacturer's DP test procedure (to be reviewed and approved by BHEL/Customer during contract stage)		DPT Report	√	2,3	1	-	See Remark 1
				Light Box Test/ Vacuum chamber test	100%	10%	Manufacturer's Light Box/Vacuum test procedure (to be reviewed and approved by BHEL/Customer during contract stage)		Vacuum Test Report	√	2,3	1	-	See Remark 1
2.1	Welding Procedures Specification (WPS)	Correctness	MA	Verification	100%	100%	ASME SEC-IX.	ASME SEC-IX.	QW 482 ASME SEC-IX	√	2,3	-	1	Customer /BHEL/ TPI (NPCIL, EIL, LLYODS & BVIS) approved WPS shall be used for welding
2.2	Procedure Qualification Records (PQR)	Suitability	MA	Visual & Mechanical Test	100%	100%	-do-	-do-	QW 483 ASME SEC-IX.	√	2,3	-	1	
2.3	Welders Performance Qualification	Welder's Performance Soundness Of Welds	MA	Visual / RT & Mechanical	100%	100%	-do-	-do-	QW 484 ASME SEC-IX	√	2,3	-	1	Only customer / BHEL/ TPI (NPCIL, EIL, LLYODS & BVIS) approved welder shall be engaged for welding.
2.4	Weld joint of expander/reducer.	Welding Of Outer Flange To Reducer/Expander	MA	Visual	100%	100%	Approved Drawings		Inspection Report	√	2,3	-	1	
				DPT	100%	100%	Manufacturer's DP test procedure (to be reviewed and approved by BHEL/Customer during contract stage)		DPT Report	√	2,3	1	-	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** 1: BHEL 1* SHALL BE CLEARED BY BHEL 2: VENDOR, 3: SUB VENDOR P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE CHP: CUSTOMER SHALL IDENTIFY IN COLUM "N" AS ' W"	Cust. Logo	DOC. NO.:		REV.	CAT.-
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				FOR CUST. USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

	STANDARD QUALITY PLAN	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NO. :
		BIDDER/VENDOR:	QUALITY PLAN NO.:	SPECIFICATION TITLE :
		SYSTEM:	ITEM: PHE	SECTION :
SHEET OF				

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					2/3	1				P	W	V		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	
2.5	PHE Structure	Workmanship and finish	MA	Measurement & Visual	100%	100%	Approved Drawings		Inspection Report	√	-	2	1	
2.6	Plate Gaskets	Presence Of Gasket	MA	Visual	100%	100%	Mfg. Spec.	Mfg. Spec.	-do-	√	2	1	-	
2.7	Plate arrangement to flow diagram	Correctness	CR	Visual as per flow diagram	100%	100%	Approved Drawing		Inspection Report		2	-	1	
2.8	Assembly of tightening bolts and nuts	Squeezing of threads on T/B	MA	Visual	100%	100%	Approved Drawing / Data sheet		-do-		2	-	1	
2.9	Plate Pack	Length	MA	Dimension Measurement	100%	100%	Approved Drawing		-do-		2	-	1	
3.0	FINAL INSPECTION													
3.1	Complete Assembly	a. Conformance to GA drg.	MA	-do-	100%	100%	-do-	-do-	-do-		2	1	-	CHP
		B. Dimensions, No. of Heat Transfer Plates, Workmanship & finish	MA	-do-	100%	100%	-do-	-do-	-do-	√	2	1	-	CHP
3.2	Unbalanced hydrostatic pressure (Primary Side)	Leakage / strength of structure	MA	Hyd. Test	100%	100%	Manufacturer's Hydro test procedure (to be reviewed and approved by BHEL/Customer during contract stage)		Hydro Test Report	√	2	1	-	CHP.
3.3	Unbalanced hydrostatic pressure (Secondary Side)	Leakage / strength of structure	MA	Hyd. Test	100%	100%	-do-		-do-	√	2	1	-	CHP.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** 1: BHEL 1* SHALL BE CLEARED BY BHEL 2: VENDOR, 3: SUB VENDOR P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE CHP: CUSTOMER SHALL IDENTIFY IN COLUM "N" AS 'W'	Cust. Logo	DOC. NO.:		REV.	CAT.-
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE			FOR CUST. USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL	

	STANDARD QUALITY PLAN	CUSTOMER:	PROJECT TITLE:	SPECIFICATION NO. :
	SHEET OF	BIDDER/VENDOR:	QUALITY PLAN NO.:	SPECIFICATION TITLE :
		SYSTEM:	ITEM: PHE	SECTION :

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					2/3	1				P	W	V	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.
3.4	Completeness of all previous tests	Completeness	MA	Verification of reports	100%	100%	Tech. Specs / App. Drawings	Completion Certificate	/	2	-	1	
3.5	Painting and packing	Dry film thickness, shade, soundness & completeness	MA	Measurement & visual	100%	100%	Customer/BHEL Tech. Spec. / Approved Data sheets	-do-	√	2	-	1	

REMARKS:-

1 As per Sect. C , Clause No. 4.2, random witness by BHEL/ NTPC at Bidder's works, in case any defect is found in any of selected % of plates, the whole lot shall be tested in presence of BHEL & Customer. H.T. Plates without defect only shall only be accepted.

2 Ultrasonic test of tie rods shall be carried out using 10 mm / 20 mm size Normal Beam Probe of frequency 2 MHz. Using this probe the back wall echo in the sound area of bar shall be adjusted to 100% of full Screen Height (FSH). The whole bar shall be scanned under this sensitivity setting. In this sensitivity setting any defect echo indication having height greater than 20% of FSH is not acceptable.

3. Inspection of Heat Transfer Plate Area Measurement shall be by White Light Scanning Method from Third Party like TUV/ Lloyd and certificate shall be submitted for review of BHEL.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** 1: BHEL 1* SHALL BE CLEARED BY BHEL 2: VENDOR, 3: SUB VENDOR P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE CHP: CUSTOMER SHALL IDENTIFY IN COLUM "N" AS ' W"	Cust. Logo	DOC. NO.:		REV.	CAT.-
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR CUST. USE				
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

1X500 MW FG UNCHAHAR TPP (NTPC LTD)

VOLUME –III

**TECHNICAL SPECIFICATION
FOR
PLATE HEAT EXCHANGERS**

Specification No. : PE-TS-401-179-N001 (Rev 0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301**



TITLE :
**TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS
PREAMBLE**

SPEC. NO.: PE-TS-401-179-N001

VOLUME III

SECTION

REV. NO. 0

DATE 30.08.2014

The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 Volume -I CONDITIONS OF CONTRACT

This consists of four parts as below:

Volume - I A: This part contains instructions to bidders for making bids to BHEL.

Volume - I B: This part contains general commercial conditions of the tender and includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C: This part contains special conditions of contract.

Volume - I D: This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 Volume - II TECHNICAL SPECIFICATIONS Technical requirements are stipulated in Volume II which comprises of :

Volume - II A: General Technical Conditions

Volume - II B: Technical specification including drawings, if any.

1.2.1 Volume - II B : This volume is sub-divided into following sections:

Section – A: This section outlines the scope of enquiry.

Section – B: This section provides “Project Information”

Section – C: This section indicates technical requirements specific to the contract, not covered in Section-D.

Section – D: This section comprises of technical specifications of equipments complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 Volume - III: TECHNICAL SCHEDULES - This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Volume-III.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D



TITLE :
**TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS**

SPECIFICATION NO. PE-TS-401-179-N001

VOLUME III

REV. NO. 0

DATE 30.09.2014

SHEET 1 OF 1

INDEX

SECTION	TITLE
A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER
A.1	COMPLIANCE CERTIFICATE (AS PER ENCLOSED FORMAT)
A.2	SCHEDULE OF DEVIATIONS (AS PER ENCLOSED FORMAT)
A.3	SCHEDULE OF PERFORMANCE GUARANTEE (AS PER ENCLOSED FORMAT)
A 4	GA DRG OF PHE
A.5	SCHEDULE OF PRICES (AS PER NIT FORMAT)
A.6	SCHEDULE OF UNIT PRICES (AS PER NIT FORMAT)
A 7	CERTIFICATE FOR PLATE AREA CONFIRMATION, DULY ENDORSED FROM HEAD OF ENGG/ R&D OF PRINCIPAL SUPPLIER.
A 8	SCHEDULE OF DECLARATION (AS PER ENCLOSED FORMAT)
A 9	THERMAL SIZING CALCULATIONS
B	DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI
B 1	DATA SHEET – B (AS PER ENCLOSED FORMAT)
B 2	GA - CS DRAWING ALONG WITH FOUNDATION DETAILS.
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B 4	PERFORMANCE CURVES
B 5	QUALITY PLAN
B 6	SCHEDULES AS PER ENCLOSED LIST



TITLE :
TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS

SPECIFICATION NO. PE-TS-401-179-N001

VOLUME III

REV. NO. 0

DATE 30.09.2014

SHEET 1 OF 1

DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER



TITLE :
**TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS**

SPECIFICATION NO. PE-TS-401-179-N001

VOLUME III

SECTION

PROJECT NAME :

REV. NO. 0 DATE 30.09.2014

SHEET 1 OF 1

COMPLIANCE CERTIFICATE

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

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval.
GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval.
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Performance Guarantees for PHE's shall stand valid as per commercial terms and conditions.
- j.) Regarding bidder's association with their respective Principals (Plate & Gasket supplier) bidder confirms the following:
 - i. Plate supplier shall vet the thermal design of PHE at tender and contract stage and certify the adequacy of design and no of plates.
 - ii. Guarantee schedule duly vetted by Principal shall be submitted during contract stage.
 - iii. Bidders have back to back arrangement with their principal for technical guarantees.

	<p>TITLE</p> <p style="text-align: center;">* SCHEDULE OF DEVIATIONS</p> <p>() From Conditions of Contract (Volume – 1)</p> <p>() From General Technical Conditions (Volume – II A)</p> <p>() From Technical Specifications (Volume –II B)</p>	<p>SPECIFICATION NO</p> <p>VOL III</p> <p>SHEET..... OF.....</p>
<p>We the undersigned hereby certify that the above mentioned are the only deviations.</p>		

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

	TITLE * SCHEDULE OF DECLARATIONS	SPECIFICATION NO
		VOL III
		SHEET..... OF.....

* Bidder shall include this schedule both in technical and Price offers

DECLARATION

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

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

Bidders Company Name

Authorized representative's Signature

Name

Bidder's Intent The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

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

SL. NO.	DESCRIPTION	UNIT	GUARANTEE VALUE	
			PHE for TG Aux.	PHE for SG Aux.
SCHEDULE OF PERFORMANCE GUARANTEES				
			SPECIFICATION NO.	PE-TS-401-179-N001
PLATE HEAT EXCHANGER			Vol.	III
Project Name 1 X 500 MW FG UNCHAHAAR TPP				
PHE for TG Aux.				
PHE for SG Aux.				
1.0	PRIMARY SIDE (HOT WATER SIDE)			
	CLEAN CONDITION			
a)	Flow rate	M ³ /Hr.		
b)	DMCW inlet temperature	°C		
c)	DMCW outlet temperature	°C		
d)	Pressure drop	MWC		
2.0	SECONDARY SIDE (COLD WATER SIDE)			
	CLEAN CONDITION			
a)	Flow rate	M ³ /Hr.		
b)	ACW inlet temperature	°C		
c)	ACW outlet temperature	°C		
d)	Pressure drop	MWC		
3.0	PRIMARY SIDE (HOT WATER SIDE)			
	FOULED CONDITION			
a)	Flow rate	M ³ /Hr.		
b)	DMCW inlet temperature	°C		
c)	DMCW outlet temperature	°C		
d)	Pressure drop	MWC		
4.0	SECONDARY SIDE (COLD WATER SIDE)			
	FOULED CONDITION			
a)	Flow rate	M ³ /Hr.		
b)	ACW inlet temperature	°C		
c)	ACW outlet temperature	°C		
d)	Pressure drop	MWC		
PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE				
NAME				
SIGNATURE				
DATE				



TITLE :
TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS

SPECIFICATION NO. PE-TS-401-179-N001

VOLUME III

REV. NO. 0

DATE 30.09.2014

SHEET 1 OF 1

DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI



TITLE :
**TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS**

SPECIFICATION NO. PE-TS-401-179-N001

VOLUME III


REV. NO. 0

DATE 30.09.2014

SHEET 1 OF 1

**DATA SHEET-B
FOR PHE'S**

(TO BE FILLED UP DURING CONTRACT STAGE SEPARATELY)


	Title	DATA SHEET - B	SPECIFICATION NO. PE-TS-401-179-N001		
		PLATE HEAT EXCHANGER	VOLUME	III	PART A
			SHEET	1	OF 7

INSTRUCTION TO BIDDER

- This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
- Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS	
1.0	General			
1.1	Number of plate heat exchangers being supplied.	Nos.		
1.2	Manufacturer			
1.3	Model Number/ Type			
1.4	Whether single or double pass			
1.5	Flow Pattern			
2.0	Design			
2.1	Design Pressure	bar (g)		
2.2	Design Temperature	°C		
2.3	Heat Load(without LMTD correction)	KW		
2.4	Heat Load(with LMTD correction)	KW		
2.5	LMTD (Corrected)	°C		
3.0	Guaranteed Performance for Each Heat Exchanger		Primary Side (Hot Fluid)	Secondary Side (Cold Fluid)
3.1	Flow rate	M ³ /hr		
3.2	Inlet temperature	°C		
3.3	Outlet temperature	°C		
	a) In fouled conditions			
	b) In clean conditions			
3.4	Total pressure drop across heat exchanger from inlet to outlet(including inlet & outlet nozzles)	bar		
	a) For design flow			
	b) For 110% design flow rate			

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					


	Title	DATA SHEET - B	SPECIFICATION NO. PE-TS-401-179-N001		
		PLATE HEAT EXCHANGER	VOLUME	III	PART A
			SHEET	2	OF 7

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS	
			Primary Side (Hot Fluid)	Secondary Side (Cold Fluid)
4.0	Heat Transfer & Fluid flow data			
4.1	Film heat transfer co-efficient	KCal/hrM ² °C		
4.2	Fouling factor	M ² hr°C/KCal		
4.3	Overall fouling	M ² hr°C/KCal		
4.4	Overall heat transfer coefficient	KCal/hrM ² °C		
	a) In clean conditions			
	b) In fouled conditions			
4.5	Total effective heat transfer area per heat exchanger	M ²		
4.6	Average velocity	m/s		
	a) Through ports			
	b) Through Plate Channels			
4.7	Pressure drop in ports	bar		
	a) In Clean Condition			
	b) In fouled conditions			
4.8	Pressure drop in channels	bar		
	a) In Clean Condition			
	b) In fouled conditions			
4.9	Maximum differential pressure between hot and cold fluids in plate channels (operating)	bar (g)		

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					


	Title	DATA SHEET - B	SPECIFICATION NO. PE-TS-401-179-N001		
		PLATE HEAT EXCHANGER	VOLUME	III	PART A
			SHEET	3	OF 7

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
5.0	Heat Transfer Plates		
5.1	Area of each plate	M ²	
5.2	Dimension (width x height)	mm x mm	
5.3	Thickness	mm	
5.4	Material & chemical composition		
5.5	Number of plates per heat exchanger	Nos.	
5.6	Maximum number of plates that can be accommodated in the heat exchanger frame	Nos.	
5.7	Type of corrugation		
5.8	Minimum plate pack length	mm	
	a) As per 5.5 above		
	b) As per 5.6 above		
	Maximum plate pack length	mm	
	a) As per 5.5 above		
	b) As per 5.6 above		
5.9	Average spacing between two plates	mm	
5.10	Hold up volume of each passage	M ³	
5.11	Port size (diameter)	mm	
6.0	Plate Gaskets		
6.1	Type		
6.2	Material and composition		
6.3	Thickness of gasket	mm	
6.4	Hardness of gasket		
6.5	Expected life of gasket		

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					


	Title	DATA SHEET - B		SPECIFICATION NO. PE-TS-401-179-N001	
		PLATE HEAT EXCHANGER		VOLUME III	PART A
				SHEET 4	OF 7

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
7.0	Carrying Bar		
7.1	Type of construction		
7.2	Number per heat exchanger		
7.3	Size		
7.4	Material		
8.0	Guide Bar		
8.1	Type of construction		
8.2	Number per heat exchanger		
8.3	Size		
8.4	Material		
9.0	Frame Plate		
9.1	Type of Construction		
9.2	Material		
10.0	Pressure Plate		
10.1	Type of construction		
10.2	Material		
11.0	Supporting Columns		
11.1	Type of Construction		
11.2	Material		
12.0	Clamping/Gasket Compression Arrangement		
12.1	Type of arrangement		
12.2	Tie Rod size & material (Length to take care 25% extra plates)		
12.3	Tie Rod Nuts size & material		
12.4	Nozzle flange stud size & material		
12.5	Nozzle flange Nut size & material		

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					


	Title	DATA SHEET - B	SPECIFICATION NO. PE-TS-401-179-N001		
		PLATE HEAT EXCHANGER	VOLUME	III	PART A
			SHEET	5	OF 7

INSTRUCTION TO BIDDER

- This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
- Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS	
13.0	Inlet & outlet Connection Nozzles		Primary Side (Hot Fluid)	Secondary Side (Cold Fluid)
13.1	Size	mm		
13.2	Rating			
13.3	Facing & drilling standard			
13.4	Flange material			
13.5	Are all nozzles counter-flanges, bolts, nuts, gaskets etc., are included in the offer?		YES/NO	
14.0	Recommended Cleaning frequency of the heat exchanger for assumed fouling factor	Months		
15.0	Is backwash necessary		YES/NO	
16.0	Are all auxiliaries and accessories included in the offer		YES/NO	
17.0	Are all counter-flanges with nuts, bolts and gaskets for all terminal points included in the offer?		YES/ NO	
18.0	Are all heat exchangers supplied with necessary foundation plates, anchor, bolts, sleeves, inserts, lifting lugs etc., as specified.		YES/ NO	

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					


	Title	DATA SHEET - B			SPECIFICATION NO. PE-TS-401-179-N001	
		PLATE HEAT EXCHANGER			VOLUME	III PART A
					SHEET	6 OF 7

INSTRUCTION TO BIDDER

- This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
- Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
19.0	Shop Tests & Inspection		
19.1	Whether all the tests and inspections as detailed in the specification/ quality plan are carried out		YES/ NO
19.2	Hydrostatic Test : a) Test Pressure b) Test duration	bar (g) min.	
19.3	Are all plates checked for cracks and other defects by the penetration method? If not, what percentage is checked?		YES/NO
19.4	Is hardness test conducted for plate gaskets?		YES/NO
20.0	Details of Painting		
20.1	Exterior surface a) Surface preparation b) Primer c) Finish Preparation		
20.2	Interior Surface a) Surface preparation b) Primer c) Finish Preparation		
21.0	Weight of each heat exchanger	kg.	

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					

	Title	DATA SHEET - B	SPECIFICATION NO. PE-TS-401-179-N001	
		PLATE HEAT EXCHANGER	VOLUME III	PART A
			SHEET 7	OF 7

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-401-179-N001, Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
	a) Empty b) Flooded		
	Flooded Weight of heat exchanger with Max. Plates		
22.0	Overall dimensions - (Length x Breadth x Height)	mm x mm x mm	
23.0	withdrawal space		
24.0	Recommended Maintenance tools and tackles furnished		Yes/No
25.0	Mesh Size of recommended Strainer	mm	
26.0	Foundation nuts and bolts supplied		Yes/No
27.0	Other information (if any)		

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					
Date :					

CHECKLIST — LIST OF SCHEDULES

Sl. No.	Form No.	Description	Tick Applicable Forms
1.	PEM-6024	Schedule of Drawings / Catalogues submitted with Bid	✓
2.	PEM-6025@	Schedule of Occurance of Key Events of Delivery, Erection & Commissioning	
3.	PEM-6026	Schedule of Equipment Manufacture, Despatch and Shipment to Site.	✓
4.	PEM-6027	Schedule of Weights & Dimensions	
5.	PEM-6028@	Schedule of Performance Guarantee	
6.	PEM-6030	Inspection Schedule	✓
7.	PEM-6031	Schedule of Cement and Steel and Quarterly Cement Requirement	
8.	PEM-6032	Schedule of Quarterly Requirement of Reinforcing Bars and Structural Steel	
9.	PEM-6033@	Bill of Quantities (Civil Works)	
10.	PEM-6035	Schedule of Bidder's Proposed Construction / Site Fabrication Facilities.	
11.	PEM-6036	Schedule of Deviations	✓
12.	PEM-6040	Schedule of Declaration	✓
13.	PEM-6041	Quality Plan	✓
14.	PEM-6042	Vendor's Drawings / Documents Schedule	✓
15.	PEM-6043@	Schedule of Occurance of Key Events for Civil / Structural Works	
16.	PEM-6046	Inspection Request	✓
17.	PEM-6051	Schedule of Prices	✓
18.	PEM-6052@	Schedule of Unit Prices	✓
19.	PEM-6053	Schedule of Prices for Commissioning & Mandatory Spares	✓
20.	PEM-6054	Schedule of Prices for Recommended Spares	✓
21.	PEM-6055	Schedule Prices for Erection and Maintenance Tools & Tackles	✓
22.	PEM-6056	Schedule of Bidder's Man-power for Supervision of E & C and their Charges.	✓
23.	PEM-6057	Schedule of Daily & Overtime Rates	
24.	PEM-6058	Schedule of Hire-charges for Construction / Site Fabrication Facilities	
For Forms marked with @ certain information to be filled by DEs - before issuing to bidder.			



**SCHEDULE OF DRAWINGS/CATALOGUES
SUBMITTED WITH BID**

SPECIFICATION NO

VOL III


SHEET..... OF.....

Section C/D enclosed with the specification indicate the drawings / catalogues to be furnished with the bid. The bidder in addition to furnishing the same, can also include any other drawings / catalogues which he may desire to submit with the bid. This schedule duly lists out such drawings as enclosed by the bidder with the bid.

DRAWING/ CATALOGUE NUMBER	DESCRIPTION	NUMBER OF SHEETS

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	

	SCHEDULE OF EQUIPMENT, MANUFACTURE, DESPATCH AND SHIPMENT TO SITE			SPECIFICATION NO
				VOL III
				SHEET..... OF.....
Equipment/Major Bought-out items	Time for Manufacture/ Procurement from Date of issues of Letter of intent (Weeks)	Time for Test Dismantling Packing & Ready for Dispatch (Weeks)	Time required fro Shipment to Site (Weeks)	Total Time from Date of Issue of Letter of intent to Shipment to Site (Weeks)
<p>We, the undersigned hereby undertake to meet the schedule in weeks fro manufacture, dispatch and shipment of each equipment and procurement of major boughtout items as listed above.</p>				

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



**SCHEDULE OF
WEIGHTS & DIMENSIONS**

SPECIFICATION NO

VOL III


SHEET..... OF.....

The bidder shall state below the weights and dimensions of various packages for shipment covering the complete scope.

Description of Package(S)	Dimension (in meters)	Weight (in tones)

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

	INSPECTION SCHEDULE			SPECIFICATION NO
				VOL III
				SHEET..... OF.....
S No.	ITEM/COMPONENT	PLACE & ADDRESS OF TEST / INSPECTION	SCHEDULE D DATE OF INSPECTION	DURATION OF TEST / INSPECTION (IN DAYS)
<p>This schedule shall be in the line with specification and quality plan requirements. The information in this form shall be furnished after receipt of LOL/PO.</p>				

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

FORM No. PEM - 6056-D



TITLE

**SCHEDULE OF BIDDER'S MAN POWER
FOR SUPERVISION OF E & C
AND THEIR CHARGES**

SPECIFICATION NUMBER

VOLUME III

SHEET OF

The bidder shall indicate below, designation-wise, the personnel required for supervision of erection and commissioning and their charges.

SUPERVISION OF ERECTION


S. No.	Designation	Normal rate per day of 8 hours	Overtime rate per hour

SUPERVISION OF COMMISSIONING

Sl. No.	Designation	Normal rate per day of 8 hours	Overtime rate per hour


PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

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	*SCHEDULE OF PRICES FOR COMMISSIONING AND MANDATORY SPARES						SPECIFICATION NO		
							VOL III		
							SHEET..... OF.....		
<p>*Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid The bidder shall indicate here the quantity required for erection / commissioning and mandatory spares for equipment as listed in Section C / Section – D. If the listed spares are not adequate then the bidder shall indicate those and additional spares considered necessary by him.</p>									
Type	Manufacturer's Drawing No / Part of spare	Description	Material	Quantity per Unit / Equipment	Quantity Recommended	If Set, Nos. Per Set	Delivery Period (Weeks)	Unit Price (Rs.)	Total Price (Rs.)
Erection & Commissioning									
Mandatory Spares									
Additional Spares Mandatory Erection / Commissioning									

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

FORM NO PEM 6041-1

		QUALITY PLAN			CUSTOMER			PROJECT TITLE		SPECIFICATION NUMBER		
					BIDDER/VENDOR			QUALITY PLAN NUMBER		PACKAGE : PLATE HEAT EXCHANGER		
		SHEET OF			SYSTEM			ITEM		SECTION VOLUME III		
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECK	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
BHEL			PARTICULARS			BIDDER / VENDOR			BIDDER/VENDOR COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									

INSTRUCTIONS FOR FILLING QUALITY PLAN

(Form No. PEM-6042-0)

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/component/assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The following guide lines may be noted:

- Column 1- Serial Number
- Column 2- Component/Operation- The component and/or operation being checked shall be given here.
- Column 3- Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc..
- Column 4- Category - 'CR' stands for critical characteristic - affecting safety of equipment and personnel
'MA' stands for major Characteristic - affecting safety of equipment and personnel
'MI' stands for minor characteristic - affecting appearance etc.
- Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.
- Column 6- Extent of check, such as, 100, 10, 1 per heat etc.
- Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.
- Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.
- Column 9- Format of Record - Formats, log sheets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.
- Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'
The agency which verifies test certificates/inspection records and carries out audit check of the components/operation shall be written in sub-column 'V'
The agencies are codified '1' stands for (BHEL)
as 1, 2 & 3 '1*' means the operation shall be cleared by BHEL before the start of the next operation.
'2' Stands for Vendor
'3' stands for sub-Vendor of the Vendor and so on.

Example :

Entry '3' in column 'P' means test/inspection to be performed by sub-Vendor's QC

Entry '2' in column 'W' means test/inspection to be witnessed by Vendor's QC

Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL

Column II- Remarks - Any special remarks shall be given here.

NOTES :

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn by BHEL and all tests as per relevant specifications shall be carried out in their presence or in recognized Government Laboratory.
2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be preserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless otherwise agreed.
3. For castings and forgings integral test specimens shall be provided. When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.
4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.
5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings/specifications, the latter shall prevail.
6. Wherever inspection by BHEL's Purchaser/Third Party/Statutory authorities are mandatory, this shall be compiled with.
7. Inspection reports, log sheets, test reports/certificate, etc. shall be furnished to BHEL at the appropriate stage or at the time of final inspection, as required.
8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.
9. The quality plan shall be submitted in septuplicate (7 Copies).

**PROCEDURE FOR MEASUREMENT OF HEAT TRANSFER SURFACE AREA OF THE
PHE PLATES**

Definition of Heat transfer area:

The Heat transfer area of the PHE plate is the area of the plate participating in the heat transfer process viz. the wetted surface area inside the gasketed groove of the plate as the Annexure 1.

Steps to Measure the Area:

- 1) The surface area of the plate shall be cleaned thoroughly.
- 2) Apply the developer (as used in Dye Penetrant test) over the entire surface of the plate.
- 3) Fix the reference stickers at several appropriate locations on the plate.
- 4) White light (CFL) is projected on the plate.
- 5) The entire surface area including all the geometrical features of the plate (corrugations) is captured by the 3D camera.
- 6) The 3D image of the plate is then converted into CAD format.
- 7) The surface area can be measured from the 3D- CAD drawing.

ANNEXURE -1

Heat transfer area to be measured – Shown in Hatched portion below

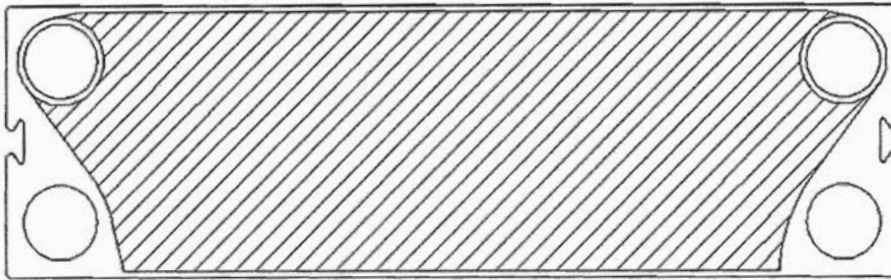


Fig. 1: Wetted Surface Area for Parallel Connection

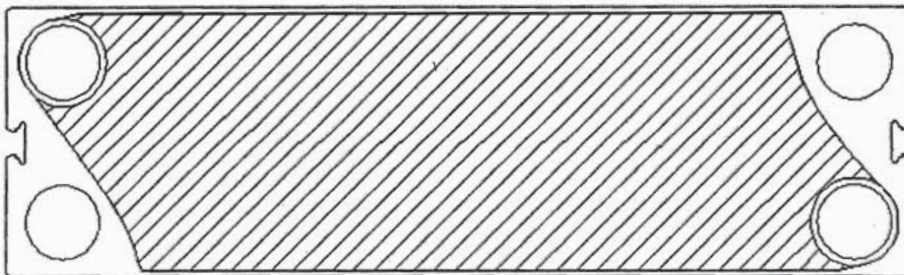


Fig. 2: Wetted Surface Area for Diagonal Connection