Bharat Heavy Electricals Limited, Trichirapalli – 620 014

MM : CAPITAL PURCHASE

(To be filled and submitted along with offer)

BHEL Commercial Terms and Conditions for **Indigenous Supplies**	Vendor's Confirmation / Comments
Technical confirmation to BHEL's Specification as called for in BHEL Format shall be furnished. If needed additional sheets shall be used.	
Prices shall be **quoted item wise** only as per the model format enclosed.	
Prices shall be quoted on **"FIRM PRICE"** basis only. The prices should by only on **F.O.R / Despatching station** basis inclusive of **Packing & Forwarding** charges if any. **Applicable % of ED & Sales Tax , Freight & Insurance, Installation & Commissioning Charges should be clearly indicated.**	
Validity of offer shall be for a minimum period of 120 days from the date of Tender opening	
Delivery period from the date of Letter of Intent / Purchase order shall be clearly mentioned in the offer.	
Liquidated damages @ ½% per week subject to a maximum of 15% of the order value shall be applicable for delay in deliveries.	
Following Risk Purchase clause shall be applicable: The purchaser at his option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or dispatch within the time stipulated or if the same were not available, the best and the nearest available substitute therefore. The supplier shall be liable for any loss which the Purchaser may sustain by reason of such risk purchases.	
Submission of Performance Bank Guarantee (PBG): Vendor should provide a performance bank guarantee(PBG) for 10% of the total Purchase order value valid for a period of 12 months from the date of commissioning (or) 18 months from the date of dispatch whichever is later with an additional claim period of 2 months. This PBG shall form one of the documents for effecting payment. The PBG shall be submitted in non-judicial stamp paper value of not less than Rs.80/- issued by any one of the following banks who is a member bank in our consortium of banks. **1) State Bank of India, 2) State Bank of Hyderabad, 3) State Bank of Travancore, 4) State Bank of Mysore, 5) Canara bank, 6) Bank of Baroda, 7) Punjab National bank, 8) Deutsche Bank, 9) HDFC Bank, 10) Standard Chartered Bank, 11) Citi Bank, 12) Standard Chartered Grindlays Bank 13) Bank of America and 14) Any one of the Nationalised banks.**	
Payment terms for supply portion: • **100%** payment will be made within 45 to 90 days after receipt and acceptance / commissioning of goods at BHEL. against submission of PBG for 10% of Order value with required validity. **(or)** * **80%** value of the goods will be paid within 45 to 90 days against dispatch documents negotiated through bank. Balance 20% will be paid within 45 to 90 days from the date of acceptance / commissioning of goods against submission of supplementary invoice and also against submission of PBG for 10% of Order value with required validity. **All bank charges are to vendor's account only.**	
Erection / commissioning: Erection / commissioning shall be done at free of cost.	
The equipment shall be guaranteed for a period of 12 months from the date of commissioning.	
Equipment will be inspected and proved at vendor's works prior to dispatch. However final inspection and acceptance of equipment will be after installation at BHEL,Trichy.	
The vendor shall provide necessary drawings,Test Certificates and Operating Maintenance Manuals etc., as called for in the Technical Specification, in the required number of copies at no extra cost.	
Any warranty replacement during warranty period shall be supplied free of charge on FOR BHEL, Trichy basis.	
Offers should be submitted only in **sealed cover super-scribing clearly the Enquiry reference and due date.**	

NOTE:-

a) **It is confirmed that all the terms and conditions stipulated in the Enquiry have been fully understood by us and all clarifications & details have been obtained.**

b) **Your offer should be indicating applicable if any P&F Charges, % of ED, Sales Tax -CST or VAT, Service Tax), Freight, Insurance and Installation and Commissioning Charges etc., as per our Price Format.**

c) **Your specific acceptance to our Payment terms, LD, Risk Purchase Clause & Submission of PBG for 10% of the order value are essential for consideration of your offer. Other wise your offer is liable for rejection.**

Signature & Office Seal of the vendor

BHEL ENQUIRY NO & DATE

VNDOR OFFER REF NO & DTAE

MODEL PRICE BID FORMAT FOR INDIGENOUS VENDORS

S.No.	Description of Item	Unit	Qty	Rate	Value

Ex-work Value :

Packing & Forwarding Charges, If any :

FOR /Dispatching Station value Rs. :

% Of Excise Duty (extra or inclusive) :

% Of TAX (TNGST with FORM-17 or CST with C-FORM)

% Of TAX (TNGST without FORM-17 or CST with C-FORM) :

% Of Any other Tax applicable other than the above :

Approximate Freight charges Rs. :

Approximate Transit Insurance charges Rs. :

Approximate Gross Weight, Net. Weight & Dimensions of the Consignment :

Signature & Seal of Vendor

NOTE: The Price bid should submitted strictly in line with the above FORMAT.

CAPITAL PURCHASE

COMMERCIAL TERMS AND CONDITIONS

1.0 QUOTATIONS

The Bidders shall submit the offer in **TWO INNER ENVELOPES** as indicated below which shall be sealed in one outer envelope.

Envelope I This sealed envelope should contain all the copies of technical bid together with un-priced commercial bid. This envelope should be clearly marked **"Part I - Technical and commercial bid"**, indicating Enquiry No., Due Date and Address & Reference of the Bidder.

Envelope II This sealed envelope should contain **price details**. This envelope should be clearly marked **"Part II - Price bid"**, indicating Enquiry No., Due Date and Address & Reference of the Bidder.

Both the envelopes (Part I & II) shall be put in one cover, duly sealed, superscribing as Part I and Part II of Enquiry No., due date of opening and the address and reference of the Bidder.

The above offer should reach this office on or before the due date by 14.00 Hrs (IST). Late offers will not be considered.

Tender should not be addressed to any Individual's name but only by designation to:

SENIOR MANAGER / CAPITAL PURCHASE / MM / FB
BHARAT HEAVY ELECTRICALS LIMITED
HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620 014
TAMIL NADU, INDIA

Tenders should be free from **CORRECTION AND ERASURES,** Corrections if any, must be attested. All amount shall be indicated both in words as well as in figures. Where there is difference between amount quoted in words and figures, amount quoted in words shall prevail.

Offers should be in **ENGLISH** and accompanied by detailed technical literature, catalogue and detailed dimensional drawings in **ENGLISH** or otherwise, the offers will not be considered.

2.0 PART I (TECHNICAL & COMMERCIAL BID)

2.1 Technical

This part shall include / indicate the following :

2.1.1. Offer should contain complete scope of supply with all technical details, specifications, delivery and other commercial terms and conditions.
2.1.2. Point by point confirmation for the Technical Specification enclosed to be provided. if there are any deviation, the same should be clearly specified. Offers received without confirmation to our specification will be rejected.
2.1.3. List of customers to whom same or similar equipment have been supplied along with performance certificates to be enclosed.
2.1.4. Relevant catalogues to be attached
2.1.5. List of spares parts (with part numbers) for two years operation and maintenance should be attached.
2.1.6. Information on shipping weight and cubage (length, width & height) to be provided.
2.1.7. Incase of foreign bidder offer, the Principal's technical offer should be enclosed.

2.2 Commercial

This part shall include / indicate the following :

2.2.1. Port of shipment / Station of despatch
2.2.2. Terms of payment
2.2.3. Taxes & duties applicable.
2.2.4. Delivery Schedule
2.2.5. Offer validity
2.2.6. Country of origin

2.2.7. Percentage of agency commission if any along with a copy of Agency agreement.
2.2.8. A copy of "Un-Priced Part II" i.e., a copy of the Price Bid **without the price details** to be enclosed.

3.0 PART II (PRICE- BID)

This part should contain the schedule of price particulars and to be co-related to the technical details provided in Part I.

4.0 OPENING OF TENDERS

The Part I - Technical & commercial bid alone would be opened on the Tender opening date.
The Part II - Price bid of Technically suitable Bidders alone would be opened. The Technically suitable Bidders would be informed about the tender opening date.
Clarifications if any required by BHEL for Technical evaluation would be sought from Bidders before opening of Part II - price bid.

5.0 GENERAL

5.1. Incomplete offers will not be considered.
5.2. **Fixed price:** Prices quoted by the bidder shall be fixed and not subject to any escalation whatsoever during the period of bid validity and execution of the Purchase Order. A bid submitted with an adjustable price will be treated as non - responsive and rejected. Prices shall be written in words and figures. In the event of difference, the price in words shall be valid and binding. Unit prices shall be considered correct in the event of any discrepancy with regard to total price.
5.3. **Bid currency:** Indian bidders should submit the prices only in Indian Rupees. Foreign bidders may submit their bid in their home currency.
5.4. **Terms of Delivery:** Bidders are required to quote their best delivery period. Foreign Bidders should submit their offer for net **FOB Nearest Sea / Air Port.** Indian Bidders should submit their offer for **FOR Despatching station.**
5.5. **Taxes and Duties :** All Taxes and Duties payable as extra to the quoted price should be specifically stated in offers along with CST & VAT / Tariff No. etc., failing which the purchaser will not be liable for payment of such Taxes and Duties.
5.6. **Validity :** The offers for main equipment and spares shall be kept open for acceptance for **120 days (one hundred and twenty days)** from the date of opening of the tender (Part I).
5.7. **Terms of Payment :**
5.7.1. **Indian Bidders**
5.7.1.1. The preferred payment terms are indicated below :
5.7.1.2. 100% payment, within 45 to 90 days, after receipt / acceptance / commissioning of equipment at BHEL, Tiruchi, against 10% Performance Bank Guarantee on total order value.
or
5.7.1.3. 80% payment against documents through bank within 45 to 90 days, (after pre-despatch inspection) and balance 20% payment after receipt / acceptance / commissioning of the equipment against 10% Performance Bank Guarantee on total order value.
5.7.2. **Foreign Bidders**
An Irrevocable Letter of Credit shall be established for 80% of the value of the goods. Balance 20% shall be paid on receipt / acceptance / commissioning of the goods at BHEL against 10% Performance Bank Guarantee on total order value. All bank charges outside India are to Vendor's account.
5.8. **Performance Bank Guarantee (PBG):** The Bidder, in the event of an order, should furnish a bank Guarantee from an Indian Bank approved by BHEL, at no extra cost in a proforma prescribed by BHEL, alongwith the order, for an amount equivalent to **10% (Ten percent)** of the value of the contract. The PBG shall be valid for period of 18 months from the date of despatch or **12 months** from the date of receipt / acceptance / commissioning of the equipment at BHEL, Tiruchi which ever is more, with a claim period of two months.

The Performance Bank Guarantee shall be obtained from any one of the following banks who is a member bank in our consortium of banks.

State Bank of India, 2) State Bank of Hyderabad, 3) State Bank of Travancore, 4) State Bank of Mysore, 5) Canara Bank, 6) Bank of Baroda, 7) Punjab National Bank, 8) Deutsche Bank, 9) HDFC Bank, 10) Standard Chartered Bank, 11) Citi Bank, 12) Standard Chartered Grindlays Bank, & 13) Bank of America or any other Nationalised Bank.

5.9. **Liquidated damages** : It is clearly understood among the parties to the contract the **" Time is the essence of the contract ".** Therefore, the delivery of the goods specified in the purchase order should be made within the time prescribed. Where the seller supplies or despatches the goods, beyond the delivery period specified the purchaser will have no obligation to accept the goods. If accepted liquidated damages at the rate of 1/2% of the value of goods delayed for each week of delay subject to a maximum of 15% of the order value will be levied.

5.10. **Risk purchase** : Alternatively the purchaser at his option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or despatch within the time stipulated as aforesaid or if the same were not available, the best and the nearest available substitute therefor. The supplier shall be liable for any loss which the Purchaser may sustain by reason of such risk purchases.

5.11. **Agency commission :** In case of Foreign Bidders, agency commission if any, payable to their Indian Agents, shall shown separately in the Offer. This will be paid by us in India, in Indian Rupees, on satisfactory completion of the Contract. Copies of current Agency Agreement / Authorization Letter in respect of Agency Commission shall be furnished alongwith offer. For calculation of Rupee equivalent of Agency Commission, exchange rate as prevailing on the date of offer will be taken.

5.12. **Test certificates / Operating and Maintenance manuals :** The Bidders shall clearly mention in their offer, that Test Certificates and Operating Maintenance Manuals, etc., as called for in the Technical Specification, in the required number of copies will be provided at no extra cost.

5.13. **Modvat credit** : (for Indian Bidders only) If any Excise Duty is payable, the chapter head / sub-head reference and the rate of the duty should be quoted. If the tender is availing **MODVAT** credit for his input materials, the effect of proforma credit should be passed on to the purchaser.

5.14. **Packing and marking :** The Supplier shall arrange for securely protecting and packing the stores to avoid loss or damages during transit.

5.15. BHEL shall be at liberty to reject or accept any tender, part or in full, at their own discretion and any such action is not liable for any question or claim against BHEL.

For any queries / clarifications the bidders may contact us through our FAX NO. +91 431 2520719 or through e-mail sdharma@bheltry.co.in(or)gvijay@bheltry.co.in

BHEL / Tiruchy
Materials Management /Mfg

Ref:MM/MFG/SDC
Date: 19.11.2007

Dear Sir.

Sub: Payment through Electronic transfer.

With the advent of electronic mode of funds transfer for effecting payments, we have been advising all our vendors to switch over to e-payment mode and reap the benefits of 'E"-Payment.

The E-payment mode facilitates momentary transfer of credit to your account through electronic means from BHEL's bank account. The payment time is reduced by 2-15 days as compared to the conventional mode of cheque payment.

Recently the Central Vigilence Commission, a governing body under Govt. of India has advised BHEL that all the payments to our vendors should be made only through E - payment mode in future and cheque payments should be dispensed with. In line with this directive, we shall suspend payment by cheque and switch over to E payment mode to all the vendors with immediate effect. BHEL shall not be held responsible for any delay in payment on account of the above reason.

Further all our fresh enquiries will indicate that E payment mode is the only mode of payment and in case the same is not confirmed/complied, your offer is likely to be rejected.

Hence we request you to fill up the format attached and get it endorsed by your banker and submit to us as quickly as possible to enable us to make payments to you through 'E' payment mode.

We solicit your kind understanding and cooperation in this regard.

BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI – 620 014

FORMAT TO RECEIVE e - PAYMENT THROUGH EXISTING ACCOUNT WITH NEFT / SEFT / RTGS ENABLED BANK BRANCH

Sub : E - Payment vide NEFT / SEFT / RTGS - Reg.

SL. NO.	DETAIL	TO BE FILLED BY VENDOR
1	VENDOR CODE AS PER BHEL RECORDS	
2	VENDOR NAME AS PER BANK RECORDS	
3	ACCOUNT TYPE	
4	BANK ACCOUNT NUMBER	
5	NAME & ADDRESS OF THE BANK	
6	BRANCH CODE	
7	BRANCH RTGS CODE	
8	BRANCH MICR CODE	
9	NAME OF THE AUTHORISED SIGNATORY	

I / we confirm that I / We will bear the charges, if any levied by my / our bank for the credit of SEFT / RTGS amounts in our account.

For.....

SIGNATURE
(Authorized signatory)

We confirm that we are enabled for receiving NEFT / SEFT / RTGS credits and we further confirm that the account number, the signature of the authorized signatory, branch code, RTGS code and MICR code of our branch mentioned above are correct.

BANK VERIFICATION
(Manager's / Officer's signature under bank stamp)

GENERAL NOTE

1. We need two 2 no of stands, one for the primary side and another for the secondary side of the equipment. Scope of supply shall include: Design review, procurement of materials, manufacture, inspection, testing dispatch, integrating the stand at BHEL's work, erection and commissioning, trial runs, performance testing, spares required during these operations and handing over.

2. Since the scope of work for the vendor includes trial runs and performance testing of the systems at our works after installation, payment stages may be suitably tied up with this critical activity, which will be the basis for acceptance.

3. Suppliers may be asked to indicate separate delivery schedules as below

   - For the dispatch of components and sub assemblies from their works
   - Receipt of materials at our works, erection, commissioning, trial runs for performance testing and handing over.

4. The filter specification calls for a custom built design. So, some of the system suppliers may have difficulties in procuring the same, in which case we can procure the filters alone separately and supply to the vendors as Free Issue Material. Hence alternative offers for supply of the total stand without filters alone may also be obtained. How ever, erection of the filters to integrate them with the stand must be included in vendors scope.

5. Suppliers must furnished the list of recommended spares for pumps, valves, filters and instruments and any other item required for the system for 5 years operation along with unit wise price which we will order together with main PO.

6. Additionally, vendors are requested to indicate unit prices for the following items which we may order subsequently as spares;

   a) Total filter assembly
   b) Only filter element (basket) assembly
   c) Filter assembly without basket assembly

Specification for Flushing Stand –Primary side

1. Purpose :

This flushing stand is required to create hot flushing water (DM water) circulation for final cleaning of internals of an equipment (SG) and shall ensure:

1. Continuous circulation of hot DM water at around 90 °C temperature and at 400 Tons/hr flow rate with reversal of flow direction through the equipment being flushed for sufficiently long durations till cleanliness acceptance criteria is met.
2. Provision for checking of flushing water flow rate and temperature at the outlet of the equipment during flushing.
3. Retention of mechanical particles, corrosion products and other contamination
4. Provision for periodically checking the cleanliness of filters at the outlet of the equipment.
5. Flushing water sampling for checking of pH, chloride ion concentration, mass concentration of dense residue and salt content at the inlet and outlet of the equipment.
6. Conformance to the cleanliness requirement as per clause 9.0
7. Complete venting and draining of the system. Drain and vent points at different locations in the loop may be required to ensure this.
8. Adequate safety and interlocking features for safe operation shall be provided.
9. Provision for pressure drop measurement across the equipment

The flushing stand before being connected to the equipment shall undergo hot flushing in the same manner as the equipment, using flushing water of the same specification and meeting the same acceptance criteria for cleanliness. Cleanliness and preservation of all elements of the flushing system at the components stage and after final assembly therefore needs to be checked and ensured by the supplier as per approved Quality Assurance Plan

2. Scope of Supply / Work

- Design review and validation of the system for meeting the performance parameters.

- Preparation and submission of Lay out drawing in 3D in line with the schematic drawing with minor modifications (if required) limiting the overall dimension to approximately to 4.0 M x 4.0 M x 4.0 M.. Lay out shall ensure that the strainers are located above the water level in the storage tank so that complete draining of water from the bucket is not required during basket replacement.
- Supply of the complete system as per Scheme drawing No. SK-3-D040-003 mounted on a suitable skid which shall include all the items indicated in the Scheme and Specification as well as such of those items which may be required to ensure satisfactory performance of the system.
- Supply of loose pipes, ONE number each of sizes 200 NB, 150 NB dia, and 3 meters length along with a set of matching counter flanges (WNRF), gaskets and fasteners.
- Supply of suitable bridge piece with end flanges, fasteners and gaskets for connecting the inlet and outlet of the system so that the system by itself forms a closed circuit and thereby isolating the equipment..
- Filters with higher mesh sizes will be used during start up cycles. For this purpose 4 nos filtering elements of mesh size 300 microns shall also be supplied. How ever, except for the mesh size, dimension details and fixing details of these elements shall be same as the element being assembled in the system
- Supply and installation of thermal insulation for the complete system.
- Supply and laying of the total power cables and control / Instrumentation cables from the common supply point.
- MCC and Instruments mounting panel along with complete cabling for motors and instrumentation items.
- Provision shall be made in the piping for connecting Differential Pressure Indicator across the inlet and outlet connection near the equipment. Exact location of tapping will be decided based on the lay out. However the location shall be as close to the equipment as possible and shall be free from any disturbance for a straight length of 1200 mm in the upstream and 500 mm in the downstream
- Erection and commissioning of the system at our works including trial runs to demonstrate the performance of the system. BHEL will provide only power and DM water at single points and also any civil work if required. For the civil work required from BHEL, the complete details shall be provided well in advance.

- Canopy suitable for outdoor installation of the system.
- The interconnection between the Flushing stand and the equipment to be flushed. Components required for this purpose shall be suitably sized and supplied by the vendor based on the piping lay out to be prepared by them. The distance between the flushing stand and the equipment stand can be taken as 5.0 meters. Where ever welding is required in the interconnection piping, the same will be done by BHEL
- Training of Operation and Maintenance personnel at BHEL works
- Necessary tools and tackles for erection work shall be arranged by supplier.
- Technical support during actual flushing of first two equipments
- The supplier must offer the components to BHEL inspection at appropriate stages which will be identified in the quality plan by the component supplier and approved by BHEL .

3. Description of Flushing Stand

The equipment, after complete fabrication, is required to be flushed by circulating through it clean hot DM water at 90 °C temperature and at prescribed flow rates, so as to remove the impurities that might have got in during intermediate stages of manufacturing. Required cleanliness of the vessel is to be achieved by maintaining the circulation of water for sufficiently long time with flow reversal as required. After completing the flushing cycles the flushing stand will be used to measure the differential pressure across the steam generator to ensure that the interior surfaces are free from blockages.

The flushing stand envisaged for this purpose consists broadly of the following :

1. Storage tank.
2. Set of pumps selected to meet the discharge and head requirement.
3. A cooler to control the water temperature.
4. Set of strainers to remove impurities .
5. A cooling tower system for the cooling water for Cooler Secondary Side. Quantity and Head of cooling water required on the secondary side shall be indicated by the supplier.
6. Interconnecting pipes, valves and fittings.
7. Control and Instrumentation items.

8. Proper lighting arrangement for the total system
9. A common circuit breaker for isolating the total system

The following instruments and gauges shall be provided in the system to monitor the working of flushing cycle. All the instruments shall have local indication as well as remote indication in the control panel

1. Level indicator for Storage tank level
2. Pressure Indicator (Glycerine filled) for the tank, in the return line, for discharge pressure of Pump P1 and P2
3. Flow meter in the return line for indication of flow rate. Temperature of water in the tank and at the outlet from the vessel
4. Temperature of water at cooler inlet and out let.
5. Differential Pressure Indicator across the equipment
6. Temperature at the out let of Cooling tower

04. Working of the system :

The pump P1, takes suction from the storage tank located above the pump level and discharge the water into the vessel through a strainer. After flushing, the water is circulated back to the storage tank through another filter as shown in the Scheme. The strainers in the pump discharge line is meant to retain suspended particles of sizes more than *100 microns*. and the strainers in the return line is meant to retain suspended particles of sizes more than *200 microns*. In order to facilitate easy removal / assembly, the strainers shall have flanged end connection. *Design of the strainers shall allow easy replacement of the filter element when required*

Impurities not being retained by the return line filters will settle in the storage tank to be periodically blowed down through the drain valve.

In order to avoid temperature raising beyond 90° C and maintain the flushing medium temperature at the desired level, a cooler is also provided in a separate loop circuit with independent pump (P2) and provision for regulating the flow through the cooler.

The secondary side cooling water from the cooler is circulated through a cooling tower to bring down the temperature and is again admitted in to the cooler.

Before starting the flushing cycle, the entire system has to be thoroughly cleaned by continuous recirculation of hot water. During flushing operation the strainers in the return

lines shall be monitored for their normal working. Required flow at the required head through the vessel is to be achieved by manipulating the by pass valve in the by pass line and throttling valve in the pump discharge lines.

5. Design requirements :

Table –1 Process Design parameters

Sl.No.	Parameter	
01	Flushing flow rate, Tons /Hr	400
02	Flushing water temperature at outlet to the equipment (°C)	80
03	Operating Pressure MPa	1.4

All the components of the flushing stand except for the storage tank, shall be rated for a maximum pressure of 15 kg/cm^2 and maximum operating temperature of 100 °C. Storage tank shall be rated for a pressure of 5 kg/cm^2 and temperature 100 ° C.

Design and construction of the system shall be as per ASME Section VIII Division –1 and the material of construction of all the items *(e.g. internals of pump, strainers, valves, piping etc.)* that come in direct contact with the flushing medium shall be Stainless Steel of Grade 304L

As the required temperature of water is proposed to be *maintained* by using the heat generated by the pump, the heat loss has to be kept minimum and hence the equipments and the piping of the flushing stand shall be provided with thermal insulation. Thickness of insulation shall be suitable for maintaining a surface temperature not more than 50 °C

DM water in the storage tank will be provided with Nitrogen blanket (By BHEL) at a pressure of about 0.2 Mpa for preventing atmospheric contamination as well as for improving the NPSH at the pump inlet.

Size and details of piping and pipe fittings shall be selected for flow velocity of around 3.5 m/s and minimize pressure drop under maximum flow condition

All equipments and piping of the flushing stand shall be neatly arranged. Pump will be provided with sufficient space all around for accessing and maintaining them, when ever required, hand wheels of manually operated valves shall be positioned at suitable elevation for easy operation, sufficient space for removal of cartridges / strainer baskets

shall be provided. Local control panel for operation of pumps and mounting of instruments and gauges shall be appropriately located so that operation of the system can be monitored from the panel location (near to flow regulating valves)

Hydrotest of the individual equipment as well as the system shall be carried out as per ASME Section VIII Division 1 using DM water meeting the quality requirement as per Clause 9

Required sizes of pipes are indicated in the scheme and a indicative list of valves required for the system is furnished separately. Quantity and type of various pipe fittings including adapters, wherever required, and length of pipes will be decided by the vendor based on the piping layout to be prepared by them for a minimum pressure drop.

Joints on the pressure boundary or those coming in contact with flushing fluid are made with full penetration welds without backing ring so as to have no crevices for accumulation of contamination.

Joits shall be made using qualified procedure as per applicable code.

Surfaces of all welds shall be smooth with surface finish of 6.3 microns or better.

All pressure boundary joints are subjected to NDE as per code. PT is required for all joints

6. Materials :

Pipes, pipe fittings, valves and flanges shall conform to the following ANSI Standards

i)	Pipes	ANSI B 36.10
ii)	Pipe fittings with BW Ends	ANSI B 16.9
iii)	Pipe fittings with SW Ends	ANSI B 16.11
iv)	Pipe Fittings with Threaded Ends	ANSI B 16.11
v)	Flanges	ANSI B 16.5
vi)	Valves	ANSI B 16.34

Material of construction for Pipes, pipe fittings, valves, flanges and fasteners and gaskets for flanges shall be as per the following ASTM Standards.

i)	Pipes	ASTM A –312 TP 304L
ii)	Pipe fittings	ASTM A –182 F- 304L/
iii)	Flanges	ASTM A –182 F- 304L
iv)	Valves	ASTM A –182 F- 304 For forged bodies ASTM A-351 CF 8 for Cast bodies
v)	Fasteners	ASTM SA 193 B7/ SA 194 2H
vi)	Gaskets	Viton of shore hardness >75
vii)	Packing gland in Valves and Pumps	PTFE ropes.

All pipe fittings of sizes upto 40 NB shall be socket welded ends and fittings of larger sizes shall be of butt welded types and shall be rated for a design pressure of 15 Kg/cm^2 and maximum working temperature of 100 ^{o} C. All pipes, fittings, valves etc coming in contact with flushing medium shall have a smooth finish on ID.

7. Technical points :

1. The details provided in this specification and the enclosed data sheets of the individual equipments are to be used as design basis. The supplier shall make an independent design review of the total system for the adequacy of the system parameters, including design parameter of the individual equipment, material selection for gaskets etc., so as to achieve the final performance parameters as detailed below.
2. *Suppliers of all bought out items shall be identified in the offer and approved by BHEL before placing PO.*
3. *The flushing system shall not have stagnant zones, long corrugated piping, crevices etc. allowing accumulation/concentration of impurities and contamination.*
4. Specification, *drawings and suppliers* of individual items like pump, motor, filters, cooler, cooling tower and valves shall be submitted for approval before ordering.

5. Where ever possible, pump motors shall be low speed motor (1450 rpm)
6. Electrical connections from the panel to individual motors shall be by copper cables.
7. Contactors and FSU units shall be SIEMENS / L&T make.
8. Only calibrated instruments shall be used
9. All gauges, transmitters and other instrument components shall be of reputed make
10. A control panel with digital read out of all measured parameters shall be provided at a location near the flow regulating valves to permit easy regulation and control of flow and temperature by the operator.
11. All instruments , gauges that are required to be mounted on the local control panel shall be neatly laid out at appropriate levels for ease of operation and maintenance Starters for the pumps motor shall be available on the panel and shall be mounted in segregated area of panel if combined with other instrument panel.
12. Proper venting provision shall be made for complete venting.
13. Valve bodies shall be visually inspected, pickled and passivated in the presence of BHEL before assembly as per procedure to be approved by BHEL. Valve stem surface shall be smoothly finished so as to avoid peeling of packing material during opening and closing of valves and the same will be inspected by BHEL during assembly stage.
14. Also, the material for packing gland in the valves shall be suitable for the intended application without disintegration during service.
15. Material for gaskets between flanges shall also be selected so that there is no degradation of the gaskets during service. Gaskets shall be properly cut without any projection into the flow path.
16. All the instruments shall be properly calibrated and the calibration procedure for flow meters may be submitted for approval.
17. Thorough cleaning / pickling and passivation shall be done for all the stainless steel parts as per approved procedure and cleanliness shall be checked for all the components of the flushing system at components stage before assembly. This shall be one of the stages in QAP to be submitted by the supplier.
18. All external surfaces shall be coated with Aluminum paint.

8. Cleaning and preservation of parts and assemblies :

1. Cleanliness of parts and assemblies are considered to be satisfactory, if there is no dirt on wiping the surface with clean white lint free napkins wetted with acetone and cavities of the completed equipment do not have surface scaling, untypical deposits of corrosion products or foreign objects (e.g chip, powder, metal spray, weld spatter, slag, dirt, grease)
2. In order to ensure cleanliness of all parts and sub assemblies before assembly, cleaning, degreasing and drying is done before they become difficult to access.
3. Once cleaned, cleanliness is to be preserved by suitable methods. Cleaned and degreased surfaces are to be handled using clean gloves made from lint free material.
4. Prior to final assembly, all parts and sub assemblies are checked for cleanliness and absence of foreign objects in the inner cavities.
5. Parts and sub assemblies after cleaning and degreasing are to be dried by wiping the surfaces with clean white lint free napkins and completely dried in air.
6. All tools and fixtures including the cutting and measuring tools made of carbon steel used for handling SS materials during assembly in the inner cavities must have an anti corrosion (Chromium or Nickel) coating / wrapping.
7. All tools and fixtures used during assembly shall be clean and grease free.

9. Flushing and Pressure drop measurement of system after Erection and Commissioning :

The flushing system after final assembly and before being connected to the equipment shall undergo hot flushing as a closed circuit with hot DM water (To be supplied by BHEL) as per the following sequence and it's performance and cleanliness level as given below shall be demonstrated in the presence of BHEL inspectors.

Chemistry of water to be used for flushing will be as follows :

Total mass concentration of salts **Or** Specific electric conductivity	1 mg/dm^3 or less 2.0 μ s/cm
mass concentration of dense residue	2 mg/dm^3 or less
mass concentration of chloride ions	0.05 mg/dm^3 or less
pH	6.5 - 7

Sequence of operation for flushing the system

i) *Prepare the system pipelines, filters etc. for flushing by closed circuit water circulation. Check their cleanliness and clean them, if required. Visible contamination on filters is prohibited.*

ii) *Connect the bridge piece across the inlet and outlet lines.*

iii) *Take DM water sample just before filling the system to check chemistry*

iv) *Fill the flushing system with DM water. Suitable provision for venting and draining shall be ensured. Start circulating water and ensure flow rate at 400±10 tons / hr.*

v) *Maintain the circulation till the water temperature reaches 80°C. Cooler may be used if temperature exceeds 90 °C.*

vi) *Flush the system at 400±10 T/hr with flow reversal as required after every 30 minutes. Flushing of system shall be done for min. 8 hrs.*

vii) *Periodicity of outlet filter inspection for cleanliness is 2-4 hrs.*

viii) *Clean or Replace filtering elements as they are contaminated, but not later than 8 hrs. of washing.*

ix) *Final flushing is performed by 2 hrs cycles with flow reversal every 30 min. as required. Each cycle is completed by flushing in forward direction.*

x) *At the end of flushing cycle, flushing water sample shall be taken for water quality analysis.*

xi) *Outlet filter shall be inspected after washing cycle end. Acceptance as mentioned below.*

xii) *Flushing is treated as satisfactory, if in three samples consequently taken every 30 minutes :*

a) There are no visible mechanical particles, oil products and other greasing impurities which is confirmed by the results of water sampling analysis.

b) Growth of mass concentration of dense residue and salt content does not exceed 1.0 mg/dm^3 and 0.5 mg/dm^3 respectively, if compared with initial water. Chloride ion content does not exceed 0.05 mg/dm^3.

c) There are no mechanical particles, corrosion and other contamination on outlet filter element when checked with finer white lint free cloth.

d) Absence of oil products, rainbow on water surface and oil spot on white filter paper.

e) *There are no visible mechanical particles and contamination on accessible inner surfaces of adapters, piping etc.*

xiii) *After completing the flushing cycles satisfactorily as above, measure the pressure drop across the system which shall not exceed 2.5* kg/sq.cm.

xiv) *Complete draining of the system shall be ensured after completion of flushing.*

xv) *Finally, outlet filter in the return line shall be inspected to ensure there are no visible mechanical particles, corrosion and other contamination on the mesh.*

10. Equipment Layout and Piping

All equipments and piping of the flushing stand shall be neatly arranged. Pump will be provided with sufficient space all around for accessing and maintaining them, when ever required, handles of manually operated valves shall be positioned at suitable elevation for easy operation, sufficient space for removal of cartridges / strainer baskets shall be provided. Local control panel for operation of pumps and mounting of instruments and gauges shall be appropriately located so that operation of the system can be monitored from the panel location

Required sizes of pipes are indicated in the scheme and a indicative list of valves required for the system is furnished separately. Quantity and type of various pipe fittings and length of pipes will be decided by the vendor based on the piping layout to be prepared by them.

11. Documents / details to be submitted along with the technical Bid.

- Lay out drawing in 3D indicating the overall dimensions of the system.
- Bill of materials covering the total scope.
- List of recommended spares for erection and commissioning and for 5 years operation with item wise price.
- Catalogues and data sheets of pumps, motors, Cooler, Strainers, Cooling tower, flow measurement devices and other instrumentation items.
- Filters being a very critical component, the constructional features of filters showing the sealing arrangement and fixing details of filter elements, which will

illustrate the method of removal and replacement of filter elements shall be furnished.

- Total power requirement for the system shall be indicated in the offer
- Detailed quality plan for the total system as well as the individual items like pumps, valves, filters, coolers and instruments for approval.
- Details of cooling tower and the quantity of cooling water required for the secondary side.
- Pressure drop in the total system and also across individual strainers and Valves shall be indicated in the offer.

12. Documents to be submitted after placement of order

- Pressure drop calculation for the total system and also across individual strainers and Valves.
- The orifice calculation for DP and calibration certificate for the transmitter to match with DP
- **Three sets** of Operation & Maintenance manual giving the following details to be provided in **hard and soft copies (CDs)**
- Complete step-by-step operating procedure including safety precautions.
- Maintenance procedures & trouble shooting hints for the system and individual components including preventive maintenance check points.
- Complete set of assembly & sub-assembly drawings with dimensions & bill of materials and manufacturing part drawings for wearing components.
- Complete specification and original catalogues of all the bought out items.
- Complete list of spares with purchase specifications, part numbers, make, etc.

Valves Schedule Primary Side Flushing Scheme

Serial No.	Valve No.	Size	Type	Function & Location
1	V-1	250 NB	Gate	Tank to pump P-1 suction
2	V-2	200 NB	Globe	Pump, P-1 bypass line
3	V-3	200 NB	Globe	Pump, P-1 discharge
4	V-4,5,6,7	200 NB	Gate	Isolation valves for strainers
5	V-8	40 NB	Gate	Tank to pump P-4 suction
6	V-9	25 NB	Globe	Pump P4 discharge line for initial filling
7	V-10	25 NB	Globe	Pump, P-4 bypass
8	V-11	25 NB	Globe	Cooler inltet
9	V-12	25 NB	Globe	Cooler outlet
10	V-13	40 NB	Globe	Storage tank Vent
11	V-14	40 NB	Globe	Storage tank DM water filling
12	V-15	20NB	Globe	Impulse line process valves for Storage tank level
13	V-16	40 NB	Gate	Storage tank drain
14	V-17	20 NB	Needle	Sampling line at tank
15	V-18,19	20 NB	Globe	Impulse line process valves across FE
16	V-20,21	20 NB	Globe	Impulse line process valves across DPI
17	V-22,23	20 NB	Needle	Sampling line at inlet & outlet of equipment
18	V-24	40 NB	Globe	Valves for chemical addition to tank
19	V-25	20 NB	PRV	Storage tank Nitrogen filling
20	V-26	20 NB	SRV	Storage tank safety relief valve

Data sheet for Storage Tank -Primary

S.No.			
1	Quantity		1 No.
2	Type		Cylindrical tank with dished ends at both the ends &supported on saddles
3	Capacity		10 Cum
4	Operating Pressure		2.5 Kg/sq. cm
5	Operating Temparature		90 deg C
6	Design Pressure		5 Kg/sq. cm
7	Design Temparature		100 deg C
8	Design Code		ASME Section VIII, Div. 1
9	Material of construction		Stainless Steel - Grade 304L
10	Material Specification No.		
	I).	Shell and Closures	ASTM A-240 Type 304L
	ii).	Nozzles	ASTM A-312 Type 304L
	iii).	Flanges	ASTM A-182 Type 304L
	iv).	Gaskets	Viton of shore hardness> 75
	v).	Manhole	ASTM A-240 Type 304L
	vi)	Supports	Carbon steel (support welding to tank with SS poison plate of ASTM A-240 Type304L
11	Support type & Nos.		Saddle type -2 Nos. with one end free.
12	Insulation		To be selcted by the vendor

Nozzle Schedule

S. No.	Description	Size	Qty.
1	Pump P1 suction	250 NB Sch 40	1 No.
2	Pump P2 suction	40 NB Sch 40	1 No.
3	Filling / chemical addition	40 NB Sch 40	1 No.
4	Vent	40 NB Sch 40	1 No.
5	Drain	40 NB Sch 40	1 No.
6	Nitrogen filling	20 NB Sch 40	1 No.
7	Safety relief Valve	20 NB Sch 40	1 No.
8	Water Level measurement	20 NB Sch 40	2 Nos.
9	From Strainers	200 NB Sch 40	1Nos.
10	Temperature indicator tapping	20 NB Sch 40	1 No.
11	Pressure indicator tapping	20 NB Sch 40	1 No.
12	From Cooler	25 NB Sch 40	1 No.
13	Pump, P-1 discharge bypass	200 NB Sch 40	1 No.
14	Manhole	600 mm ID	1 No.

Technical Specification of Strainers in the Primary return Line

01.	Type of filter	Basket type with wire mesh type filter element. As an alternative, wedge wire type filter element shall also be proposed. Selected option will be indicated in the P.O
02.	Rating / mesh size	**200** microns maximum pore size. Details like size and number of strainers required for specified service shall be indicated.
03.	Flow medium	Demineralised (DM) water
04.	Medium pressure	15 Kg/cm^2
05.	Medium Temperature	100 ° C
06.	Flow rate	400 T / hr (Operating condition)
07.	Quantity	To be specified by the supplier to meet the specified flow rate and pressure drop for the specified size Additional spares required for bucket and filter element assembly will be specified before placing P.O.
08.	Mode of operation	Continuous operation in multiple 8 hrs cycle. Filter element may need frequent replacement. Design & installation shall ensure easy replacement. Davit arrangement may be provided.
09.	Constructional details	• A sketch showing suggestive arrangement of the filter is enclosed. • The sketch gives schematic arrangement of the strainer with wire mesh type filter element. Sizes shown are only indicative. • Details of sizing and design along with detailed fabrication drawings shall be submitted for approval for wire mesh type and wedge wire type filter element separately. • The wire mesh shall be supported by suitable perforated shells. • Details ensuring following requirements shall be clearly shown in the sketch a) Leak proof brazed/welded mesh long seam joint b) Leak proof brazed/welded mesh/wedge wire to end caps c) Leak proof welded end caps to flange

10.	Pressure drop	Maximum of 2.5-meter water column across inlet and outlet nozzle of strainer. Calculation for the same shall be submitted.
11.	Inlet	200 NB with WNRF flanged end
12.	Outlet	200 NB with WNRF flanged end
13.	Material of construction	SS 304L for all wetted parts Gasket: VITON of shore hardness >75
14.	Code of Construction	ASME Sec. VIII Div.1
15.	Strainer Flange connection	Groove type with O ring gasket
16.	Tests to be carried out & documents to be submitted	a) QAP & test procedures indicating stages of inspection to be submitted with the quotation. b) Material's TCs; after placement of PO. c) Bubble test for pore size of mesh. d) Seat leak test shall be conducted at 15 Kg/cm^2 pressure Detailed testing procedure shall be submitted for approval. e) NDE of weld joints f) Cleaning of all parts as per procedure to be submitted for approval g) Pickling and passivation of all parts. Procedure to be submitted for approval h) Hydro test of the equipment with DM water. Procedure to be submitted for approval.
17.	Guarantee	Trouble free operation for one year from the date of commissioning or 18 months from the date of receipt of material at our works, which ever is later, shall be guaranteed.

Technical Specification of Strainers in the Primary Supply Line

01.	Type of filter	Basket type with wire mesh type filter element. As an alternative, wedge wire type filter element shall also be proposed. Selected option will be indicated in the P.O
02.	Rating / mesh size	**100** microns maximum pore size. Details like size and number of strainers required for specified service shall be indicated.
03.	Flow medium	Demineralised (DM) water
04.	Medium pressure	15 Kg/cm^2
05.	Medium Temperature	100 ^{o} C
06.	Flow rate	400 T / hr (Operating condition)
07.	Quantity	To be specified by the supplier to meet the specified flow rate and pressure drop for the specified size Additional spares required for bucket and filter element assembly will be specified before placing P.O.
08.	Mode of operation	Continuous operation in multiple 8 hrs cycle. Filter element may need frequent replacement. Design & installation shall ensure easy replacement. Davit arrangement may be provided.
09.	Constructional details	• A sketch showing suggestive arrangement of the filter is enclosed. • The sketch gives schematic arrangement of the strainer with wire mesh type filter element. Sizes shown are only indicative. • Details of sizing and design along with detailed fabrication drawings shall be submitted for approval for wire mesh type and wedge wire type filter element separately. • The wire mesh shall be supported by suitable perforated shells. • Details ensuring following requirements shall be clearly shown in the sketch a) Leak proof brazed/welded mesh long seam joint b) Leak proof brazed/welded mesh/wedge wire to end caps c) Leak proof welded end caps to flange

10.	Pressure drop	Maximum of 2.5-meter water column across inlet and outlet nozzle of strainer. Calculation for the same shall be submitted.
11.	Inlet	200 NB with WNRF flanged end
12.	Outlet	200 NB with WNRF flanged end
13.	Material of construction	SS 304L for all wetted parts Gasket: VITON of shore hardness >75
14.	Code of Construction	ASME Sec. VIII Div.1
15.	Strainer Flange connection	Groove type with O ring gasket
16.	Tests to be carried out & documents to be submitted	a) QAP & test procedures indicating stages of inspection to be submitted with the quotation. b) Material's TCs; after placement of PO. c) Bubble test for pore size of mesh. d) Seat leak test shall be conducted at 15 Kg/cm^2 pressure Detailed testing procedure shall be submitted for approval. e) NDE of weld joints f) Cleaning of all parts as per procedure to be submitted for approval g) Pickling and passivation of all parts. Procedure to be submitted for approval h) Hydro test of the equipment with DM water. Procedure to be submitted for approval.
17.	Guarantee	Trouble free operation for one year from the date of commissioning or 18 months from the date of receipt of material at our works, which ever is later, shall be guaranteed.

Data sheet for Pump P1- Primary side

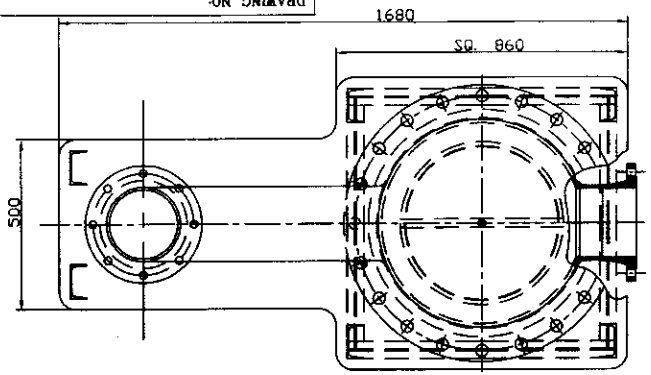
01	Type	Horizontal type single stage centrifugal pump with end suction and vertical discharge, electrically driven mounted on a common base plate
02	Medium	Demineralised water
03	Design pressure	15 Kg/cm^2
04	Design Temperature	100 ° C
05	Flow rate	480 tons / hr at 100 ° C
06	Head	120 M
07	Quantity	1 No
08	Discharge Nozzle size	200 NB
09	Suction Nozzle size	250 NB
10	End connections	With corresponding size flanges
11	Material of Construction (All wetted parts)	Stainless steel (Grade 304L)
12	Material for Packings	PTFE ropes
13	Motor rating	To be furnished by vendor Recommended Suppliers for motors : M/s SIEMENS, M/s KIRLOSKAR, M/s BIJLEE BHARAT, M/s NGEF, M/s CROMPTON

Data sheet for Pump P2- Primary side

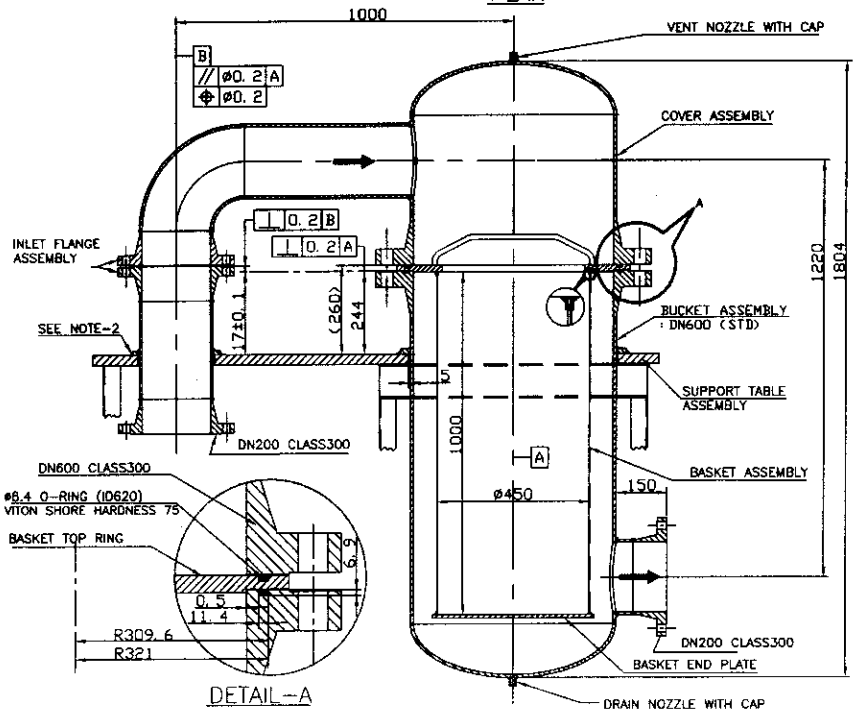
01	Type	Horizontal type single stage centrifugal pump with end suction and vertical discharge.
02	Medium	Demineralised water
03	Design pressure	15 Kg/cm^2
04	Design Temperature	100 ^{o} C
05	Flow rate	6 tons / hr
06	Head	75 M
07	Quantity	1 No
08	Discharge Nozzle size	25 NB
09	Suction Nozzle size	40 NB
10	End connections	With corresponding size flanges
11	Material of Construction (All wetted parts)	Stainless steel (Grade 304L)
12	Material for Packings	PTFE ropes
13	Motor rating	To be furnished by vendor Recommended Suppliers for motors : M/s SIEMENS, M/s KIRLOSKAR, M/s BIJLEE BHARAT, M/s NGEF, M/s CROMPTON

DRAWING NO: SK-3-D040-068

ALL DIMENSIONS ARE IN MILLIMETERS



PLAN



DETAIL-A
(TYP)NTS

NOTES:
1. MATERIAL OF CONSTURCTION OF ITEMS EXCEPT FOR SUPPORT PLATE ASSEMBLY SHALL BE SS304L

2. WELD SHALL BE DONE WITH DISTROTION CONTROL IN ASSEMBLY/FIT UP CONDITION WITH INLET FLANGE ASSEMBLY.

3. THIS DRG SHOWS ONLY SCHEMATIC ARRANGEMENT OF THE STRAINER WITH WIRE MESH TYPEFILTER ELEMENT. SIZES SHOWN ARE INDICATIVE.

REV	DATE	ALTERED :
01		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BARC

PRODN.DRG.

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
05-229/D

	NAME	SIGNATURE	DATE	NO. OF VAR
DRN	P.B		181007	
CHD	SANJAY			
APPD	A.S.			

DEPT	GRADE OF UNTOL DIM		SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG	ITEM NO	NO OF ITEMS
NC	C/M/F		1:1	0.000			
CODE 150							

TITLE: FILTER-PRIMARY SIDE

CARD CODE: U 01

DRAWING NO : SK-3-D040-068

REV: 00

Size A3

Data sheet for Storage Tank -Primary

S.No.			
1	Quantity		1 No.
2	Type		Cylindrical tank with dished ends at both the ends &supported on saddles
3	Capacity		10 Cum
4	Operating Pressure		2.5 Kg/sq. cm
5	Operating Temparature		90 deg C
6	Design Pressure		5 Kg/sq. cm
7	Design Temparature		100 deg C
8	Design Code		ASME Section VIII, Div. 1
9	Material of construction		Stainless Steel - Grade 304L
10	Material Specification No.		
	I).	Shell and Closures	ASTM A-240 Type 304L
	ii).	Nozzles	ASTM A-312 Type 304L
	iii).	Flanges	ASTM A-182 Type 304L
	iv).	Gaskets	Viton of shore hardness> 75
	v).	Manhole	ASTM A-240 Type 304L
	vi)	Supports	Carbon steel (support welding to tank with SS poison plate of ASTM A-240 Type304L
11	Support type & Nos.		Saddle type -2 Nos. with one end free.
12	Insulation		To be selcted by the vendor

Nozzle Schedule

S. No.	Description	Size	Qty.
1	Pump P1 suction	250 NB Sch 40	1 No.
2	Pump P2 suction	40 NB Sch 40	1 No.
3	Filling / chemical addition	40 NB Sch 40	1 No.
4	Vent	40 NB Sch 40	1 No.
5	Drain	40 NB Sch 40	1 No.
6	Nitrogen filling	20 NB Sch 40	1 No.
7	Safety relief Valve	20 NB Sch 40	1 No.
8	Water Level measurement	20 NB Sch 40	2 Nos.
9	From Strainers	200 NB Sch 40	1Nos.
10	Temperature indicator tapping	20 NB Sch 40	1 No.
11	Pressure indicator tapping	20 NB Sch 40	1 No.
12	From Cooler	25 NB Sch 40	1 No.
13	Pump, P-1 discharge bypass	200 NB Sch 40	1 No.
14	Manhole	600 mm ID	1 No.

Data sheet for Cooler-Primary side

Sl.No	Description		
01	Quantity	1 No.	
02	Type	Shell and Tube Heat Exchanger	
03	Rating	Shall be same as the Pump P1 Motor rating	
		Shell Side	Tube Side
04	Design Pressure (Kg/cm^2)	15	10
05	Design Temperature ($^{\circ}C$)	100	100
06	Medium	DM water	Cooling water
	Operating Temperatures		
07	Inlet	90 $^{\circ}C$	35 $^{\circ}C$
08	Outlet	To be indicated	45 $^{\circ}C$
09	Rated Flow (M^3 / Hr)	6	-
10	Inlet/Outlet Nozzle sizes	40 NB	65 NB
11	Material of construction	SS 304	SS 304
12	Applicable Codes	TEMA Class C / ASME Sec VIII Div -1	

Data sheet for Cooling Tower –Primary side

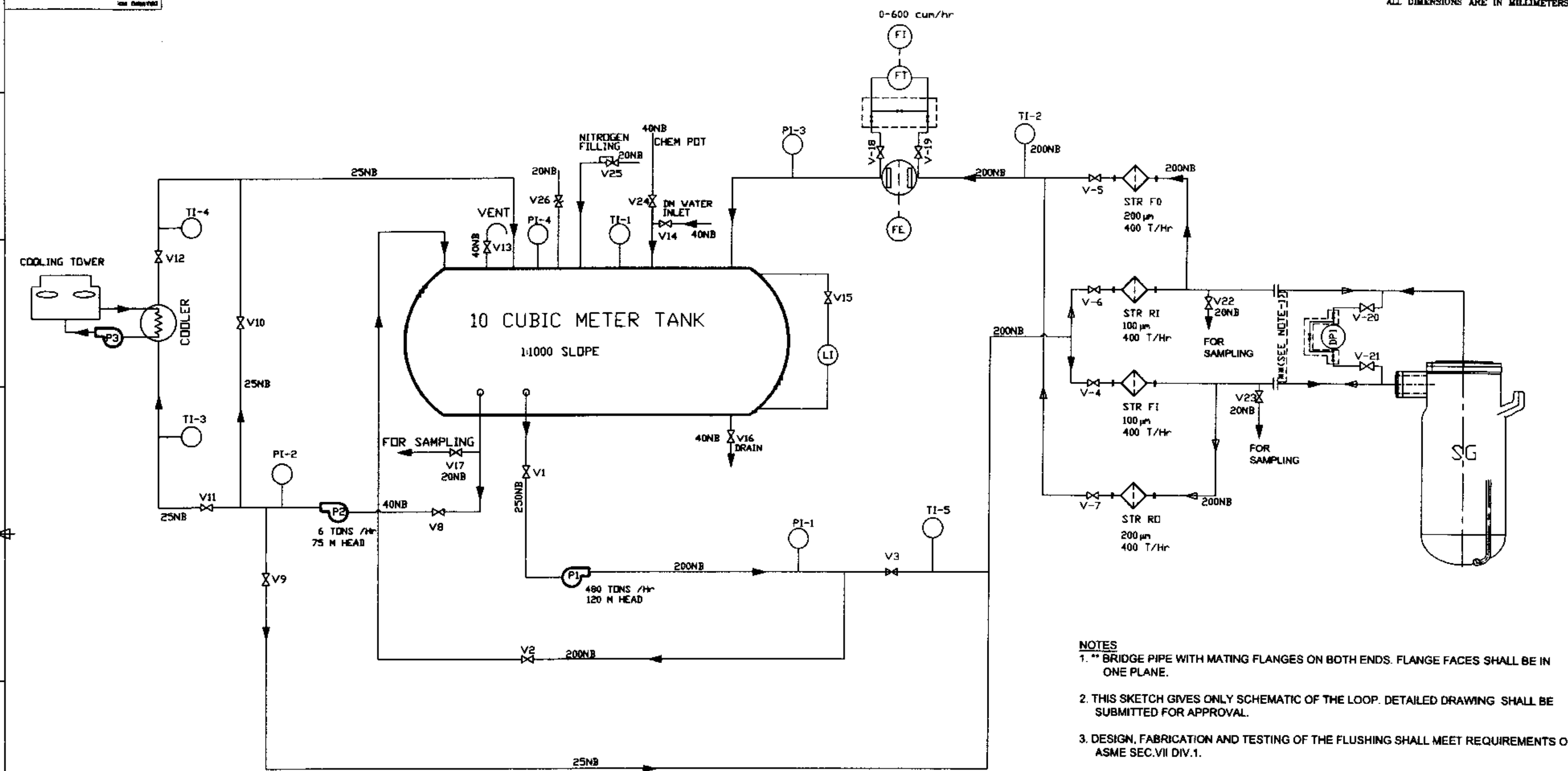
Sl.No	Description	
01	Quantity	1 No.
04	Design Pressure (Kg/cm^2)	5
05	Design Temperature ($^{\circ}C$)	50
06	Medium	Cooling water
	Operating Temperatures	
07	Inlet	45 $^{\circ}C$
08	Outlet	To be indicated
09	Rated Flow (M^3 / Hr)	To be indicated
10	Inlet/Outlet Nozzle sizes	65 NB / 65 NB
11	Material of construction	SS 304

Valves Schedule Primary Side Flushing Scheme				
Serial No.	**Valve No.**	**Size**	**Type**	**Function & Location**
1	V-1	250 NB	Gate	Tank to pump P-1 suction
2	V-2	200 NB	Globe	Pump, P-1 bypass line
3	V-3	200 NB	Globe	Pump, P-1 discharge
4	V-4,5,6,7	200 NB	Gate	Isolation valves for strainers
5	V-8	40 NB	Gate	Tank to pump P-4 suction
6	V-9	25 NB	Globe	Pump P4 discharge line for initial filling
7	V-10	25 NB	Globe	Pump, P-4 bypass
8	V-11	25 NB	Globe	Cooler inltet
9	V-12	25 NB	Globe	Cooler outlet
10	V-13	40 NB	Globe	Storage tank Vent
11	V-14	40 NB	Globe	Storage tank DM water filling
12	V-15	20NB	Globe	Impulse line process valves for Storage tank level
13	V-16	40 NB	Gate	Storage tank drain
14	V-17	20 NB	Needle	Sampling line at tank
15	V-18,19	20 NB	Globe	Impulse line process valves across FE
16	V-20,21	20 NB	Globe	Impulse line process valves across DPI
17	V-22,23	20 NB	Needle	Sampling line at inlet & outlet of equipment
18	V-24	40 NB	Globe	Valves for chemical addition to tank
19	V-25	20 NB	PRV	Storage tank Nitrogen filling
20	V-26	20 NB	SRV	Storage tank safety relief valve

Schedule of Instrumentation and Control Primary side

Serial No.	Tag NO.	Process Parameter	Location	Units	Values		Accuracy	Idendication Local/ Inst Panel	Alarm/ Interlocks	Remarks
					Nominal	Range				
1	PI-1	Pump P-1 Discharge Pressure	Pump, P-1 Discharge Line	Kg/cm^2	12	0-16	±1%	Local	No	Bourdon Gauge
2	PI-2	Pump P-2 Discharge Pressure	Pump, P-2 Discharge Line	Kg/cm^2	7.5	0-16	±1%	Local	No	Bourdon Gauge
3	PI-3	Return Line Pressure	Return Line to Tank	Kg/cm^2	12	0-16	±1%	Local	No	Bourdon Gauge
4	PI-4	Storage Tank Pressure	Storage Tank	Kg/cm^2	2	0-6	±1%	Local	No	Bourdon Gauge
5	LI	Storage Tank Level	Storage Tank	mm	2000	0-3000	±1%	Local	No	Level Indicator
6	DPI	Differential Pressure across Vessel	Across inlet to the vessel and outlet from the vessel	Kg/cm^2	2.5	0-5	±1%	Local	No	DP gauge
7	FI	Flow through the eqipment	Return line(200NB)	tons /hr	400	0-600	±1%	Local	No	Orifice plate with flow transmitter
8	TI-1	Temperature of medium in Tank	Tank	° C	75	0-100	±1%	Inst. Panel	No	RTD
9	TI-2	Temperature of medium in the return line	Return line at Strainer inlet	° C	70	0-100	±1%	Inst. Panel	No	RTD
10	TI-3	Temperature of medium at the Cooler inlet	Cooler inlet line	° C	95	0-100	±1%	Inst. Panel	No	RTD
11	TI-4	Temperature of medium at the Cooler outlet	Cooler outlet line	° C	40	0-100	±1%	Inst. Panel	No	RTD
12	TI-5	Temperature in the discharge line of pump	Discharge line	° C	90	0-100	±1%	Inst. Panel	No	RTD

ALL DIMENSIONS ARE IN MILLIMETERS



NOTES
1. ** BRIDGE PIPE WITH MATING FLANGES ON BOTH ENDS. FLANGE FACES SHALL BE IN ONE PLANE.

2. THIS SKETCH GIVES ONLY SCHEMATIC OF THE LOOP. DETAILED DRAWING SHALL BE SUBMITTED FOR APPROVAL.

3. DESIGN, FABRICATION AND TESTING OF THE FLUSHING SHALL MEET REQUIREMENTS OF ASME SEC.VII DIV.1.

4. SYSTEM SHALL NOT HAVE STAGNANT ZONES (e.g. CREVICES, CORRUGATED PIPING ELEMENTS ETC.)RESULTING IN COCENTRATION OF CONTAMINATION.

5. IF PUMPS COME WITH INTEGRAL PRESSURE GAUGE AT ITS DISCHARGE, THEN ADDITIONAL PRESSURE GAUGES PI-1& PI-2 ARE NOT REQUIRED.

6. FOR DP MEASURE VALVE OPENING AND CLOSING SCHEMES SHALL BE SAME AS FORWARD FLOW SCHEME EXCEPT THAT VALVES V21 & V22 SHALL BE KEPT OPEN.

VALVE OPENING(O), CLOSING(C) & REGULATING(R) SCHEME.

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26
FORWARD ——→	O	R	O	O	O	C	C	C	C	C	C	C	C	C	O	C	C	O	O	C	C	C	C	C	–	–
REVERSE ——→	O	R	O	C	C	O	O	C	C	C	C	C	C	C	O	C	C	O	O	C	C	C	C	C	–	–
HEATING UP ——→	O	O	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	–	–

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: D040 BARC

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014

DRN	P.B		181007
CHD	S.K		181007
APPD	A.S		181007

MC 150 | NTS

TITLE: PRIMARY SIDE FLUSING SCHEME

DRAWING NO: SK-3-D040-003 | REV 00

U 01

Size A1 12

SK-1-D040-003

Annexure - 1
Quality Assurance Plan

01	Raw material	Verification of Material TC's (pipes, pipe fittings, valves, plates, qaskets, packinqs, consumables	
		Visual inspection & record of all accessible surfaces for cleanliness, burrs, qeneral surface finish	
		Cleaning of all parts before assembly. All SS parts shall be pickled and passivated	
		Immediately before assembly wipe all parts with acetone soaked lint free cloth	Note 2
02	Pump / Valve	Verification for Pumps: TC's, Performance test records, Characteristic curves, Motors TC's	
		Verification of BOM and TC's for the raw materials. Eliminate any material that can degrade during flushing.	
		Cleaning of all parts before assembly. All SS parts shall be pickled and passivated	
		Immediately before assembly wipe all parts with acetone soaked lint free cloth	Note 2
		RT of welded joints, if any. Only full penetration welds permitted.	
		Dry and pack hermetically	
03	Filter	Verification of BOM and TC's for the raw materials. Eliminate any material that can degrade during flushing.	
		Bubble test of mesh to determine biggest pore size	
		Only full penetration welds permitted. RT of all weld joints	
		Verification of long seam joint, end cap to mesh, end cap to collar joint on filter element for leak tightness	
		Pickling and passivation of the equipment without filter element and preservation till assembly	
		Cleaning of the filter element and other parts that are not pickled with acetone soaked lint free cloth and assembly	Note 2
		Hydrotest	
	Instrumentation	Verify TC's and calibration records	

Notes

1. This is only an indicative QAP covering the minimum stages of inspection required. Supplier shall submit a detailed Quality Assurance Plan that will ensure product quality.
2. Wiping with acetone soaked lint free white cloth shall not lead to discoloration of the cloth

Technical Specification for Flushing Stand –Secondary side

1. Purpose :

This flushing stand is required to create hot flushing water (DM water) circulation for final cleaning of internals of an equipment (SG) and shall ensure:

1. Continuous circulation of hot DM water at around 90 °C temperature and at 40 Tons/hr flow rate through the equipment being flushed for sufficiently long durations till cleanliness acceptance criteria is met.
2. Provision for checking of flushing water flow rate and temperature at the outlet of the equipment during flushing.
3. Retention of mechanical particles, corrosion products and other contamination
4. Provision for periodically checking the cleanliness of filters at the outlet of the equipment.
5. Flushing water sampling for checking of pH, chloride ion concentration, mass concentration of dense residue and salt content at the inlet and outlet of the equipment.
6. Conformance to the cleanliness requirement as per clause 9.0
7. Complete venting and draining of the system. Drain and vent points at different locations in the loop may be required to ensure this.
8. Adequate safety and interlocking features for safe operation shall be provided.
9. Provision for pressure drop measurement across the equipment

The flushing stand before being connected to the equipment shall undergo hot flushing in the same manner as the equipment, using flushing water of the same specification and meeting the same acceptance criteria for cleanliness. Cleanliness and preservation of all elements of the flushing system at the components stage and after final assembly therefore needs to be checked and ensured by the supplier as per approved Quality Assurance Plan

2. Scope of Supply / Work

- Design review and validation of the system for meeting the performance parameters.
- Preparation and submission of Lay out drawing in 3D in line with the schematic drawing with minor modifications (if required) limiting the overall dimension to approximately to 4.0 M x 4.0 M x 4.0 M. Lay out shall ensure that the strainers are located above the water level in the storage tank so that complete draining of water from the bucket is not required during basket replacement.
- Supply of the complete system as per Scheme and drawing No. SK-3-D040-004 mounted on a suitable skid which shall include all the items indicated in the Scheme and Specification as well as such of those items which may be required to ensure satisfactory performance of the system.
- Supply of loose pipes, ONE number each of sizes 100 NB, 40 NB dia, and 3 meters length along with a set of matching counter flanges (WNRF), gaskets and fasteners.
- Supply of suitable bridge piece with end flanges, fasteners and gaskets for connecting the inlet and outlet of the system so that the system by itself forms a closed circuit and thereby isolating the equipment..
- Filters with higher mesh sizes will be used during start up cycles. For this purpose 4 nos filtering elements of mesh size 300 microns shall also be supplied. How ever, except for the mesh size, dimension details and fixing details of these elements shall be same as the element being assembled in the system
- Supply and installation of thermal insulation for the complete system.
- Supply and laying of the total power cables and control / Instrumentation cables from the common supply point.
- MCC and Instruments mounting panel along with complete cabling for motors and instrumentation items.
- Provision shall be made in the piping for connecting Differential Pressure Indicator across the inlet and outlet connection near the equipment. Exact location of tapping will be decided based on the lay out. However the location shall be as close to the equipment as possible and shall be free from any disturbance for a straight length of 600 mm in the upstream and 300 mm in the downstream

- Erection and commissioning of the system at our works including trial runs to demonstrate the performance of the system. BHEL will provide only power and DM water at single points and also any civil work if required. For the civil work required from BHEL, the complete details shall be provided well in advance.
- Canopy suitable for outdoor installation of the system
- The interconnection between the Flushing stand and the equipment to be flushed. Components required for this purpose shall be suitably sized and supplied by the vendor based on the piping lay out to be prepared by them. The distance between the flushing stand and the equipment stand can taken as 5.0 meters. Where ever welding is required in the interconnection piping, the same will be done by BHEL
- Training of Operation and Maintenance personnel at BHEL works
- Necessary tools and tackles for erection work shall be arranged by supplier.
- Technical support during actual flushing of first two equipments
- The supplier must offer the components to BHEL inspection at appropriate stages which will be identified in the quality plan by the component supplier and approved by BHEL .

3. Description of Flushing Stand

The equipment, after complete fabrication, is required to be flushed by circulating through it clean hot DM water at 90 °C temperature and at prescribed flow rates, so as to remove the impurities that might have got in during intermediate stages of manufacturing. Required cleanliness of the vessel is to be achieved by maintaining the circulation of water for sufficiently long time with flow reversal as required. After completing the flushing cycles the flushing stand will be used to measure the differential pressure across the steam generator to ensure that the interior surfaces are free from blockages.

The flushing stand envisaged for this purpose consists broadly of the following :

1. Storage tank.
2. Set of pumps selected to meet the discharge and head requirement.
3. A set of electrical heaters to raise the water temperature.
4. Set of strainers to remove impurities .
5. Interconnecting pipes, valves and fittings.

6. Control and Instrumentation items.
7. Proper lighting arrangement for the total system
8. A common circuit breaker for isolating the total system

The following instruments and gauges shall be provided in the system to monitor the working of flushing cycle. All the instruments shall have local indication as well as remote indication in the control panel

1. Level indicator for Storage tank level
2. Pressure Indicator (Glycerine filled) for the tank, in the return line, for discharge pressure of Pump P1.
3. Flow meter in the return line for indication of flow rate.
4. Temperature of water in the tank and at the inlet /outlet from the vessel
5. Differential Pressure Indicator across the equipment

04. Working of the system :

The pumps P1 takes suction from the storage tank located above the pump level and discharge the water into the vessel through a strainer. After flushing, the water is circulated back to the storage tank through another filter as shown in the Scheme. The strainer in the pump discharge line is meant to retain suspended particles of sizes more than *100 microns*. and the strainers in the return line is meant to retain suspended particles of sizes more than *200 microns*. In order to facilitate easy removal / assembly, the strainers shall have flanged end connection. *Design of the strainers shall allow easy replacement of the filter element when required*

Impurities not being retained by the return line filters will settle in the storage tank to be periodically blowed down through the drain valve.

Before starting the flushing cycle, the entire system has to be thoroughly cleaned by continuous recirculation of hot water. During flushing operation the strainers in the return lines shall be monitored for their normal working. Required flow at the required head through the vessel is to be achieved by manipulating the by pass valve in the by pass line and throttling valve in the pump discharge lines.

5. Design requirements :

Table –1 Process Design parameters

Sl.No.	Parameter	
01	Flushing flow rate, Tons /Hr	40
02	Flushing water temperature at outlet to the equipment (^{o}C)	80
03	Operating Pressure MPa	1.0

All the components of the flushing stand except for the storage tank, shall be rated for a maximum pressure of 10 kg/cm^2 and maximum operating temperature of 100 ^{o}C. Storage tank shall be rated for a pressure of 5 kg/cm^2 and temperature 100 ^{o} C.

Design and construction of the system shall be as per ASME Section VIII Division –1 and the material of construction of all the items *(e.g. internals of pump, strainers, valves, piping etc.)* that come in direct contact with the flushing medium shall be Stainless Steel of Grade 304L.

The required temperature of water (80 ^{O}C)is to be *achieved with in a time period of 8 hours and the Electrical heaters shall be suitably sized.*. The heat loss has to be kept minimum and hence the equipments and the piping of the flushing stand shall be provided with thermal insulation. Thickness of insulation shall be suitable for maintaining a surface temperature not more than 50 ^{o}C

DM water in the storage tank will be provided with Nitrogen blanket (By BHEL) at a pressure of about 0.2 Mpa for preventing atmospheric contamination as well as for improving the NPSH at the pump inlet.

Size and details of piping and pipe fittings shall be selected for flow velocity of around 3.5 m/s and minimize pressure drop under maximum flow condition

All equipments and piping of the flushing stand shall be neatly arranged. Pump will be provided with sufficient space all around for accessing and maintaining them, when ever required, hand wheels of manually operated valves shall be positioned at suitable elevation for easy operation, sufficient space for removal of cartridges / strainer baskets shall be provided. Local control panel for operation of pumps and mounting of instruments and gauges shall be appropriately located so that operation of the system can be monitored from the panel location (near to flow regulating valves)

Hydrotest of the individual equipment as well as the system shall be carried out as per ASME Section VIII Division 1 using DM water meeting the quality requirement as per Clause 9

Required sizes of pipes are indicated in the scheme and a indicative list of valves required for the system is furnished separately. Quantity and type of various pipe fittings including adapters, wherever required, and length of pipes will be decided by the vendor based on the piping layout to be prepared by them for a minimum pressure drop.

Joints on the pressure boundary or those coming in contact with flushing fluid are made with full penetration welds without backing ring so as to have no crevices for accumulation of contamination.

Joits shall be made using qualified procedure as per applicable code.

Surfaces of all welds shall be smooth with surface finish of 6.3 microns or better.

All pressure boundary joints are subjected to NDE as per code. PT is required for all joints

6. Materials :

Pipes, pipe fittings, valves and flanges shall conform to the following ANSI Standards

i)	Pipes	ANSI B 36.10
ii)	Pipe fittings with BW Ends	ANSI B 16.9
iii)	Pipe fittings with SW Ends	ANSI B 16.11
iv)	Pipe Fittings with Threaded Ends	ANSI B 16.11
v)	Flanges	ANSI B 16.5
vi)	Valves	ANSI B 16.34

Material of construction for Pipes, pipe fittings, valves, flanges and fasteners and gaskets for flanges shall be as per the following ASTM Standards.

i)	Pipes	ASTM A –312 TP 304L
ii)	Pipe fittings	ASTM A –182 F- 304L
iii)	Flanges	ASTM A –182 F- 304L
iv)	Valves	ASTM A –182 F- 304L For forged bodies ASTM A-351 CF 8 for Cast bodies
v)	Fasteners	ASTM SA 193 B7/ SA 194 2H
0vi)	Gaskets	Viton of shore hardness >75
vii)	Packing gland in Valves and Pumps	PTFE ropes.

All pipe fittings of sizes upto 40 NB shall be socket welded ends and fittings of larger sizes shall be of butt welded types and shall be rated for a design pressure of 10 Kg/cm^2 and maximum working temperature of 100 ° C. All pipes, fittings, valves etc coming in contact with flushing medium shall have a smooth finish on ID.

7. Technical points :

1. The details provided in this specification and the enclosed data sheets of the individual equipments are to be used as design basis. The supplier shall make an independent design review of the total system for the adequacy of the system parameters, including design parameter of the individual equipment, material selection for gaskets etc., so as to achieve the final performance parameters as detailed below.
2. *Suppliers of all bought out items shall be identified in the offer and approved by BHEL before placing PO.*
3. *The flushing system shall not have stagnant zones, long corrugated piping, crevices etc. allowing accumulation/concentration of impurities and contamination.*
4. Specification, *drawings and suppliers* of individual items like pump, motor, filters, cooler, cooling tower and valves shall be submitted for approval before ordering.
5. Where ever possible, pump motors shall be low speed motor (1450 rpm)

6. Electrical heaters shall be rated so that the water in the system plus tank is heated to 80 °C with in 8 hours. For finer temperature control, more number of heater banks (minimum 5) with individual ON/OFF control may be selected meeting the total heating requirement. The heating elements shall not come in contact with the medium
7. Electrical connections from the panel to individual motors shall be by copper cables.
8. Contactors and FSU units shall be SIEMENS / L&T make.
9. Only calibrated instruments shall be used
10. All gauges, transmitters and other instrument components shall be of reputed make
11. A control panel with digital read out of all measured parameters shall be provided at a location near the flow regulating valves to permit easy regulation and control of flow and temperature by the operator.
12. All instruments , gauges that are required to be mounted on the local control panel shall be neatly laid out at appropriate levels for ease of operation and maintenance Starters for the pumps motors and control switch for electrical heaters shall be available on the panel and shall be mounted in segregated area of panel if combined with other instrument panel.
13. Proper venting provision shall be made for complete venting.
14. Valve bodies shall be visually inspected, pickled and passivated in the presence of BHEL before assembly as per procedure to be approved by BHEL. Valve stem surface shall be smoothly finished so as to avoid peeling of packing material during opening and closing of valves and the same will be inspected by BHEL during assembly stage.
15. Also, the material for packing gland in the valves shall be suitable for the intended application without disintegration during service.
16. Material for gaskets between flanges shall also be selected so that there is no degradation of the gaskets during service. Gaskets shall be properly cut without any projection into the flow path.
17. All the instruments shall be properly calibrated and the calibration procedure for flow meters may be submitted for approval.

18. Thorough cleaning / pickling and passivation shall be done for all the stainless steel parts as per approved procedure and cleanliness shall be checked for all the components of the flushing system at components stage before assembly. This shall be one of the stages in QAP to be submitted by the supplier.
19. All external surfaces shall be coated with Aluminum paint.

8. Cleaning and preservation of parts and assemblies :

1. Cleanliness of parts and assemblies are considered to be satisfactory, if there is no dirt on wiping the surface with clean white lint free napkins wetted with acetone and cavities of the completed equipment do not have surface scaling, untypical deposits of corrosion products or foreign objects (e.g chip, powder, metal spray, weld spatter, slag, dirt, grease)
2. In order to ensure cleanliness of all parts and sub assemblies before assembly, cleaning, degreasing and drying is done before they become difficult to access.
3. Once cleaned, cleanliness is to be preserved by suitable methods. Cleaned and degreased surfaces are to be handled using clean gloves made from lint free material.
4. Prior to final assembly, all parts and sub assemblies are checked for cleanliness and absence of foreign objects in the inner cavities.
5. Parts and sub assemblies after cleaning and degreasing are to be dried by wiping the surfaces with clean white lint free napkins and completely dried in air.
6. All tools and fixtures including the cutting and measuring tools made of carbon steel used for handling SS materials during assembly in the inner cavities must have an anti corrosion (Chromium or Nickel) coating / wrapping.
7. All tools and fixtures used during assembly shall be clean and grease free.

9. Flushing and Pressure drop measurement of system after Erection and Commissioning :

The flushing system after final assembly and before being connected to the equipment shall undergo hot flushing as a closed circuit with hot DM water (To be supplied by

BHEL) as per the following sequence and it's performance and cleanliness level as given below shall be demonstrated in the presence of BHEL inspectors.

Chemistry of water to be used for flushing will be as follows :

Total mass concentration of salts **Or** Specific electric conductivity	1 mg/dm^3 or less 2.0 μ s/cm
mass concentration of dense residue	2 mg/dm^3 or less
mass concentration of chloride ions	0.05 mg/dm^3 or less
pH	6.5 - 7

Sequence of operation for flushing the system

i) *Prepare the system pipelines, filters etc. for flushing by closed circuit water circulation. Check their cleanliness and clean them, if required. Visible contamination on filters is prohibited.*

ii) *Connect the bridge piece across the inlet and outlet lines.*

iii) *Take DM water sample just before filling the system to check chemistry*

iv) *Fill the flushing system with DM water. Suitable provision for venting and draining shall be ensured. Start circulating water and ensure flow rate at 40±2 tons / hr.*

v) *Maintain the circulation till the water temperature reaches 80-90 °C. Heaters must be switched on to achieve the temperature.*

vi) *Flush the system at 40±2 T/hr. Flushing of system shall be done for min. 8 hrs.*

vii) *Periodicity of outlet filter inspection for cleanliness is 2-4 hrs.*

viii) *Clean or Replace filtering elements as they are contaminated, but not later than 8 hrs. of washing.*

ix) *Final flushing is performed by 2 hrs cycles. Each cycle is completed by flushing in forward direction.*

x) *At the end of flushing cycle, flushing water sample shall be taken for water quality analysis.*

xi) *Outlet filter shall be inspected after washing cycle end. Acceptance as mentioned below.*

xii) *Flushing is treated as satisfactory, if in three samples consequently taken every 30 minutes :*

a) There are no visible mechanical particles, oil products and other greasing impurities which is confirmed by the results of water sampling analysis.

b) Growth of mass concentration of dense residue and salt content does not exceed 1.0 mg/dm^3 and 0.5 mg/dm^3 respectively, if compared with initial water. Chloride ion content does not exceed 0.05 mg/dm^3.

c) There are no mechanical particles, corrosion and other contamination on outlet filter element when checked with finer white lint free cloth.

d) Absence of oil products, rainbow on water surface and oil spot on white filter paper.

e) *There are no visible mechanical particles and contamination on accessible inner surfaces of adapters, piping etc.*

xiii) *After completing the flushing cycles satisfactorily as above, measure the pressure drop across the system which shall not exceed 1.5* kg/sq.cm.

xiv) *Complete draining of the system shall be ensured after completion of flushing.*

xv) *Finally, outlet filter in the return line shall be inspected to ensure there are no visible mechanical particles, corrosion and other contamination on the mesh.*

10. Equipment Layout and Piping

All equipments and piping of the flushing stand shall be neatly arranged. Pump will be provided with sufficient space all around for accessing and maintaining them, when ever required, handles of manually operated valves shall be positioned at suitable elevation for easy operation, sufficient space for removal of cartridges / strainer baskets shall be provided. Local control panel for operation of pumps and mounting of instruments and gauges shall be appropriately located so that operation of the system can be monitored from the panel location

Required sizes of pipes are indicated in the scheme and a indicative list of valves required for the system is furnished separately. Quantity and type of various pipe fittings and length of pipes will be decided by the vendor based on the piping layout to be prepared by them.

11. Documents / details to be submitted along with the technical Bid.

- Lay out drawing in 3D indicating the overall dimensions of the system.
- Bill of materials covering the total scope.

- List of recommended spares for erection and commissioning and for 5 years operation with item wise price.
- Catalogues and data sheets of pumps, motors, Strainers, flow measurement devices and other instrumentation items.
- Filters being a very critical component, the constructional features of filters showing the sealing arrangement and fixing details of filter elements, which will illustrate the method of removal and replacement of filter elements shall be furnished.
- Total power requirement for the system shall be indicated in the offer
- Detailed quality plan for the total system as well as the individual items like pumps, valves, filters, and instruments for approval.
- Pressure drop in the total system and also across individual strainers and Valves shall be indicated in the offer.

12. Documents to be submitted after placement of order

- Pressure drop calculation for the total system and also across individual strainers and Valves.
- The orifice calculation for DP indicator and calibration certificate for the transmitter to match with DP
- **Three sets** of Operation & Maintenance manual giving the following details to be provided in **hard and soft copies (CDs)**
- Complete step-by-step operating procedure including safety precautions.
- Maintenance procedures & trouble shooting hints for the system and individual components including preventive maintenance check points.
- Complete set of assembly & sub-assembly drawings with dimensions & bill of materials and manufacturing part drawings for wearing components.
- Complete specification and original catalogues of all the bought out items.
- Complete list of spares with purchase specifications, part numbers, make, etc.

Technical Specification of Strainers in the secondary Supply Line

01.	Type of filter	Basket type with wire mesh type filter element. As an alternative, wedge wire type filter element shall also be proposed. Selected option will be indicated in the P.O
02.	Rating / mesh size	**100** microns maximum pore size. Details like size and number of strainers required for specified service shall be indicated.
03.	Flow medium	Demineralised (DM) water
04.	Medium pressure	10.0 Kg/cm^2
05.	Medium Temperature	100 $^{\circ}$ C
06.	Flow rate	40 T / hr (Operating condition)
07.	Quantity	To be specified by the supplier to meet the specified flow rate and pressure drop for the specified size Additional spares required for bucket and filter element assembly will be specified before placing P.O.
08.	Mode of operation	Continuous operation in multiple 8 hrs cycle. Filter element may need frequent replacement. Design & installation shall ensure easy replacement. Davit arrangement may be provided.
09.	Constructional details	• A sketch showing suggestive arrangement of the filter is enclosed. • The sketch gives schematic arrangement of the strainer with wire mesh type filter element. Sizes shown are only indicative. • Details of sizing and design along with detailed fabrication drawings shall be submitted for approval for wire mesh type and wedge wire type filter element separately. • The wire mesh shall be supported by suitable perforated shells. • Details ensuring following requirements shall be clearly shown in the sketch a) Leak proof brazed/welded mesh long seam joint b) Leak proof brazed/welded mesh/wedge wire to end caps c) Leak proof welded end caps to flange

10.	Pressure drop	Maximum of 2.5-meter water column across inlet and outlet nozzle of strainer. Calculation for the same shall be submitted.
11.	Inlet	80 NB with WNRF flanged end
12.	Outlet	80 NB with WNRF flanged end
13.	Material of construction	SS 304L for all wetted parts Gasket: VITON of shore hardness >75
14.	Code of Construction	ASME Sec. VIII Div.1
15.	Strainer Flange connection	Groove type with O ring gasket
16.	Tests to be carried out & documents to be submitted	a) QAP & test procedures indicating stages of inspection to be submitted with the quotation. b) Material's TCs; after placement of PO. c) Bubble test for pore size of mesh. d) Seat leak test shall be conducted at 10 Kg/cm^2 pressure. Detailed testing procedure shall be submitted for approval. e) NDE of weld joints f) Cleaning of all parts as per procedure to be submitted for approval g) Pickling and passivation of all parts. Procedure to be submitted for approval h) Hydro test of the equipment with DM water. Procedure to be submitted for approval.
17.	Guarantee	Trouble free operation for one year from the date of commissioning or 18 months from the date of receipt of material at our works, which ever is later, shall be guaranteed.

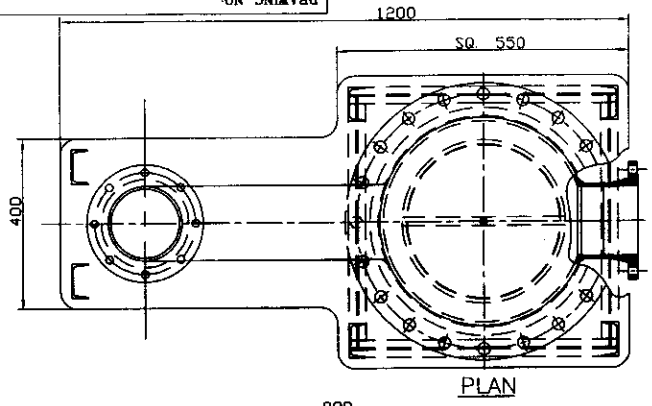
Technical Specification of Strainers in the Secondary return Line

01.	Type of filter	Basket type with wire mesh type filter element. As an alternative, wedge wire type filter element shall also be proposed. Selected option will be indicated in the P.O
02.	Rating / mesh size	**200** microns maximum pore size. Details like size and number of strainers required for specified service shall be indicated.
03.	Flow medium	Demineralised (DM) water
04.	Medium pressure	10.0 Kg/cm^2
05.	Medium Temperature	100 ^{o} C
06.	Flow rate	40 T / hr (Operating condition)
07.	Quantity	To be specified by the supplier to meet the specified flow rate and pressure drop for the specified size Additional spares required for bucket and filter element assembly will be specified before placing P.O.
08.	Mode of operation	Continuous operation in multiple 8 hrs cycle. Filter element may need frequent replacement. Design & installation shall ensure easy replacement. Davit arrangement may be provided.
09.	Constructional details	• A sketch showing suggestive arrangement of the filter is enclosed. • The sketch gives schematic arrangement of the strainer with wire mesh type filter element. Sizes shown are only indicative. • Details of sizing and design along with detailed fabrication drawings shall be submitted for approval for wire mesh type and wedge wire type filter element separately. • The wire mesh shall be supported by suitable perforated shells. • Details ensuring following requirements shall be clearly shown in the sketch a) Leak proof brazed/welded mesh long seam joint b) Leak proof brazed/welded mesh/wedge wire to end caps c) Leak proof welded end caps to flange

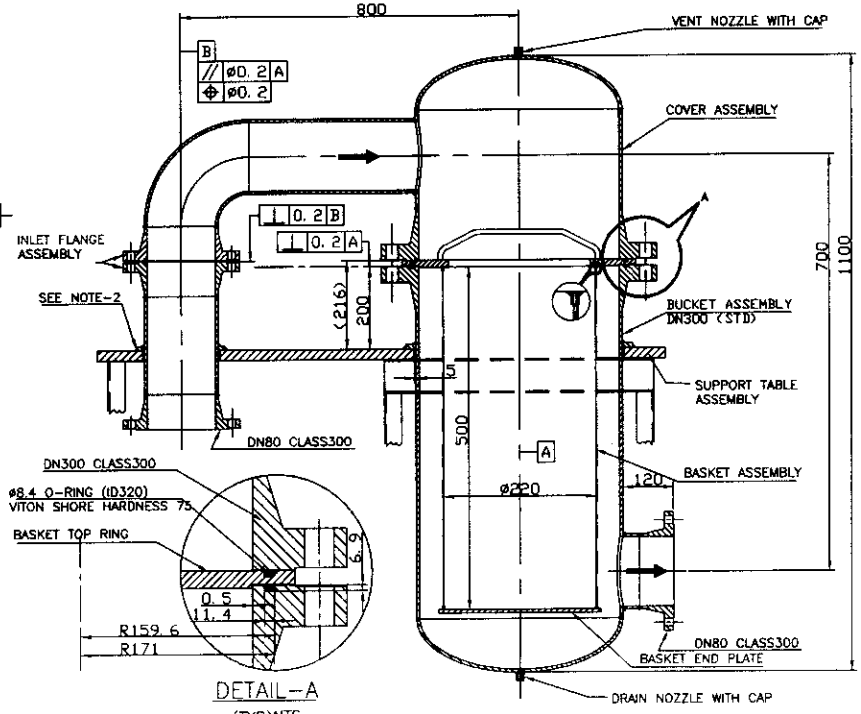
10.	Pressure drop	Maximum of 2.5-meter water column across inlet and outlet nozzle of strainer. Calculation for the same shall be submitted.
11.	Inlet	80 NB with WNRF flanged end
12.	Outlet	80 NB with WNRF flanged end
13.	Material of construction	SS 304L for all wetted parts Gasket: VITON of shore hardness >75
14.	Code of Construction	ASME Sec. VIII Div.1
15.	Strainer Flange connection	Groove type with O ring gasket
16.	Tests to be carried out & documents to be submitted	a) QAP & test procedures indicating stages of inspection to be submitted with the quotation. b) Material's TCs; after placement of PO. c) Bubble test for pore size of mesh. d) Seat leak test shall be conducted at 10 Kg/cm^2 pressure. Detailed testing procedure shall be submitted for approval. e) NDE of weld joints f) Cleaning of all parts as per procedure to be submitted for approval g) Pickling and passivation of all parts. Procedure to be submitted for approval h) Hydro test of the equipment with DM water. Procedure to be submitted for approval.
17.	Guarantee	Trouble free operation for one year from the date of commissioning or 18 months from the date of receipt of material at our works, which ever is later, shall be guaranteed.

DRAWING NO: SK-3-D040-069

ALL DIMENSIONS ARE IN MILLIMETERS



PLAN



DETAIL-A
(TYP)NTS

NOTES:
1. MATERIAL OF CONSTURCTION OF ITEMS EXCEPT FOR SUPPORT PLATE ASSEMBLY SHALL BE SS304L

2. WELD SHALL BE DONE WITH DISTROTION CONTROL IN ASSEMBLY/FIT UP CONDITION WITH INLET FLANGE ASSEMBLY.

3. THIS DRG SHOWS ONLY SCHEMATIC ARRANGEMENT OF THE STRAINER WITH WIRE MESH TYPEFILTER ELEMENT. SIZES SHOWN ARE INDICATIVE.

REV	DATE	ALTERED :
01		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: BARC

PRODN.DRG.

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI – 620014
05-229/D

	NAME	SIGNATURE	DATE	NO. OF VAR
DRN	P.B		181007	
CHD	SANJAY			
APPD	A.S.			

DEPT	GRADE OF UNTOL DIM		SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG	ITEM NO	No OF ITEMS
NC	C/M/F		1:1	0.000			
CODE 150							

TITLE: FILTER-SECONDARY SIDE

CARD CODE: U 01

DRAWING NO : SK-3-D040-069

REV: 00

Size A3

Data sheet for Pump P1-Secondary side

01	Type	Horizontal type single stage centrifugal pump with end suction and vertical discharge, electrically driven mounted on a common base plate
02	Medium	Demineralised water
03	Design pressure	10 Kg/cm^2
04	Design Temperature	100 ^{o} C
05	Flow rate	50 tons / hr at 100 ^{o} C
06	Head	75 M
07	Quantity	1 No
08	Discharge Nozzle size	80 NB
09	Suction Nozzle size	100 NB
10	End connections	With corresponding size flanges
11	Material of Construction (All wetted parts)	Stainless steel (Grade 304 L)
12	Motor rating	To be furnished by vendor Recommended Suppliers for motors : M/s SIEMENS, M/s KIRLOSKAR, M/s BIJLEE BHARAT, M/s NGEF, M/s CROMPTON

Data sheet for Storage Tank -Secondary

S.No.			
1	Quantity		1 No.
2	Type		Cylindrical tank with dished ends at both the ends &supported on saddles
3	Capacity		5 Cum
4	Operating Pressure		2.5 Kg/sq. cm
5	Operating Temparature		90 deg C
6	Design Pressure		5 Kg/sq. cm
7	Design Temparature		100 deg C
8	Design Code		ASME Section VIII, Div. 1
9	Material of construction		Stainless Steel - Grade 304L
10	Material Specification No.		
	I).	Shell and Closures	ASTM A-240 Type 304L
	ii).	Nozzles	ASTM A-312 Type 304L
	iii).	Flanges	ASTM A-182 Type 304L
	iv).	Gaskets	Viton of shore hardness> 75
	v).	Manhole	ASTM A-240 Type 304L
	vi)	Supports	Carbon steel (support welding to tank with SS poison plate of ASTM A-240 Type304L
11	Support type & Nos.		Saddle type -2 Nos. with one end free.
12	Insulation		To be selcted by the vendor

Nozzle Schedule

S. No.	Description	Size	Qty.
1	Pump P1 suction	100 NB Sch 40	1 No.
3	Filling / chemical addition	40 NB Sch 40	1 No.
4	Vent	40 NB Sch 40	1 No.
5	Drain	40 NB Sch 40	1 No.
6	Nitrogen filling	20 NB Sch 40	1 No.
7	Safety relief Valve	20 NB Sch 40	1 No.
8	Water Level measurement	20 NB Sch 40	2 Nos.
9	From Strainers	80 NB Sch 40	1Nos.
10	Temperature indicator tapping	20 NB Sch 40	1 No.
11	Pressure indicator tapping	20 NB Sch 40	1 No.
13	Pump, P1 discharge bypass	80 NB Sch 40	1 No.
14	Manhole	600 mm ID	1 No.

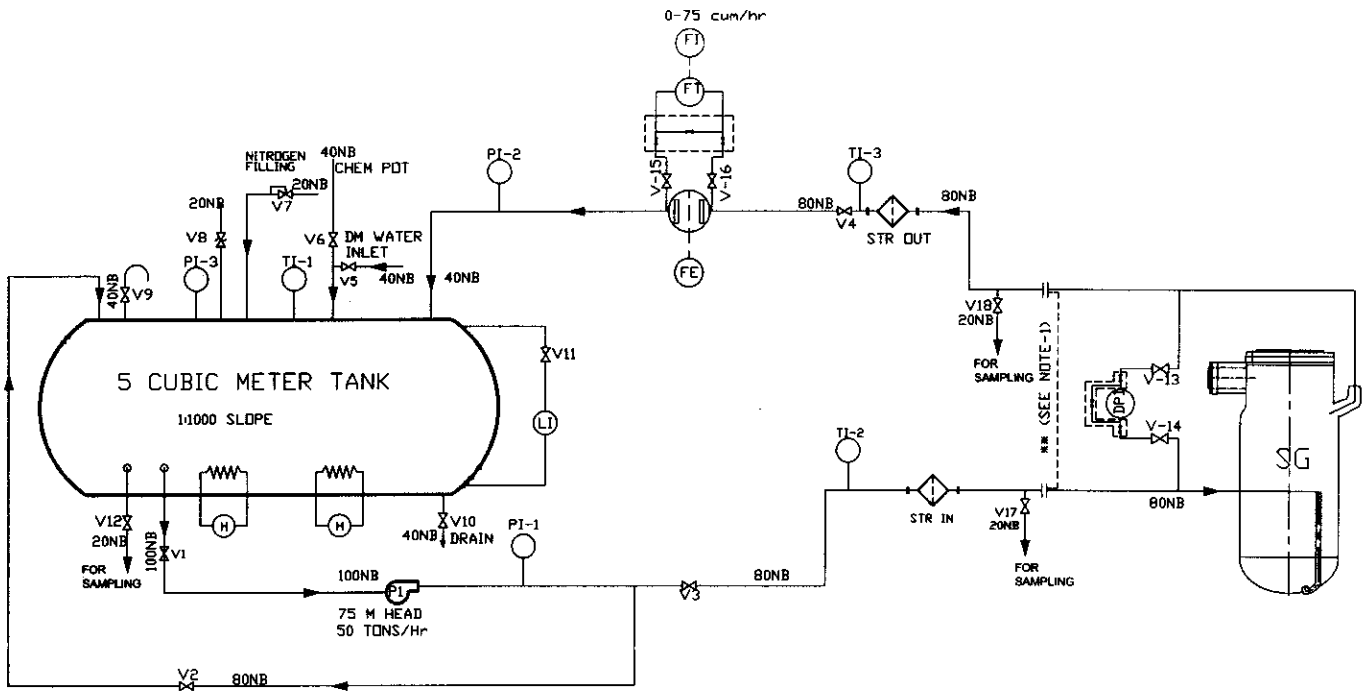
Valves Schedule for Secondary Side Flushing Scheme				
Serial No.	**Valve No.**	**Size**	**Type**	**Function & Location**
1	V-1	100 NB	Gate	Tank to pump P-2 suction
2	V-2	100 NB	Globe	Pump, P-2 bypass line
3	V-3	80 NB	Globe	Pump, P-2 discharge
4	V-4	80 NB	Globe	Pump, P-3 bypass line
5	V-5	80 NB	Globe	Pump, P-3 discharge
6	V-6	80 NB	Globe	Pump P-2,P-3 flow regulating valve
7	V-7,8	80 NB	Gate	Strainer isolation valve
8	V-9	40 NB	Globe	Storage tank Vent
9	V-10	40 NB	Globe	Storage tank DM water fillig
10	V-11	40 NB	Gate	Storage tank drain
11	V-12	20NB	Globe	Impulse line process valves for Storage tank level
12	V-13,14	20 NB	Globe	Impulse line process valves across DPI
13	V-15,16	20 NB	Globe	Impulse line process valves across FE
14	V-17,18	20 NB	Needle	Sampling line at inlet & outlet of equipment
15	V-19,20,21	80 NB	Gate	Valves for isolating flushing sys. From equipment
16	V-22	20 NB	Needle	Sampling line at tank

Schedule of Instrumentation and Control - Secondary side

Serial No.	Tag NO.	Process Parameter	Location	Units	Values		Accuracy	Idendication Local/ Inst Panel	Alarm/ Interlocks	Remarks
					Nominal	Range				
1	PI-1	Pump P-1 Discharge Pressure	Pump, P-1 Discharge Line	Kg/cm^2	7.5	0-16	±1%	Local	No	Bourdon Gauge
	PI-2	Pressure in the return line	Return line	Kg/cm^2	7.5	0-16	±1%	Local	No	Bourdon Gauge
	PI-3	Tank pressure	Storage tank	Kg/cm^2	2.5	0-5	±1%	Local	No	Bourdon Gauge
2	LI	Storage Tank Level	Storage Tank	mm	2000	0-3000	±1%	Local	No	Level Indicator
3	FI	Flow from the eqipment	Discharge line(65NB)	tons /hr	Feb-00	0-50	±1%	Local	No	Orifice plate with flow transmitter
4	TI-1	Temperature of medium in Tank	Tank	° C	75	0-100	±1%	Inst. Panel	No	RTD
5	TI-2	Temperature in the pump discharge line	Discharge line	° C	90	0-100	±1%	Inst. Panel	No	RTD
6	TI-3	Temperature of medium in the return line	Return line	° C	70	0-100	±1%	Inst. Panel	No	RTD
7	DPI	Differential Pressure across Vessel	Across inlet and outlet from the vessel	Kg/cm^2	2.5	0-5	±1%	Local	No	DP gauge

SK-3-D040-004

ALL DIMENSIONS ARE IN MILLIMETERS



NOTES

1. ** BRIDGE PIPE WITH MATING FLANGES ON BOTH ENDS. FLANGE FACES SHALL BE IN BE PLANE.
2. THIS SKETCH GIVES ONLY SCHEMATIC OF THE LOOP. DETAILED DRAWING SHALL BE SUBMITTED FOR APPROVAL.
3. DESIGN, FABRICATION AND TESTING OF THE FLUSHING SHALL MEET REQUIREMENTS OF ASME SEC.VII DIV.1.
4. SYSTEM SHALL NOT HAVE STAGNANT ZONES (e.g. CREVICES, CORRUGATED PIPING ELEMENTS ETC.)RESULTING IN COCENTRATION OF CONTAMINATION.
5. IF PUMPS COME WITH INTEGRAL PRESSURE GAUGE AT ITS DISCHARGE, THEN ADDITIONAL PRESSURE GAUGES PI-1 ARE NOT REQUIRED.
6. FOR DP MEASURE VALVE OPENING AND CLOSING SCHEMES SHALL BE SAME AS FORWARD FLOW SCHEME EXCEPT THAT VALVES V13 & V14 SHALL BE KEPT OPEN.

VALVE OPENING(O), CLOSING(C) & REGULATING(R) SCHEME.

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18
FORWARD ⟶	O	R	O	O	C	C	–	–	C	C	O	C	C	C	O	O	C	C
SYSTEM CLEANING ⟶	O	C	O	O	C	C	–	–	C	C	C	C	C	C	C	C	C	C

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	D040 BARC		
Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI – 620014	DRN P.S 181007 CHD S.K 181007 APPD A.S 181007		
MATERIAL 160	WEIGHT (Kg)		
TITLE: SECONDARY SIDE FLUSING SCHEME	CAGE CODE U 01	DRAWING NO: SK-3-D040-004	REV 00

Size A1

Annexure - 1
Quality Assurance Plan

01	Raw material	Verification of Material TC's (pipes, pipe fittings, valves, plates, qaskets, packinqs, consumables	
		Visual inspection & record of all accessible surfaces for cleanliness, burrs, qeneral surface finish	
		Cleaning of all parts before assembly. All SS parts shall be pickled and passivated	
		Immediately before assembly wipe all parts with acetone soaked lint free cloth	Note 2
02	Pump / Valve	Verification for Pumps: TC's, Performance test records, Characteristic curves, Motors TC's	
		Verification of BOM and TC's for the raw materials. Eliminate any material that can degrade during flushing.	
		Cleaning of all parts before assembly. All SS parts shall be pickled and passivated	
		Immediately before assembly wipe all parts with acetone soaked lint free cloth	Note 2
		RT of welded joints, if any. Only full penetration welds permitted.	
		Dry and pack hermetically	
03	Filter	Verification of BOM and TC's for the raw materials. Eliminate any material that can degrade during flushing.	
		Bubble test of mesh to determine biggest pore size	
		Only full penetration welds permitted. RT of all weld joints	
		Verification of long seam joint, end cap to mesh, end cap to collar joint on filter element for leak tightness	
		Pickling and passivation of the equipment without filter element and preservation till assembly	
		Cleaning of the filter element and other parts that are not pickled with acetone soaked lint free cloth and assembly	Note 2
		Hydrotest	
	Instrumentation	Verify TC's and calibration records	

Notes

1. This is only an indicative QAP covering the minimum stages of inspection required. Supplier shall submit a detailed Quality Assurance Plan that will ensure product quality.
2. Wiping with acetone soaked lint free white cloth shall not lead to discoloration of the cloth