

**GUJRAT STATE ELECTRICITY CORPORATION LTD.
WANAKBORI STPP UNIT-8
(1 X 800 MW)**

VOLUME –IIB

**TECHNICAL SPECIFICATION
FOR
PLATE HEAT EXCHANGERS**

Specification No. : PE-TS-408-179-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-408-179-N001

VOLUME II B

SECTION

REV. NO. 0

DATE 26/11/15

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



TITLE :
TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS

SPECIFICATION NO. PE-TS-408-179-N001

VOLUME II B

SECTION : -

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SECTION	TITLE
A	SCOPE OF ENQUIRY
B	PROJECT INFORMATION
C	SPECIFIC TECHNICAL REQUIREMENTS
D	STANDARD TECHNICAL SPECIFICATIONS OF PHE'S ALONGWITH ▪ DATA SHEET – A ▪ QUALITY PLAN



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

SPECIFICATION NO. PE-TS-408-179-N001

VOLUME II B

SECTION A

REV. NO. 0 DATE 26/11/15

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), mandatory spares, including site PG test as mentioned in this specification for the 1x800 MW WANAKBORI STPP, UNIT # 8.

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.



TITLE :
TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS

SPECIFICATION NO. PE-TS-408-179-N001

VOLUME II B

SECTION C

REV. NO. 0

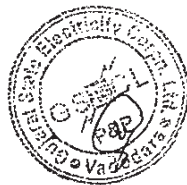
DATE 26/11/15

SECTION B
PROJECT INFORMATION

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION



DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-1&2)

028



VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Supercritical Thermal Power Project would be set up by Gujarat State Electricity Corporation Limited (GSECL) at Kheda district of Gujarat.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

The proposed site is located in Kheda district about 13 kilometers from the nearest commercial town of Balasinor & 10 kilometers from Sevalia town. The National Highway, NH-08, connecting Dakor – Godhra is about 10 kilometers from the site. The State Highway SH – 59 connecting Balasinor – Sevalia is about 2 Kilometers from the site. Nearest railway station to the existing site is Sevalia, located about 8 kilometers from the site on Anand – Godhara main broad gauge line of Western Railway.

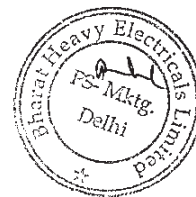
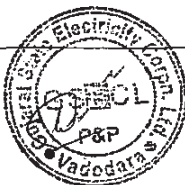
Nearby Air Ports are Ahmedabad at a distance of about 110 kilometers from the site and Vadodara at a distance of about 85 kilometers from the site.

3.00.00 LAND

The proposed extension unit will be developed in the existing Wanakbori Thermal Power Station and will be located north east side of the existing plot in the Kheda District of Gujarat. The land of the proposed plant will be filled in upto a desired level. Existing Ash Pond/ Dyke area will be utilized for the extension unit.

4.00.00 SOURCE OF COAL

Indian coal would be sourced from captive mines Machha Kata in Talcher, State – Orissa which are situated about 1800 Kms from the project site. GSECL will arrange for transportation of the coal required for the extension unit from these captive mines by the existing railway facilities for delivery of coal supply to the Wanakbori power station.



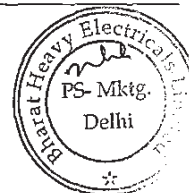
CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	INTRODUCTION
2.00.00	APPROACH TO SITE
3.00.00	LAND
4.00.00	SOURCE OF COAL
5.00.00	SOURCE OF WATER
6.00.00	ASH DISPOSAL AREA
7.00.00	SALIENT DESIGN DATA



DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-1&2)

030



5.00.00 SOURCE OF WATER

The water required for the new unit shall be obtained from River Mahi, flowing by the side of the existing Wanakbori Power Station.

One (1) new jackwell will be installed on Mahi river for supply of water for new plant. In addition, existing Canal Water and Jackwell Water will have interconnection with new plant to cater plant water requirement of new plant.

6.00.00 ASH DISPOSAL AREA

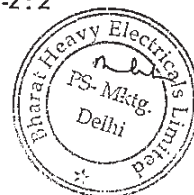
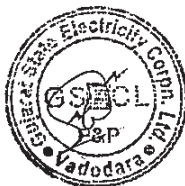
Existing Ash Pond / Dyke area will be utilized for the extension unit. Fly ash silos will be located outside plant boundary wall (but within GSECL land) in the vicinity of the Ash Dyke area.

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	72 M
Max. daily average temp	:	34 °C
Min. daily average temp	:	11.7 °C
Max. Ambient air temp. (daily)	:	34°C
Max. Ambient air temp. (yearly)	:	30°C
Max. Ambient air temp.	:	42°C
Wet bulb temperature	:	28°C
Relative Humidity	:	RH varies within a range from 50% to 95%.
Average annual rainfall	:	750 mm

[Metrological data of Vadodara is attached for reference].



VOLUME : IIA
SECTION-IX
SALIENT DESIGN DATA
[TABLE-I TO TABLE-VII]



DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-9)

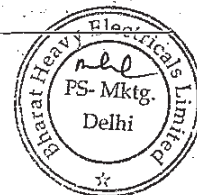


TABLE-VII
CLIMATOLOGICAL TABLE OF BARODA

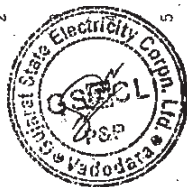
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STATION : Baroda 42747 .. contd

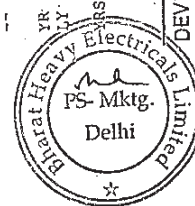
Weather										Wind speed		% Wind Direction				Total Cloud				Low cloud				Visibility												
MN	PPT	HAIL	THUN	FOG	D.STM	SQUA	62	61	19	0	N	NE	E	SE	S	SW	W	NW	0	0	T-2	3-5	6-7	8	F8	<1	1-4	4-10	10-20	>20						
1	0.3	0.0	0.1	0.5	0.0	0.0	0	0	19	12	13	39	2	2	1	3	1	3	36	20	5	3	2	1	28	2	1	0	0	0	0.3	1.7	2.0	25.6	1.4	
2	0.3	0.0	0.1	0.2	0.0	0.0	0	0	25	6	12	30	2	0	0	3	8	23	22	19	6	3	2	1	28	2	1	0	0	0	0.0	0.0	0.0	1.9	29.1	
3	0.3	0.0	0.1	0.2	0.0	0.0	0	0	17	11	10	31	1	2	2	7	2	4	41	20	4	3	1	0	25	1	1	0	0	0	0.2	1.6	2.3	23.9	0.0	
4	0.3	0.0	0.1	0.2	0.0	0.0	0	0	24	4	10	21	2	2	0	9	12	28	15	19	5	2	2	0	25	2	1	0	0	0	0.0	0.0	0.0	1.7	26.3	
5	0.2	0.0	0.2	0.0	0.0	0.0	0	0	19	12	7	15	1	3	5	16	5	7	41	20	5	4	2	0	29	1	1	0	0	0	0.0	0.5	0.7	29.8	0.0	
6	0.2	0.0	0.5	0.0	0.0	0.0	0	0	27	4	7	13	2	1	1	15	16	32	13	20	6	3	2	0	28	2	1	0	0	0	0.0	0.0	0.0	1.5	28.5	
7	0.2	0.0	0.5	0.0	0.0	0.0	0	0	22	8	5	5	1	2	6	29	10	12	30	19	5	3	2	1	27	2	1	0	0	0	0.0	0.1	0.1	29.7	0.1	
8	0.4	0.0	0.6	0.0	0.3	0.0	0	0	27	3	4	4	1	0	1	20	26	35	9	16	7	3	3	1	25	4	1	0	0	0	0.0	0.0	0.0	0.3	29.7	
9	0.4	0.0	0.6	0.0	0.3	0.0	0	0	28	3	1	1	1	1	5	57	17	7	10	15	6	7	3	0	19	4	6	2	0	0	0.0	0.0	0.0	30.8	0.2	
10	7.6	0.0	3.3	0.0	0.1	0.2	0	0	1	29	1	1	2	0	1	2	45	30	14	5	21	8	1	1	0	24	6	1	0	0	0.0	0.0	0.0	1.7	29.3	
11	19.8	0.0	2.1	0.0	0.0	0.1	0	0	27	4	0	0	0	0	1	8	62	14	0	15	0	2	5	8	16	4	4	14	8	1	0	0.0	0.0	0.2	30.8	0.0
12	17.8	0.0	1.8	0.0	0.0	0.0	0	0	27	3	0	0	0	0	2	8	60	18	3	9	1	1	5	11	13	1	7	13	9	1	0	0.0	0.0	0.3	4.3	26.4
13	17.8	0.0	1.8	0.0	0.0	0.0	0	0	26	5	1	0	0	0	7	55	20	1	16	0	1	4	8	18	4	4	13	9	1	0	0.0	0.1	0.8	29.2	0.9	
14	10.2	0.0	2.6	0.0	0.0	0.0	0	0	23	7	2	3	0	2	5	37	18	5	27	4	6	6	6	8	12	4	8	5	1	0	0.0	0.1	0.2	29.3	0.4	
15	1.6	0.0	1.4	0.2	0.0	0.0	0	0	20	11	9	15	3	2	1	3	32	26	15	17	2	9	6	8	5	6	12	8	4	0	0.0	0.0	0.1	2.6	27.3	
16	1.1	0.0	0.3	0.2	0.0	0.0	0	0	17	13	11	33	4	3	1	2	0	1	45	18	6	3	2	1	27	1	2	0	0	0	0.1	0.3	0.4	28.3	0.9	
17	0.3	0.0	0.2	0.2	0.0	0.0	0	0	20	11	12	43	3	1	1	1	0	1	38	19	5	4	2	1	29	1	1	0	0	0	0.0	0.0	0.0	0.7	29.3	
18	0.3	0.0	0.2	0.2	0.0	0.0	0	0	21	10	17	24	4	1	0	2	4	16	32	17	7	3	3	1	28	2	1	0	0	0	0.0	1.3	1.3	27.4	1.0	
19	0.3	0.0	0.2	0.2	0.0	0.0	0	0	21	10	17	24	4	1	0	2	4	16	32	17	7	3	3	1	28	2	1	0	0	0	0.0	0.0	0.0	0.6	30.4	

YR	58.8	0.0	13.2	1.3	0.4	0.3	0	0	263	102	6	16	1	2	5	29	9	4	28	154	58	55	45	53	237	34	62	29	3	0	0.6	5.9	8.6	344.1	5.8
W.Y.							0	5	297	63	6	12	2	1	2	26	16	17	18	150	78	43	53	41	219	67	53	24	2	0	0.0	1.1	22.6	340.2	
VERS				26					24					29													27								
									24					29													26								

V.IIA/S-IX: 11



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Gujarat State Electricity Corporation Ltd
1x800 MW Supercritical Thermal Power Project

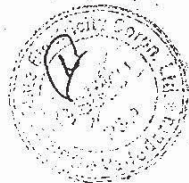
EPC Bid Document
K9213R-EPC-SPC-001

STATION : Baroda (A)										42748 LAT: 22 20 N LONG: 73 16 E HT. ABOVE M.S.L. 38 METERS DATA 1952 TO 1980														
Mean Temperature										Extremes					Cloud					Rainfall				
MM	SLP	DB	WB	MAX	MIN	HIGH	LOW	MAX DT	MIN DT	RH	VP	TOT LOW	TOT RAINY	WET	DRY	HEAVY	DAY	WS						
1	1011.5	15.2	11.3	29.4	12.2	33.4	7.2	35.8 13	2.8 22	59 10.3	1.2 0.1	1.3	0.1	15.8	0.0	14.0	07	7.6						
	1008.1	27.6	17.3					1979	1962	31 11.5	1.2 0.1			1953			1953							
2	1010.0	17.8	12.4	32.1	13.9	36.6	8.8	40.6 28	3.9 10	50 10.2	1.0 0.3	0.7	0.1	11.0	0.0	6.0	02	7.6						
	1006.3	30.9	17.8					1953	1950	23 9.9	1.0 0.3			1961			1961							
3	1008.1	23.2	16.5	36.4	18.2	40.5	13.0	43.9 29	9.3 08	48 13.4	1.1 0.2	1.2	0.2	21.4	0.0	11.5	25	7.5						
	1003.9	35.1	20.0					1977	1979	21 11.2	1.3 0.2			1967			1967							
4	1005.6	27.8	20.8	39.5	22.8	42.9	18.2	45.9 29	14.4 15	51 19.0	1.2 0.3	0.3	0.0	8.2	0.0	8.2	25	8.3						
	1000.9	38.5	21.8					1979	1955	19 12.8	1.5 0.3			1978			1978							
5	1002.7	29.9	24.6	40.3	26.5	43.7	22.9	46.1 20	19.4 27	64 26.6	1.9 1.6	3.7	0.2	50.1	0.0	40.9	29	14.6						
	997.7	39.0	24.5					1955	1974	29 19.0	0.9 0.5			1974			1956							
6	999.0	29.3	26.1	36.7	26.8	40.9	23.2	45.6 06	17.1 03	77 31.0	4.9 3.4	129.7	5.0	439.0	0.0	187.3	06	18.0						
	994.9	34.6	26.6					1979	1980	54 28.1	3.9 2.5			1976			1976							
7	997.7	27.4	25.8	32.4	25.6	36.2	23.5	39.6 02	22.2 28	88 32.0	6.6 4.1	290.7	12.6	605.6	60.8	162.0	11	15.2						
	994.7	30.2	26.5					1968	1952	75 31.6	6.5 3.9			1976			1976							
8	999.5	26.5	25.2	31.3	24.9	34.4	23.2	39.1 16	21.7 16	90 31.0	6.8 3.9	274.4	11.8	657.4	38.5	277.1	05	12.6						
	996.5	29.3	26.0					1969	1956	76 30.8	6.5 3.8			1978			1956							
9	1003.2	26.5	24.6	32.7	24.2	36.5	22.2	41.1 29	18.1 25	85 29.4	4.7 2.6	147.0	7.2	456.4	0.3	221.6	07	9.1						
	999.7	30.9	25.4					1951	1972	65 28.1	4.5 2.6			1958			1970							
10	1007.2	26.0	21.7	35.4	21.1	37.9	16.5	41.2 15	12.8 27	67 22.6	1.7 0.6	21.6	1.3	143.9	0.0	71.1	01	6.2						
	1003.7	32.9	23.0					1980	1960	41 20.2	1.8 0.8			1956			1954							
11	1010.3	21.7	16.7	33.4	16.7	36.2	12.4	39.4 01	6.0 26	58 15.0	1.6 0.4	16.5	0.7	190.1	0.0	61.4	04	6.7						
	1006.9	30.2	20.2					1980	1968	37 15.6	1.5 0.5			1979			1962							
12	1011.7	17.3	13.3	30.7	13.7	33.5	9.5	37.2 06	6.4 30	61 12.1	1.5 0.1	3.3	0.2	34.2	0.0	34.2	01	7.0						
	1008.3	28.0	18.3					1968	1977	36 13.3	1.6 0.2			1978			1978							

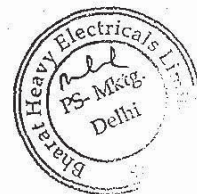
YR 1005.5	24.1	19.9	34.2	20.6	44.1	6.8	46.1	2.8	67	21.1	2.9	1.5	911.1	39.4	1721.7	314.9	277.1	10.0
LY 1001.8	32.3	22.3							42	19.3	2.7	1.3			1976			
YRS 29	29	29	29	29	29	29	31	31	29	28	29	16	30	30	31	31	31	29
29	29	29	29	29	29	29	29	29	29	28	28	29	16	30	30	31	31	29

DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Val-IIA-Sec-9)

V.II.AS-IX:12



1980



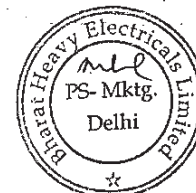
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[illegible]

YR LY YRS

YES

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DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol.II(A-Sec-9))

V.II.A/S-9: 13



TITLE :
TECHNICAL SPECIFICATION FOR
PLATE HEAT EXCHANGERS

SPECIFICATION NO. PE-TS-408-179-N001

VOLUME II B

SECTION C

REV. NO. 0

DATE 26/11/15

SECTION C
SPECIFIC TECHNICAL REQUIREMENTS



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

SPECIFICATION NO. PE-TS-408-179-N001

VOLUME II B

SECTION C

REV. NO. 0 **DATE 26/11/15**

SHEET 1 OF 3

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 1x800 MW WANAKBORI STPP, Unit # 8 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 **Maximum length of PHE (excluding reducer) shall not exceed 5.0 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 60 minutes holding time for each side.

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.

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



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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. In case inspection of plate area measurement by white light scanning method of specific PHE model has been witnessed by BHEL in past project then 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 testing.



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6.0 SPARES :

6.1 **Mandatory Spares:** Shall be as per data sheet A.

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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	PLATE HEAT EXCHANGER			Vol/Section	IIB/D	
	DATASHEET - A			Rev	0	
				Date	26/11/2015	
	PROJECT			1X800 MW WANAKBORI STPP UNIT-8		
1.0	General			(TG AUX.)	(SG AUX.)	
1.1	Number of Plate Heat Exchanger		Nos	Total three (3) nos for station i.e. [2W+1S] for one unit	Total two (2) nos for Station i.e. [1W+1S] for one unit	
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			Clarified Water (Refer enclosed water analysis)	Clarified 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 6.7 Kg/sq. cm(g)	About 8.9 Kg/sq. cm(g)	
		(Secondary Side)	Kg/cm ² (g)	About 3.1 Kg/sq. cm(g)	About 3.1 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	8500 (Max.)	8500 (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	1051	904	
		(ACW Side)	M ³ /hr	1051	904	
3.2	Inlet temperature	(DMCW Side)	°C	46.7	45	
		(ACW Side)	°C	36	36	
3.3	Outlet temp	(DMCW Side)	°C	38	38	
		(ACW Side)	°C	44.7	43	
3.4	* Allowable pressure drop across heat exchanger from inlet to outlet in fouled conditions at the 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 1.1 times of 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 (minimun)	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, 65 ± 5 Deg. shore hardness	Nitrile rubber, 65 ± 5 Deg. shore hardness	

	TECHNICAL SPECIFICATION FOR		Technical	PE-TS-408-179-N001 (Rev 0)	
	PLATE HEAT EXCHANGER		Vol/Section	IIB/D	
	DATASHEET - A		Rev	0	
			Date	26/11/2015	
	PROJECT		1X800 MW WANAKBORI STPP UNIT-8		
6.3	Compression/Fixed/Frame/Movable Pressure plates		Carbon Steel, ASTM A-283 Grade C, Epoxy painted		
6.4	Guide Rails/ bar		Carbon Steel, ASTM A-283 Grade C, Epoxy painted		
6.5	Support Beam/ column		Carbon Steel, ASTM A-283 Grade C, Epoxy painted		
6.6	Nozzle		Carbon steel as per IS 2062 Grade B		
6.7	Nozzle flanges		Carbon Steel as per IS 2062 (Confirming to ANSI B 16.5, Class 150)		
6.8	Flange/ Counter flanges		Carbon Steel as per IS 2062 Gr. B (Confirming to ANSI B 16.5 class, Min.-150 lb) Epoxy Coated		
6.9	Tightening Bolts/Rods & Nuts		SAE 1045, epoxy painted		
6.10	Nozzle flange bolt and nut		SA 193 B7 / SA 194 2H		
6.11	Nozzle flange gasket		3 mm wire inserted red rubber		
6.12	Name Plate		SS-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 (SA 2.5) etc shall be subjected to BHEL/Customer approval. 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				
8.1	Plates		5% for each Category of material, size and thickness		
8.2	Valves		10% or Minimum 1 No. For each type, size and Pressure rating Whichever is higher		
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 PHEs shall be PG Tested by bidder at site to demonstrate the guaranteed performance parameters.		
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 – 100%)				
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

CLARIFIED WATER ANALYSIS

Sl no.	Particulars	Units	Value
1	pH	---	8.42
2	TSS	ppm	15 ppm
3	Conductivity	Micro S/cm	440
4	Calcium Hardness	ppm as CaCO ₃	52
5	Magnesium hardness	ppm as CaCO ₃	82
6	Sodium	ppm as CaCO ₃	79
7	Iron in solution	ppm as Fe	Nil
8	Manganese in solution	ppm as CaCO ₃	Nil
9	Total Cations		213
10	Bicarbonate	ppm as CaCO ₃	152
11	Carbonate	ppm as CaCO ₃	2
12	Hydroxide	-----	Nil
13	Sulphate	ppm as CaCO ₃	13
14	Chloride	ppm as CaCO ₃	46.48
15	Nitrate	ppm as NO ₃	Nil
16	Fluoride	ppm as CaCO ₃	Nil
17	Total Anions		213
18	Reactive Silica as SiO ₂	ppm	22
19	Colloidal Silica as SiO ₂	ppm	Nil.

* Note: Other parameters not indicated above considering as Nil.

STANDARD QUALITY PLAN SHEET OF		CUSTOMER:		PROJECT TITLE:			SPECIFICATION NO. :				
		BIDDER/VENDOR:		QUALITY PLAN NO.:			SPECIFICATION TITLE :				
		SYSTEM:		ITEM: PHE			SECTION :				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK 2/3 1	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	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	-do-	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/He -at Batch	1/ Heat/He -at Batch	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/He -at Batch	1/ Heat/He -at Batch	-do-	-do-	-do-	2,3 - 1	-do-
		Dimensions	MA	Measurement	100%	Sample	Approved Drawings	Approved Drawings	Inspection Reports	2,3 - 1	
1.3	Gaskets	Dimensions	MA	Measurement	100%	Sample	Approved Drawings	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-	-do-	2,3 - 1	
		Contour	MA	Visual	-do-	-do-	Mfg. Drgs / specification	-do-	-do-	2,3 - 1	

MANUFACTURER/ SUB-SUPPLIER		SIGNATURE	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-
			FOR CUST. USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL		

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		BIDDER/VENDOR:		QUALITY PLAN NO.:		SPECIFICATION TITLE :				
SHEET OF		SYSTEM:		ITEM: PHE		SECTION :				
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1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
		Hardness	CR	Measurement	-do-	Approved Drawings	-do-	D* 2,3	-	1
1.4	Tightening Bolts & Nuts. (Tie Rod)	Physical Properties	MA	Physical Test	1/ Heat	App. Drg./ data sheet	Relevant Material Spec.	Mill Tc Or Lab Test Report	2,3	1
		Chemical Properties	MA	Chemical Analysis	1/ Heat	-do-	-do-	-do-	2,3	1
		Dimensions	MA	Measurement	100%	Approved Drawings	IR	-do-	2,3	1
		Workmanship and Finish	MA	Visual	100%	-do-	-do-	-do-	2,3	1
		Internal Soundness (For diameter >= 40 mm)	CR	UT	100%	ASTM A 388	See Remark - 3	-do-	2,3	1
2.0	IN PROCESS INSPECTION									
		Area Measurement	NA	White Light Scanning	1 per Type	Approved drawing/ data sheet	Approved drawing/ data sheet	IR	2,3	1
		Physical Properties	MA	Physical Test	1 Sample per Heat	Approved drawing/ data sheet	Relevant Material Spec.	Mill TC or Lab Test Report	2,3	1
		Chemical Properties	MA	Chemical Analysis	1 Sample per Heat	Approved drawing/ data sheet	Relevant Material Spec.	Mill TC or Lab Test Report	2,3	1
	HT PLATES	Dimension	MA	Measurement	1 Sample per Heat	Approved drawing/ data sheet	Approved drawing/ data sheet	Inspection Report	2,3	1

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SIGNATURE		REVIEWED BY		APPROVAL SEAL	

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

STANDARD QUALITY PLAN SHEET OF		CUSTOMER:		PROJECT TITLE:			SPECIFICATION NO. :						
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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
1.	2.	3.	4.	5.	2/3	1	6.	7.	8.	9.	P	W	V
		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	✓	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-	✓	2,3	-	1	
2.3	Welders Performance Qualification	Welder's Performance Soundness Of Welds	MA	Visual / RT & Mechanical	100%	100%	-do-	-do-	✓	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	-	

MANUFACTURER/ SUB-SUPPLIER		SIGNATURE		MAIN-SUPPLIER		VENDOR	

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Cust. Logo		FOR CUST. USE		REVIEWED BY		APPROVED BY		APPROVAL SEAL			

STANDARD QUALITY PLAN SHEET OF		CUSTOMER:		PROJECT TITLE:		SPECIFICATION NO. :						
		BIDDER/VENDOR:		QUALITY PLAN NO.:		SPECIFICATION TITLE :						
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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK 2/3 1	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									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%	Approved Drawings		Inspection Report	✓	2	1	
2.6	Plate Gaskets	Presence Of Gasket	MA	Visual	100%	Mfg. Spec.		-do-	✓	2	1	-
2.7	Plate arrangement to flow diagram	Correctness	CR	Visual as per flow diagram	100%	Approved Drawing		Inspection Report		2	-	1
2.8	Assembly of tightening bolts and nuts	Squeezing of threads on T/B	MA	Visual	100%	Approved Drawing / Data sheet		-do-		2	-	1
2.9	Plate Pack	Length	MA	Dimension Measurement	100%	Approved Drawing		-do-		2	-	1
3.0 FINAL INSPECTION												
3.1	Complete Assembly	a. Conformance to GA drg.	MA	-do-	100%	-do-	-do-	-do-		2	1	-
		B. Dimensions No. of Heat Transfer Plates, Workmanship & finish	MA	-do-	100%	-do-	-do-	-do-	✓	2	1	-
3.2	Unbalanced hydrostatic pressure (Primary Side)	Leakage / strength of structure	MA	Hyd. Test	100%	Manufacturer's Hydro test procedure (to be reviewed and approved by BHEL/Customer during contract stage)		Hydro Test Report	✓	2	1	-
3.3	Unbalanced hydrostatic pressure (Secondary Side)	Leakage / strength of structure	MA	Hyd. Test	100%	-do-	-do-	-do-	✓	2	1	-

MANUFACTURER/ SUB-SUPPLIER		SIGNATURE		MAIN-SUPPLIER		VENDOR	

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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CAT	TYPE/METHOD OF CHECK	EXTENT OF CHECK 2/3 1	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
3.4	Completeness of all previous tests	Completeness	MA	Verification of reports	100%	Tech. Specs / App. Drawings		Completion Certificate	2	1	
3.5	Painting and packing	Dry film thickness, shade, soundness & completeness	MA	Measurement & visual	100%	Customer/BHEL Tech. Spec. / Approved Data sheets		-do-	2	1	Packing procedure as attached
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.										
2	Plates without defect only shall only be accepted.										
	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.										

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Annexure - A

**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 porion below

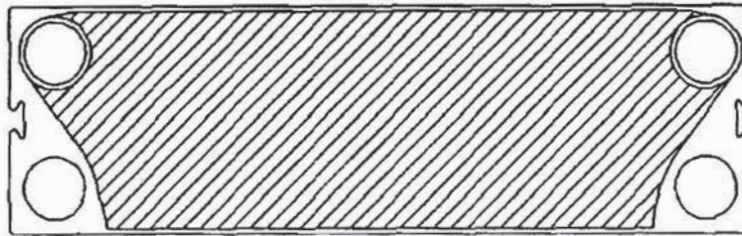


Fig. 1: Wetted Surface Area for Parallel Connection

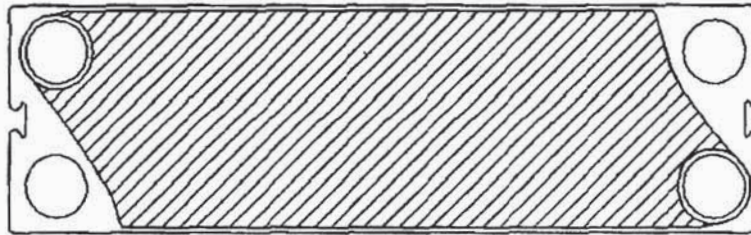


Fig. 2: Wetted Surface Area for Diagonal Connection

PHE PACKING PROCEDURE BEFORE DISPATCH

1. Purpose:

The purpose of this procedure is to outline the requirements and procedures for protecting the equipment's during shipment and preserving during the storage.

2. Preparation for Packing:

- After hydro testing, operation, all fluids e.g. water etc., shall be completely drained from all PHE's, and the equipment blown dry.
- All material shall be cleaned internally and externally to remove, scale, rust fillings and any other foreign material.
- The PHE shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation upto site.

3. Protection of parts:

- Plate Heat Exchangers shall be packed in proper sizes of wooden cases. High grade woods like Rubber woods, jungle wood, hard wood, mango wood, pine wood, etc. is used for packing.
- All finished (or) machined (External C.S. Surfaces shall be protected against corrosion with corrosion resisting coating, which is easily removable (Compound shall be such that it will remain on the surface at temperature normally encountered during shipping & storage).
- All machined surfaces shall be protected from mechanical damage. All external unfinished carbon steel surfaces shall be sand blasted & shall be coated with rust preventive primer.
- Flanged opening if any shall be covered with blank flanges sealed with blank gasket of natural rubber or equivalent. Butt welded opening shall be closed with temporary closing covers. Internal threads shall be protected with metal plug sealed with Teflon tape (if applicable). External thread shall be protected with PVC sleeve.
- Wooden cases shall be covered with HDPE cloth from inside wooden box and the top. All the opening in plate heat exchanger shall be closed properly by suitably covering to prevent foreign material entering in plate heat exchanger.
- Loose material, primary and secondary a shall be packed in corrugated box and plastic bags with proper tagging.
- All fabricated wooden cases & crates conform to the requirement as per table given below:

Gross Weight [Kgs.]	Board Thickness	Batton / Rafter Thickness
2000 to 9000	Min. 30 mm	Min. 35 mm
9000 to 18000	Min. 50 mm	Min. 35 mm

- All the equipment shall be protected for entire period of dispatch, storage and erection against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage. All MS parts which are not painted shall be provided with coating of grease.
- Clay Desiccant or such other moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

4. Special tools and Spare parts:

Special tools and tackles and spares shall be packed separately with adequate identification. Such packages shall be identified as Tools/Commissioning/Operational spares.

5. Preservation

The equipment's shall be stored under closed/open space in packed condition until installation. The packages containing loose plates and gaskets are to be protected from extreme climatic conditions.

