IB THERMAL POWER STATION, BANHARPALI
2x660MW UNIT 3&4

VOLUME –IIB

TECHNICAL SPECIFICATION
FOR
PLATE HEAT EXCHANGERS(PHE)

Specification No. : PE-TS-391-179-N001 (Rev 0)

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

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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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

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, mandatory spares, 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 2 X 660 MW IB VALLEY TPS, BANHARPALI

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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.

SECTION B

PROJECT INFORMATION

VOLUME: IIA

SECTION-III

PROJECT SYNOPSIS AND GENERAL INFORMATION

VOLUME : IIA

SECTION-III

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed Thermal Power Station comprising of 2 x 660 MW base unit size, Super-Critical Units would be set up by Odisha Power Generation Corporation Limited (OPGCL) in the Jharsuguda district of Odisha, India. OPGCL had already installed two units of 210 MW each adjacent to the proposed units under Phase-I of the project at IB Thermal Power Station and the units have been working for the last fifteen years.

Seller has acquainted himself by visiting to the site, with the conditions prevailing at site. The information given here in under is for general guidance and shall not be contractually binding on the Buyer. All relevant site data /information as may be necessary shall have to be obtained/ collected by the Seller.

2.00.00 APPROACH TO SITE

The project site is located at Banaharpalli in the Jharsuguda district of Odisha on the bank of Hirakud Reservoir and about 20 km south of Belpahar railway station and 40 km south west of Jharsuguda. The main Howrah-Mumbai railway line passes 20 km north of the plant (at Belpahar). NH-200 (Chandikhole to Raipur) and SH-10 (Sambalpur to Sundergarh) pass through Jharsuguda town.

OPGCL has a private railway siding connecting the plant to the Indian Railways network at Lajkura Railway station.

Nearest Airport – Bhubaneswar.

Nearest Seaport – Paradeep/ Haldia.

3.00.00 LAND

The total land proposed to be required (around 40 Ha) taking into account the locations of various facilities and plant auxiliaries for units 3 & 4 under IB Thermal Power Station 2 x 660 MW units 3 & 4 and also future 2 x 660 MW will be as per the Plot Plan enclosed in Volume II-L. Land for the proposed units have already been acquired and Power block area is fairly flat land sloping towards South to South -West with contour variation from RL 204.00 M to RL 199.00 M. The Seller shall accommodate equipment offered under this specification generally within the spaces allocated for such equipment in the Plot Plan. Specific approval from Consultant shall be taken by the Seller prior to any revision or relocation.

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4.00.0 SOURCE OF COAL

Coal will be the primary fuel for the proposed project. OPGC has been allotted with two coal blocks (Manoharpur and Dip-side of Manoharpur) in IB valley area with an estimated total reserve of 531.68 Million Metric Tons for captive use of the projects. Manoharpur coal block has been explored fully and has net geological reserves of 181.68 Million Metric Tons and Dip side of Manoharpur (Regionally explored) has geological reserves of 350 Million Metric Tons approximately.

Manoharpur Coal Block is about 45 Km away from Sundargarh Town along Sundargarh – Hemgiri road which passes near the block. It is also connected by black top road with two important towns of Odisha viz. Rourkela (145 Km) and Jharshuguda (75 Km). The nearest Railway station is Hemgiri, lying on the Mumbai – Howrah main line and is about 20 Km away from Manoharpur Block. Coal from the mine to the power plant will be transported by dedicated merry-go-round rail system.

5.00.00 SOURCE OF WATER

Water is drawn from the Hirakud reservoir through a 5.45 Km intake channel. The reservoir has a catchment area of 83.395 sq.km. with a current gross storage capacity of 7189 lakhs m^3. The project too will meet its water requirements from the Hirakud reservoir through the existing intake structure, which is sufficient to cater to the proposed project. The project had taken approval from the Water Resources Department of Odisha to draw 5400 m^3/hr of water from the reservoir, which will cater the requirement of Phase-I (existing 2 x 210 MW) and the proposed units of 2x660 MW.

The Power station will operate on semi open recirculating condenser cooling system using cooling towers. In addition all water conservation and recycling measures will be adopted to minimize requirement of make up water. The proposed project will adopt zero effluent discharge philosophy.

6.00.00 ASH DISPOSAL AREA

Not Used.

7.00.00 METEOROLOGICAL DATA

7.01.00 For the purpose of equipment design, the following Ambient Conditions / Meteorological data of site (Jharsuguda) shall be taken into consideration:-

Site elevation above MSL	:	199.5 M
Highest temp recorded	:	48.0 °C.
Lowest temp recorded	:	4.0 °C.
Monthly max. dry bulb temp	:	38.9 °C/28.0 °C/33.4 °C (Summer/winter/monsoon)

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Monthly min. dry bulb temp	:	25.4 °C/16.7 °C/26.8 °C (Summer/winter/monsoon)
Monthly max. wet bulb temp	:	23.9 °C/17.8 °C/25.5 °C (Summer/winter/monsoon)
Monthly min. wet bulb temp	:	17.6 °C/13.4 °C/25.0 °C (Summer/winter/monsoon)
Maximum Relative Humidity	:	46% / 67% / 87% (Summer/winter/monsoon)
Minimum Relative Humidity	:	21% / 33% / 87% (Summer/winter/monsoon)
Average relative Humidity	:	65%
Average Annual Rainfall	:	1460 mm.
Normal period of rain fall	:	June – September.
Heaviest rainfall in 24 hours	:	257.8 mm
Wind direction	:	South West – North East.
Basic Wind Speed at 10 m Height	:	44 m/sec as per IS:875 Part-3 (1987).
Seismic Zone	:	Zone III as per IS:1893 Part-1 (2002).
Geographical location	:	At Latitude 21° 48' North and Longitude 83° 52' East.

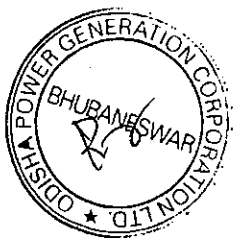

TABLE VI

DESIGN CLARIFIED WATER ANALYSIS

CONSTITUENTS	As	CONTENT
Calcium Hardness	$CaCO_3$	90 ppm
Magnesium Hardness	$CaCO_3$	40 ppm
Sodium and Potassium	$CaCO_3$	42 ppm
Iron in Solution.	Fe	0.2 ppm
Hydrogen (FMA)	$CaCO_3$	ppm
TOTAL CATIONS (Except iron in solution)	$CaCO_3$	172 ppm
Bicarbonate	$CaCO_3$	97 ppm
Carbonate	$CaCO_3$	- ppm
Hydroxide	$CaCO_3$	- ppm
Sulphate	$CaCO_3$	60 ppm
Chloride	$CaCO_3$	15 ppm
Nitrate	$CaCO_3$	- ppm
Fluoride	$CaCO_3$	- ppm
TOTAL ANIONS	$CaCO_3$	172 ppm
M-Alkalinity	$CaCO_3$	97 ppm
P-Alkalinity	$CaCO_3$	ppm
Reactive Silica (Dissolved)	SiO_2	6.0 ppm
Colloidal Silica	SiO_2	9.0 ppm
Total Iron	Fe	0.2 ppm
Conductivity at 25^0 C	-	200 Micro siemens/ cm (maximum)
Carbon-di-oxide	CO_2	
pH value at 25^0 C	-	7.5-8.5
Total Dissolved solids	-	200 ppm
Total Suspended solids	-	ppm (maximum)
Turbidity		10 NTU (maximum)
Oxygen absorbed at 27^0 C for 4 hours		Traces ppm

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PS-MKTG.

TABLE VIII

EXPECTED DM WATER ANALYSIS

1.	Total Electrolyte	:	0.1 ppm, max.
2.	Total SiO_2	:	0.01 ppm SiO_2, max.
3.	Iron as Fe	:	Nil
4.	Free CO_2 ppm as CO_2	:	Nil
5.	Total Hardness	:	Nil
6.	pH value at 25 Deg. C	:	6.8 - 7.2
7.	Conductivity, micro mho/cm	:	Less than 0.1 at 25 Deg. C

SECTION C

SPECIFIC TECHNICAL REQUIREMENTS

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 shall be as under:

Total Ten (10) nos. PHE for 2 X 660 MW IB Valley TPS, Banharpali Viz. 06 nos. for TG i.e.03 nos. [2W + 1S] per Unit and 04 nos. for SG i.e. 02 nos.(1W+1S) per unit

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.

For 2 X 660 MW IB Valley TPS, Banharpali
Total Ten (10) nos . PHE Viz. 3 nos [2W + 1S] per Unit for TG and 2 nos. (1W + 1S) per unit for SG

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.
(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 (including reducer) shall be restricted to 5.5 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. The Plates shall be pressed in Single Operation.

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.

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 testing.

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.
No. of Drawing/documents shall be submitted as follows:-

S.N.	Drawings and documents	Soft and Hard Prints
1.0	DRAWING FOR APPROVAL	
1.1	For approval	Soft+2 Hard Print
1.2	For customer approval	Soft+2 Hard Print
1.3	For final distribution	Soft+2 CD +5 Hard Print
2.0	DRAWING FOR REFERENCE	
2.1	For reference	Soft+2 Hard Print
2.2	For final distribution	Soft+2 CD+5 Hard Print
3.0	CERTIFICATE, REPORTS ETC.	Soft+2 Hard Print
4.0	AS BUILT DRAWINGS (IF REQUIRED)	Soft+2 CD+8 Hard Print
5.0	O&M MANUAL	
5.1	Draft for approval	Soft +3 CD+ 5 Hard Print
5.2	For final distribution	Soft +3 CD + 8 Hard Print
6.0	QUALITY PLAN / Field quality plan / PG test	Soft + 2 Hard Print

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.

9.0 Important Note:-

9.1 Bidder to note that Fragile materials shall be sent in separate proper packing (segregating from heavy items).

9.2 Bidder to submit separate document for handling instructions and shall ensure that packing is to be done in such a way to avoid damage of items mention above in transit and long storage at site and same shall be reviewed in contract stage by BHEL/Customer.

For detail dispatch instruction, please refer Special Conditions of Contract (SCC) for the project

SECTION - D

PLATE HEAT EXCHANGER

STANDARD TECHNICAL SPECIFICATION

DATA SHEET C

STANDARD QUALITY PLAN

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

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.

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

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

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.

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.

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.

	TECHNICAL SPECIFICATION FOR			**Technical specification no**	**PE-TS-391-179-N001 (Rev 0)**
	PLATE HEAT EXCHANGER			**Vol/Section**	**IIB/D**
	DATASHEET - A			**Rev**	**0**
				date	**20.10.2014**
	PROJECT			**2 X 660 MW IB Valley TPS, Banharpali**	
1.0	**General**			TG Aux.	SG Aux.
1.1	**Number of Plate Heat Exchanger**		Nos	Six (6) nos [2W+1S Per Unit]	Four (4) nos [1W+1S Per Unit]
1.2	**Arrangement**			3 x 50% per unit	2 x 100% per unit
1.3	**Location**			Indoor	
1.4	**Primary side (Hot) Fluid**			Passivated DM water (Refer enclosed water analysis)	
1.5	**Secondary side (Cold) fluid**			Cooling Water (Refer enclosed water analysis)	
1.6	**Connecting Pipe size**	(Primary Side)	NB	400	450
		(Secondary Side)	NB	400	450
2.0	**Design**				
2.1	**Design Pressure**		Kg/cm^2 (g)	10	12
2.2	**Operating Pressure**	(Primary Side)	Kg/cm^2 (g)	About 6.2 Kg/sq. cm	About 8.2 Kg/sq. cm
		(Secondary Side)	Kg/cm^2 (g)	About 2.8 Kg/sq. cm	About 2.7 Kg/sq. cm
2.3	**Mechanical Design Temp.**		^oC	60	
2.3	**Heat Transfer per Sq.Mtr. Of Heat Transfer Plate**		$Kcal/Hr./m^2$	8500 (Max.)	
2.4	**Minimum Heat Transfer Area**		Sq. M.	-	
2.5	**Specific Heat of Fluid**	**(Primary Side)**	Cal/gmDeg.C	1.0	
		(Secondary Side)	Cal/gmDeg.C	1.0	
2.6	**Density of Fluid**	**(Primary Side)**	gm/cc	1.0	
		(Secondary Side)	gm/cc	1.0	
3.0	**Guaranteed Performance Requirements for each Heat Exchangers in fouled condition:**				
3.1	**Flow rate**	(DMCW Side)	M^3/hr	1050	1150
		(ACW Side)	M^3/hr	1050	1150
3.2	**Inlet temperature**	(DMCW Side)	^oC	42.54	44.1
		(ACW Side)	^oC	36	36
3.3	**Outlet temp**	(DMCW Side)	^oC	38	38
		(ACW Side)	^oC	44.54	46.1
3.4	*** Allowable pressure drop across heat exchanger from inlet to outlet in fouled conditions at design flow**	(DMCW Side)	MWC	8	
		(ACW Side)	MWC	8	
	*** 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**		%	5%	
5.0	**Heat Transfer Coefficient/Margin**				
5.1	**Overall fouling resistance**	Hr m^2deg C/Kcal		0.00008	
5.2	**Minimum corrosion allowance (refer note 1)**		mm	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	
6.2	**Plate Gasket**			Nitrile Rubber, 65+/- 5 Deg. Shore hardness	

	TECHNICAL SPECIFICATION FOR		Technical specification no	PE-TS-391-179-N001 (Rev 0)
	PLATE HEAT EXCHANGER		Vol/Section	IIB/D
	DATASHEET - A		Rev	0
			date	20.10.2014
	PROJECT		2 X 660 MW IB Valley TPS, Banharpali	
6.3	Compression/ 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 with SS cladding	
6.5	Support Beam/ column		Carbon steel, ASTM A-283 Grade C, Epoxy painted	
6.6	Nozzle		Carbon steel to IS-2062 Gr. B	
6.7	Nozzle flanges		Carbon steel to IS-2062 Gr. B	
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	Tie Bolts & Nuts		IS-1367 Gr 8.8 or equivalent	
6.10	Wetted Fasteners		SS- AISI-316	
6.11	Nozzle flange bolt and nut		SA 193 B7/ SA 194 2H	
6.12	Nozzle flange gasket		3mm wire inserted Red Rubber	
6.13	Name Plate		SS- AISI-316	
6.14	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 shall be subjected to BHEL/Customer approval.	
	b.) Primer		For all the steel surfaces inside the (indoor installation) building, a coat of read oxide primer of minimum thickness of 50 microns followed up with undercoat of synthetic enamel paint of minimum thickness of 50 microns shall be applied. The top coat shall consist of two coats each: of minimum thickness of 50 microns of synthetic enamel paint and thus total thickness shall be minimum 200 microns.	
	c.) Final Paint			
7.0	Extra Carrying capacity to be provided on frame assembly.	%	25	
8.0	Mandatory Spares			
8.1	Plates		5 % of each category and material, size & thickness	
8.2	Valve		10% or minimum 1 No. for each type, size & pressure rating whichever is higher	
8.3	Definitions Regarding %	-	Quantity shall be calculated for % of total population of item in the project (if in fraction, round-off to next higher whole no.)	
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 to be tested by vendor at site to demostrate 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 – 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.**			

[redacted]

STANDARD QUALITY PLAN

SHEET OF

CUSTOMER: PROJECT TITLE:

BIDDER/VENDOR: QUALITY PLAN NO.:

SYSTEM: ITEM: PHE

SPECIFICATION NO. :

SPECIFICATION TITLE :

SECTION :

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

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CHP: CUSTOMER SHALL IDENTIFY IN COLUM "N" AS ' W"

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

Cust. Logo

FOR CUST. USE

DOC. NO.:		REV. CAT-.
REVIEWED BY	APPROVED BY	APPROVAL SEAL

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

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

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1.	2.	3.	4.	5.	6.		7.	8.	9.		** 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	-	

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1.	2.	3.	4.	5.	6.		7.	8.	9.		** 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 INSPESTION**													
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.

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1.	2.	3.	4.	5.	6.		7.	8.	9.		** 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	Packing photograph shall be submitted by vendor along with TCs

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 shell 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.

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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

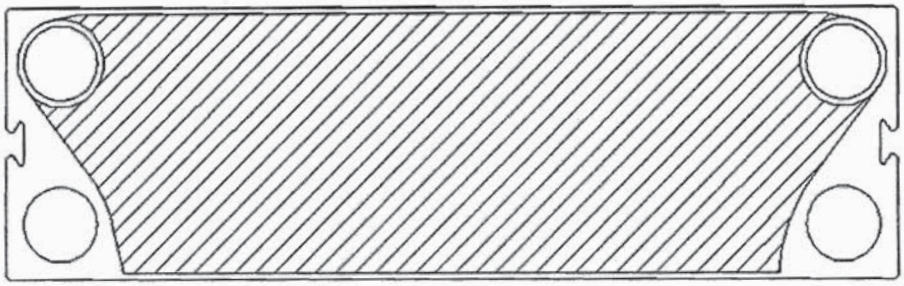

Fig. 1: Wetted Surface Area for Parallel Connection

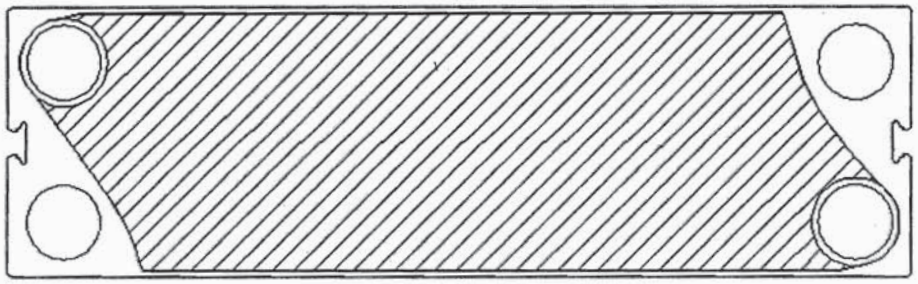

Fig. 2: Wetted Surface Area for Diagonal Connection

IB THERMAL POWER STATION, BANHARPALI
2x660MW UNIT 3&4

VOLUME –III

TECHNICAL SPECIFICATION
FOR
PLATE HEAT EXCHANGERS(PHE)

Specification No. : PE-TS-391-179-N001 (Rev 0)

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

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

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	THERMAL SIZING CALCULATION
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)
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.
B 3	AREA & HEAT LOAD CALCULATIONS
B 4	PERFORMANCE CURVES
B 5	QUALITY PLAN
B 6	SCHEDULES AS PER ENCLOSED LIST

DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER

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.

FORM NO PEM 6036-1

	TITLE *** SCHEDULE OF DEVIATIONS** ( ) From Conditions of Contract (Volume – 1) ( ) From General Technical Conditions (Volume – II A) ( ) From Technical Specifications (Volume –II B)	SPECIFICATION NO VOL III SHEET…….. OF……

We the undersigned hereby certify that the above mentioned are the only deviations.

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

	SCHEDULE OF PERFORMANCE GUARANTEES		SPECIFICATION NO.	PE-TS-391-179-N001
	PLATE HEAT EXCHANGER		Vol.	III
SL. NO.	**DESCRIPTION**	**UNIT**	**GUARANTEE VALUE**	
			Project Name 2 X 660MW IB VALLEY TPS, BANHARPALI	
			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	^oC		
c)	DMCW outlet temperature	^oC		
d)	Pressure drop	MWC		
2.0	**SECONDARY SIDE (COLD WATER SIDE)**			
	CLEAN CONDITION			
a)	Flow rate	M^3/Hr.		
b)	ACW inlet temperature	^oC		
c)	ACW outlet temperature	^oC		
d)	Pressure drop	MWC		
3.0	**PRIMARY SIDE (HOT WATER SIDE)**			
	FOULED CONDITION			
a)	Flow rate	M^3/Hr.		
b)	DMCW inlet temperature	^oC		
c)	DMCW outlet temperature	^oC		
d)	Pressure drop	MWC		
4.0	**SECONDARY SIDE (COLD WATER SIDE)**			
	FOULED CONDITION			
a)	Flow rate	M^3/Hr.		
b)	ACW inlet temperature	^oC		
c)	ACW outlet temperature	^oC		
d)	Pressure drop	MWC		

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME

SIGNATURE

DATE

FORM NO PEM 6040-1

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

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

DECLARATION

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

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

Bidders Company Name …….

Authorized representative's Signature ……..

Name …….

Bidder's 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				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI

DATA SHEET-B

FOR PHE'S

(TO BE FILLED UP DURING CONTRACT STAGE SEPARATELY)

	Title **DATA SHEET - B**	SPECIFICATION NO. PE-TS-391-179-N001
BHEL	**PLATE HEAT EXCHANGER**	VOLUME **III** PART **A**
		SHEET 1 OF 7

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-391-179-N001, Section - D, Volume - IIB.
2. 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	^oC		
2.3	Heat Load(without LMTD correction)	KW		
2.4	Heat Load(with LMTD correction)	KW		
2.5	LMTD (Corrected)	^oC		
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	^oC		
3.3	Outlet temperature	^oC		
	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-391-179-N001
BHEL	**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-391-179-N001, Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS	
4.0	**Heat Transfer & Fluid flow data**		**Primary Side (Hot Fluid)**	**Secondary Side (Cold Fluid)**
4.1	Film heat transfer co-efficient	KCal/hrM^2 ^{o}C		
4.2	Fouling factor	M^{2}hr ^{o}C/KCal		
4.3	Overall fouling	M^2 hr^{o}C/KCal		
4.4	Overall heat transfer coefficient	KCal/hrM^2 ^{o}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 :					

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-391-179-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 a) As per 5.5 above b) As per 5.6 above	mm	
	Maximum plate pack length a) As per 5.5 above b) As per 5.6 above	mm	
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		

	Title **DATA SHEET - B**	**SPECIFICATION NO.** PE-TS-391-179-N001
BHEL	**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-391-179-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 :					

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-391-179-N001, Section - D, Volume - IIB.
2. 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 :					

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-391-179-N001, Section - D, Volume - IIB.
2. 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	bar (g)	
	b) Test duration	min.	
19.3	Are all plates checked for cracks and other defects by the penetration method?		YES/NO
	If not, what percentage is checked?		
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 :					

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PE-TS-391-179-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 :					

FORM No. PEM - 6020-2

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.			

FORM NO PEM 6024-1

	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	COMPANY SEAL

FORM NO PEM 6026-1

	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)

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.

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

FORM NO PEM 6027-1

	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

FORM NO PEM 6030-1

BHEL	**INSPECTION SCHEDULE**	SPECIFICATION NO VOL III SHEET…….. OF……

S No.	ITEM/COMPONENT	PLACE & ADDRESSOF TEST / INSPECTION	SCHEDULE D DATE OF INSPECTION	DURATION OF TEST / INSPECTION (IN DAYS)

This schedule shall be in the line with specification and quality plan requirements. The information in this form shall be furnished after receipt of LOI/PO.

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

FORM No. PEM - 6056-0

	TITLE	SPECIFICATION NUMBER
BHEL	SCHEDULE OF BIDDER's MAN POWER FOR SUPERVISION OF E & C AND THEIR CHARGES	VOLUME III
		SHEET ..... OF .....

The bidder shal indicate below, designation-wise, the personnel required for superivsion 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

FORM NO PEM 6055-1

BHEL	**TITLE** *** SCHEDULE OF PRICE FOR ERECTION AND MAINTENANCE TOOLS & TACKLES**	SPECIFICATION NO VOL III SHEET…….. OF……

The bidder shall be given below the list of erection and maintenance tools and tackles as offered by him. This shall also include the customer's list of maintenance tools, if specified in Section – C / Section - D

S. No	DESCRIPTION OF TOOLS & TACKLES	QUANTITY OFFERED	UNIT PRICE (Rs.)	TOTAL PRICE (Rs.)

NOTE : The hire charges for vendors equipment called for in this schedule shall include the cost of consumables, operation services, descriptions, wear and tear as well as vendor's over head and profit (These rates will be payable by customer to the vendor, only if the customer's requires the use of this equipment for carrying out his own work out side the scope of this contract).

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

FORM NO PEM 6054-1

BHEL	***SCHEDULE OF PRICES FOR RECOMMENDED SPARES**	SPECIFICATION NO VOL III SHEET…….. OF……

***Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid**

The bidder shall give below a list of spares recommended for three years (or as otherwise specified in section – C) for trouble free performance of the equipment / system offered.

S. No.	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.)

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

FORM NO PEM 6053-1

BHEL	***SCHEDULE OF PRICES FOR COMMISSIONING AND MANDATORY SPARES**	SPECIFICATION NO VOL III SHEET…….. OF……

***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.

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	SPECIFICAION NUMBER
		BIDDER/ VENDOR	QUALITY PLAN NUMBER	PACKAGE : PLATE HEAT EXCHANGER
	SHEET OF	SYSTEM	ITEM	SECTION VOLUME III

S. No.	COMPONENT / OPERATION	CHARACTE-RISTIC 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	
	NAME		
	SIGNATURE		
	DATE		BIDDER/VENDOR COMPANY SEAL

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 shets, 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 as 1,2 & 3

'1' stands for (BHEL)
'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 11- 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 bgy BHEL and all tests as per relevent 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 presserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless other wise 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 BHELs 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 appropreate 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).