

**BHARAT HEAVY ELECTRICALS LIMITED UNIT: BHOPAL
HYDRO TURBINE ENGINEERING DIVISION**

ANNEXURE-A (Rev-00)
PI No.: 340235518

**PURCHASE SPECIFICATION FOR PLATE TYPE HEAT EXCHANGER FOR
COOLING WATER SUPPLY SYSTEM
PROJECT : KAMENG (4 X 150 MW) HEP**

1.0 Application & Design Requirements

The Plate type heat exchanger shall be used in the cooling water system of Kameng HEP. The cooled media shall be the hot water of secondary cooling water circuit (closed loop) and the cooling media shall be the river water circulating in the primary (raw water) circuit after passing through strainer. **All material in contact with the water throughout the construction shall be of silt resistant & corrosion resistant Stainless Steel.**

Each heat exchanger shall consist basically of a frame in which independent metal plates supported by the rails are clamped between a head & follower. Plates shall be sealed at their outer edges and around the ports by the gaskets so arranged that the primary and secondary water streams to be directed alternatively into the multiple parallel passes found between the plates. The inlet port shall be arranged in groups or in passes, each water streams being distributed among the parallel passes duty shall be provided in series by suitable positioning of un-pierced ports at the end of each pass. Closely spaced plates shall be through or corrugated to produce high turbulence in the water when flowing in this system between the plates and suitable design to handle muddy river water with minimum fouling of the heat transfer surfaces. The gap between plates shall be sufficient to handle the water with suspended particles. The velocity of water in the heat exchanger shall be selected so as to prevent sedimentation of silt and / or erosion due to silt in the heat exchangers.

The frame of heat exchanger shall be of suitable size to accommodate some additional quantity of plates.

The heat exchanger shall be equipped with a thermometer & a pressure gauge in each inlet and outlet. The heat exchanger shall also be provided with drain and air vent valves duly installed on inlet and outlet on both sides. Plate type heat exchanger shall be capable of transferring all heat gained during the circulation in clean water closed loop system to raw water in open circuit.



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Heat Exchanger shall be designed for the following design Data.

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|---|---|
| 1) No. of Heat exchangers required | 6 Nos. |
| 2) <u>Secondary Water Circuit</u> | |
| Flow Rate | 15000 lpm |
| Inlet Temp. of hot water | 35 °C |
| Outlet Temp. of hot water | 30 °C |
| Water filtration quality | 100μ |
| 3) <u>Primary (Raw) Water Circuit</u> | |
| Flow Rate | 15000 lpm |
| Inlet Temp. of raw water | 20°C |
| Outlet Temp. of raw water | 25 °C |
| Water filtration quality | 1000μ |
| 4) Maximum pr. Drop across the HE
both the side | less than 1 kg/cm ² at specified
flow rate |
| 5) Material / Thickness of Plate | .5mm S.S. sheet to AISI 316 |
| 6) Working Pressure | 10.0 kg/cm ² |
| 7) Design Pressure | 15.0 kg/cm ² |
| 8) Test Pressure | 22.5 kg/cm ² |
| 9) Centre to Centre distance
between connections (Vertical) | To be informed by vendor |
| 10) Centre to Centre distance
between connections (Horizontal) | To be informed by vendor |
| 11) Minimum Gap between the plates | To be confirmed by vendor |
| 12) Minimum heat transfer area | To be informed by vendor |
| 13) End Connection (Inlet / Outlet) | 300 NB (To be supplied with
companion flanges, hardware & seals) |
| 14) Connection Standard | Drilled as per ANSI B16.5 Class 150 |

** If the suction / delivery size are other than above than suitable concentric expander / concentric reducer to be provided. The divergence angle (included angle) of the concentric expander should not be greater than 6 degrees. Material of expander / reducer should be as per ASTM A 234 Gr.-WPB (Seamless), wall thickness to Schedule-40.*



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2.0 General Construction Features

- i) The Heat Exchanger shall be designed for the flow defined above with minimum head loss. All material in contact with water throughout the construction shall be of corrosion resistant Stainless Steel.
- ii) The Heat exchanger shall be complete with all plates and sealing elements (NBR) properly fitted to ensure its leak-proofness during operation. It shall be intermediate wide gap type design for minimum pressure drop in the flowing liquid and complete utilization of the plate area.
- iii) Differential pressure switches between inlet & outlet on both sides (Hot water & Raw water) of heat exchanger with visual indication and potential free contacts for alarm purpose shall be installed.

iv) Material of Heat Exchanger

- a. Main body - structural steel fabricated with S.S. lined Inlet & Outlet connections
- b. Plate element - Stainless steel to AISI 316
- c. Frame Plate & other supporting structure - Structural steel
- d. I-section carrying bar and guiding bar - Stainless steel
- e. Sealing Element - Nitrile Butadiene Rubber (NBR)
- f. All hardwares including Anchor fasteners for foundation (included in the scope of supply) shall also be of Stainless Steel

The supplier along with offer shall furnish list of material of major components

- v) Overall space requirement of the heat exchanger should not be more than 2.5 m (length) x 1 m (width) x 2 m (Height) (approx).
- vi) Hydraulic pressure testing of the heat exchanger shall be carried out at 1.5 times of the design pressure at supplier's works.



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3.0 Inspection & Testing

Following test shall be conducted on all the heat exchangers & test certificates shall be furnished accordingly.

- i) Chemical and Mechanical Tests for material of major components and hardware.
- ii) Hydraulic pressure Test of all the Heat Exchanger at specified test pressure for duration of minimum 30 minutes.
- iii) Dimensional Inspection.

Final inspection and testing shall be carried out in presence of BHEL Bhopal and Customer's representatives at supplier's works before dispatch.

4.0 Set of Spares : The supplier shall quote for spare as follows

Sl. No.	Description	Qty
1	Plate	10 Nos.
2	Plate Sealing (Gasket)	20 Nos.

*Price for spares shall be quoted separately item wise.

5.0 Paint and Protection

Heat Exchanger shall be thoroughly cleaned, shot / sand blasted and painted as follows:

- i) Internal surfaces as per supplier's standard.
- ii) External surfaces (Open to atmosphere) shall be given two coats of epoxide priming paint followed by two coats of epoxide finishing paint (Shade: Mint Green, RAL 6029).
- iii) All other un-painted & machined surfaces shall be given liberal coat of temporary rust preventive (TRP). TRP shall be easily removable at site.

6.0 Packing

The Heat Exchanger shall be suitably packed for long storage and to avoid damage during transit.

The items shall be packed & covered with polyethylene sheet and dispatched in suitable wooden cases.



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All instruments & fittings after proving with heat exchanger shall be packed separately in thermocol covered with polyethylene sheet and silica gel placed in and packed in a carton / case with adequate cushioning material to avoid damage during transit.

7.0 Guarantee Clause

The equipment shall be guaranteed for trouble free operation and good workmanship for a period of 24 months from the date of dispatch or 18 months from the date of commissioning of equipment whichever is earlier. The supplier shall under take to replace all the items free of cost if found defective during the guarantee period.

8.0 Details & Documents to be furnished

a) Along with offer

- i. List of deviations (if any)
If the supplier is unable to fulfill all the requirements mentioned in our purchase specification then a list of deviations is to be prepared by the supplier & the same should be submitted to us along with quotation. Otherwise it will be understood that the supplier is meeting all the requirements specified by us.
- ii. Overall heat transfer co-efficient ($\text{kcal/hr-m}^2\text{ }^\circ\text{C}$)
 - a) Clean
 - b) With expected fouling
 - c) Design fouling
- iii. Drawings and catalogue of Heat Exchanger showing overall dimensions and weight of the equipment.
- iv. Sectional assembly drawing indicating internal details, material of components and bill of material.
- v. A curve showing pressure drops v/s discharge through Heat Exchanger.
- vi. Loads on foundation and mounting details.
- vii. Suction and delivery connection details.
- viii. Technical particulars.
- ix. Q.A. Plan.



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b) After Placement of order

Following information / documents / drawings shall be submitted immediately after placement of order

- i) 3 copies of drawings / catalogue showing overall dimension of the equipment.
- ii) 3 copies of sectional assy. indicating internal details, material of components & Bill of Material for approval.
- iii) 3 Copies of Loads on Foundation & Mounting details.
- iv) Q.A. Plan for approval.
- v) Inspection & Testing Procedure

c) Supplier shall furnish the following documents to BHEL prior to dispatch of the equipment.

- i) 10 copies of operating & maintenance manual with catalogues / drawing.
- ii) 7 copies of Test Certificates & Inspection Reports.
- iii) 10 copies of all drawing mentioned above.
- iv) In addition to above, all drawings, O&M Manual and other important documents shall also be supplied in CD. The drawing shall be prepared in Auto-Cad Version 2010.
- v) One reproducible / original of each drawing.

d) At the time of dispatch of consignment, shipping list is to be prepared & furnished by the supplier as follows:

- i. To purchaser (BHEL) - 5 copies
- ii. Inside each package - 1 copy

Note: Shipping List shall contain the following information for each package.

- i) List of items contained in that case giving drawing / catalogue no., item no. of BOM, description of item & Quantity.
- ii) Case No. dimension of case, gross weight of case & net weight of the item.
- iii) All items shall be dispatched in suitable wooden boxes.



Handwritten:
05/03/14
Pantapendra 14/04/14
(Sr. Engr / HTE)