

PART-A(i)

INDEX

SEC.	DESCRIPTION	PAGE NO.
PART-A (TECHNICAL BID)		
(1) PROJECT INFORMATION		
1.1	Instruction to bidders	2
1.2	Scope of works	2
1.3	Free issue materials/ facilities and exclusions	2
1.4	Completion period	3
1.5	Drawings	3
1.6	Sub-contractors/ suppliers	3
1.7	Deviations	4
(2) Inspection, Testing and Commissioning		
2.1	Test certificate	4
2.2	Inspection & testing	4
2.3	Site testing	5
2.4	Welding: Inspection & Acceptance standard.	6
2.5	Acceptance	7
2.6	Completion of erection & commissioning	7
2.7	Handing over	8
2.8	Guarantee	8
2.9	Measurements of works	8
2.10	Painting: Colour code	9
(3) DESIGN BASIS		
(4) TECHNICAL SPECIFICATIONS		
4.1	Specifications of components	11
4.2	Specifications for piping installation	19
4.3	Specifications for flow balancing	20
4.4	Electrical Specifications	20
4.5	Specifications for control cables	22
(5) TECHNICAL DATA SHEETS		
(6) APPROVED MAKES		
(7) STANDARDS/ CODES		
(8) QUALITY ASSURANCE PLANS		
(9) DRAWINGS		

PART-A (TECHNICAL BID)

1. PROJECT INFORMATION

IPR is developing Liquid lead lithium MHD (LLMHD) loop and Experimental Helium Cooling Loop (EHCL) as a part of Research & Development activities.

In the LLMHD loop, number of MHD experiment with different test mock ups will be performed. An electromagnet is one of the major components of LLMHD loop. The electromagnet consists of C-shaped Iron core and two numbers of the helical coils (electrically connected in series). The heat generated during the operation of electromagnet is to be removed efficiently from both the coils. Therefore demineralized water will be required in order to remove the heat dissipated (~550 kW) in the two (Maximum Current 24kA @ 30V) coils. Both the coils of electromagnet are made of OFE copper conductor (60 x 60mm² square) with 32 mm ID for cooling water.

EHCL is a high pressure, high temperature helium cooling system which operates at 8 MPa (80 bar) pressure, 300-400 °C temperature and at maximum flow capacity of 0.4 kg/s.

In the EHCL, cooling water is required to extract heat from the components that are described below:

1. Coolers (Helium-Water heat exchanger): There are two coolers in EHCL, one unit will be operational and the other unit will be in stand-by mode. The function of cooler is to extract heat from high temperature helium and reject to cooling water.
2. Vacuum vessel: The vessel houses the test mockups and shall be cooled by cooling water from its outer body to extract the heat generated by test mockups.
3. Electron beam gun: The gun is a heat source and used to produce incident heat on the test mockups. The gun shall be cooled by cooling water to extract the heat generated in it.

The proposed cooling water system will have a header from where DM water will flow at rated pressure, temperature in both the coils and other components and heat dumped into the water will be extracted by PHE, which in turn will be further dissipated into the atmosphere through a secondary circuit containing a cooling tower. The details of the water distribution system are mentioned in this tender.

Hence, to meet the above objective, the system offered must be ease of operation and maintenance, minimum noise level, reliability, simplicity, compactness, modularity and interchangeability.

The system offered with better parameters as mentioned above and satisfying all functional aspects shall be preferred.

- The Bidder shall have studied in detail the site conditions, scope of work, specifications, tender drawings, labor and other respective terms and conditions as applicable, each system complication to make piping layout specified in the tender.
- The Bidder shall have got clarified for any confusion regarding the tender terms and conditions, specifications, drawings and may be allowed to visit the site before submitting the offer.
- The Bidder shall timely complete the scope of work, through better planning, management, execution and coordination with all concern without compromising the quality of material and finished work, as the time is the most critical requirement of the work.

1.1. ADDITIONAL INSTRUCTION TO BIDDERS:

The Bidder shall enclose following with the offer:

- a. The entire original tender documents and drawings duly endorsed.
- b. Technical data sheet duly filled in without missing any details.
- c. Sealed price bid with Schedule of Quantity with all the unit rates for all the items. The quantities specified in the SOQ are provisional. IPR reserves the right to increase or decrease the quantities of work or to totally omit any items of work and the contractor shall not be entitled to claim any extras of damages on these grounds. These variations shall be permitted until such time contractors shop drawings are approved.
- d. Documentary evidence should be furnished in support of eligibility criteria.

1.2. SCOPE OF WORK

The scope of work is supply, fabrication (to suit site condition/ system layout), installation, testing and commissioning of SS and MS Piping Works including pumps, valves, cooling tower, PHE (Plate type heat exchanger), mixed bed polishing unit, SS tank, instrumentations etc. confirming to tender specifications, relevant BIS codes, in accordance with proposed schedule of quantities and approved drawings. Also, the scope includes the preparation of pipe routing drawings and layout drawings.

The overall cooling water system for this project is designed to provide and maintain necessary temperature, pressure, flow and quality of water to various sub systems of TBM experimental system as per requirements. The Bidder shall carry out work in every respect in conformity with the contract documents and with the directions of the Engineer-in-Charge.

1.3. FREE ISSUE MATERIALS/ FACILITIES AND EXCLUSIONS

A. Free issue materials (FIM):

IPR shall provide the following valves to the vendor for installation in the Cooling Water System as per requirement and shown in P&ID. Supply of required quantity and size of mating flanges, PTFE gaskets and metric thread nut-studs fasteners sets in the vendor's scope.

Sr. no	Description	Size (NB)	Class	Rate (Rs.)	Qty.	Cost (Rs.)
1.	Butterfly Valve (BFV)	50	150	18,000	02	36,000
2.	Globe Valves (GLV)	40	150	45,000	02	90,000
3.	Pressure Reducing Valve (PRV)	50	150	75,000	01	75,000
4.	3-Way diverting valve	40 or 25	150	120,000	01	120,000
5.	Flow Meter (Turbine type)	25	150	45,000	02	90,000
6.	Flow Meter (Turbine type)	40	150	55,000	02	110,000
Total (Rs.)						5,21,000

B. Free facilities:

- IPR shall provide free power and free water (except for manufacturing or producing of any item at site, which will be charged and recovered at the prevailing market rates) for the requirement of this project.
- IPR shall provide free instrument air, other purging gases required during testing & commissioning.
- IPR shall provide main incoming power supply.

- IPR will not provide covered site office cum stores for the execution of the project.
- All the insurance after delivery of materials at the site will be the contractor's scope.

The contractor should employ required man power till the final commissioning of the project.

1.4. COMPLETION PERIOD:

The total completion period is **8 months from the date of approval of working drawing**. The work in totality must be completed within the completion time period as per approved Bar chart / Project schedule. The entire project is to be completed at the earliest; hence the Bidder's labour may have to work on 24 hours basis/ round the clock if required, with necessary prior permission.

The Bidder shall provide preliminary Bar chart along with the offer to justify the specified completion period.

1.5. DRAWINGS:

The P&I Drawings enclosed with tenders are schematic only and indicate the extent of work covered in the contract. The drawings broadly suggest the concept and routes to be followed. Under no circumstances shall dimensions be scaled from these drawings. Any modifications / changes required to coordinate installation work as per site conditions, shall be made in consultation with and approval of Engineer-in-Charge.

After the award of the contract, the Bidder shall furnish three sets of detailed shop floor drawings, including overall system flow diagram (P & I diagram), Piping & instrument layout, foundation/ support details etc. with necessary sectional views as required for the approval of Engineer-in-Charge within **4 weeks** time from the date of PO/WO. The 3-D and or isometric views shall be prepared as per the instruction of the Engineer-in-Charge. **For the list of drawings refer tender Section-9.**

All drawings shall be submitted for approval in hard as well as soft copies in the size as desired by the Engineer-in-Charge. However preliminary soft copies prepared by IPR will be furnished to the successful bidder. Where drawings are approved, said approval does not mean that drawings supersede the contract requirements nor does it in any way relieve the Bidder of the responsibility or requirement to furnish material or perform work as required by the contract.

1.6. SUB-CONTRACTORS / SUPPLIERS:

List of sub-contractors, vendors and suppliers proposed for any part of work, system components, must be submitted to IPR for approval before placing the WO/ PO by the main contractor. The decision of the IPR Engineer-in-Charge to approve or reject sub-contractors, vendors and suppliers proposed for any part of work, system components shall be final. After getting approval of IPR Engineer-in-Charge, Copy of such orders shall be submitted for confirmation along with all specifications thereafter.

1.7. DEVIATIONS:

The Bidder shall attach separate sheets containing the techno-commercial deviations if any, in the following format.

Sr. no.	Tender condition	Deviation	Remark.
----------------	-------------------------	------------------	----------------

IPR reserves the right to include additional terms and conditions in the Contract documents and it will be binding on the Contractor.

Place:
Date:

Signature and seal of Bidder

2. INSPECTION, TESTING COMMISSIONING AND ACCEPTANCE:

All materials and equipment shall confirm to the relevant Indian / equivalent standards and shall be of the approved make (Refer sections 6 & 7). All the equipment / system components specifications shall be approved before placing the order to suppliers / sub contractors. A copy of purchase / work order with specifications must be submitted for confirmation to Engineer-in-Charge.

2.1. TEST CERTIFICATES:

The contractor shall furnish following Test certificates.

- Material testing of various components of the equipment.
- Welder's qualification certificate.
- Performance test certificates carried out by manufacturer.
- Performance guarantee certificate / calibration certificate/ balancing certificate.

2.2. INSPECTION AND TESTING:

All the tests shall be carried out **in the presence of the representative of IPR**. The contractor shall provide services, required for the tests all instruments. All the system components will be physically inspected and tested before and after installation according to approved specifications and drawings. For detail procedure, refer the following.

1. All the system / equipments shall be checked before / after satisfactory commissioning, at site as may be required for the approved technical specifications, performance data provided by supplier / manufacturer. Performance acceptance is subject to comparison of test results with supplier / manufacturer's performance data and contract specification. Acceptance is subject to satisfactory Installation, commissioning and performance testing with respect to technical specifications. Rejected items must be replaced or rectified for the defects. In case of system modification / rectification complete performance tests are to be repeated. Site test readings shall be jointly recorded.

2. In general, following Inspection / tests are involved. Type of test, duration of test, testing procedure / parameters, will be as per the applicable BIS codes. However, the detailed inspection and test procedure shall be worked out jointly by the purchaser and the contractor along with the approval of drawings, within 15 days from the date of contact agreement.

- a. Pre-dispatch Inspection.
- b. Pre-dispatch testing at manufacturers shop / factory. (Material, performance, pressure, joints, etc.)
- c. Physical Inspection – Pre-installation at site.
- d. Welding joint inspection and testing at site.
- e. Pressure testing at site.
- f. Performance testing at site. (Capacity, power consumption, pressure drop, vibration, etc.)
- g. Calibration at site.

Sr. No.	ITEM/ EQUIPMENT	Inspection /Test Involved.
1.	Water chilling machines	a, b, c, e, f.
2.	Cooling Towers	a, b, c, f.
3.	PHEs	a, b, c, e, f.
4.	PUMPS-	
	- Mono block	c, e, f.
	- Split Casing - heavy duty	a, b, c, e, f.
	- BPO/ VMS SS PUMPS	a, b, c, e, f.
5.	Water Treatment systems	a, b, c, d, e, f.
6.	Electrical control panel boards	a, b, c, f.
7.	Variable speed drive and soft starter.	c, f.
8.	Piping - MS & GI	b, c, d, e.
9.	Piping and fittings - SS 316/ SS304	b, c, d, e, f.
10.	Valves / Control valves and strainers	b, c, e, f.
11.	Instruments and controls, DACS.	b, c, e, f, g.
12.	Tanks.- Pr. Vessels.	a, b, c, e.
13.	Insulation	c.
14.	MS/SS structural work	c, d.

Imported valves / instruments shall be accepted against the production of internal test reports of the manufacturer. However, it is left to the vendor to show the satisfactory performance of the valve / instrument at the site.

- All the arrangement for the said inspection and testing must be made and contractor shall absorb charges. The purchaser shall be intimated sufficiently in advance for 'a' and 'b'.
- Pre-dispatch inspection and clearance issued by purchaser / representative of purchaser, will not relieve the contractor from responsibility of showing the performance of the integrated system at IPR.
- Loop checking of all instruments at the site.

2.3.SITE TESTING:

The following aspects shall be considered for performance testing.

- Prevailing conditions shall be as close as to design conditions.
- Type, quantity, location, frequency, duration of test parameters shall be decided and recorded accordingly during the test.

- Rated capacity and other operating parameters shall be checked.

All piping shall be tested to hydrostatic test pressure of at least one and half times the maximum operating pressure, but not less than 10 kg/cm² gage for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified and gotten approved at site.

Piping repaired subsequent to the above pressure test shall be re-tested in the same manner. System may be tested in sections and such sections shall be securely capped, then re-tested for entire system.

The Contractor shall give sufficient notice to all other agencies at site of his intention to test a section or sections of piping and all testing shall be witnessed and recorded by Contractor's site representative.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through all coils and other heat exchange equipment in the system concerned. If proper circulation is not achieved due to air bound connection, the Contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectification including the tearing up and re- finishing of floors and walls as required.

The Contractor shall provide all materials, tools, equipment, instruments, and services and labour required to perform the test and to remove water resulting from cleaning and after testing.

2.4. WELDING: INSPECTION & ACCEPTANCE STANDARDS:

Use of electrodes: Only reputed electrodes like Advani / ESAB / D & H/ equivalent should be used for carrying out welding.

Following Inspection and testing shall be carried out.

- Root and final run for Butt-welds, Nozzle welds, Structural attachment weld, Hanger, Support welds, socket welds etc. shall be checked with
 - 100 % Visual examination + 10 % DP (Dye Penetration) examination + 10 % sample Radiography (SS piping- 25 NB and above)
 - 100 % Visual examination + 100 % DP examination + 10% sample Radiography (Pr. vessels and tanks & for socket welds)
 - 100 % Visual examination + 10 % DP examination for Structural welds.
- Visual checkup includes: Base metal identification, Base metal defects rectification, Edge preparation, Joint - Fit-up checking for both longitudinal and circumferential welding, Check of pipe -dia., Cleanliness, Tacking, Root pass & subsequent pass appearance, Cleaning between the passes, Completed weld appearance, Condition of the base metal in the area adjoining the welds, Excessive distortion if any due to welding.
- DP examination: Procedure shall be as per Pr. Vessel code. However it includes Check for any crack or linear indication, porosity, or slag inclusion.
- Tolerances for Fabrication of pipes and fittings:
 - Pipes:**
Dia: Tolerance: ± 0.5 % of OD (Check by measurement of circumference), Length: < 5 mm for 3 m length.,
Roundness: 1 % of Pipe Dia.
 - Fittings:**
Angular Dimension: $\pm 1/8$ " degree.

OD at Bevel: Nominal + 6.25 mm - 4.5 mm.

ID at Bevel: Nominal \pm 2.25 mm

Reinforcement Pads for Structural attachment: with gap < 1.5 mm.

- Radiography: For pipe 25 mm and above, selection of the location and dia. of the pipe and sample size shall be at the discretion of quality supervisor from Purchaser. If a joint or weld length is acceptable, the remaining length by same welder or group length shall be acceptable. In case of rejection two more length from the same lot / group shall be examined at the discretion of quality supervisor from Purchaser. If weld joints found defective after second radiography examination, all the remaining group joints shall be rejected. However the contractor shall have option of 100 % radiography. Welds with the crack, slag inclusions, cavity and incomplete fusion shall be rejected.
- Repair of Welds: Welds shall be repaired by additional welding in case of dimensional problem, but new weld joint to be done for deficient quality. Cracks can be removed by grinding, chipping, arc or flame gouging with DP test.
- All joints shall be subject to hydro test at-least 1.5 times the working pressures.
- **Valves:**
Physical, material, machining check shall be carried out stage-wise as required. Hydro-pneumatic leakage test for Body, seat shall be carried out for the time duration as per BIS code, including shop torque test. All technical performance parameters shall be checked within the allowable tolerance.

The contractor shall also demonstrate the proper operation of all controls, instruments, and other equipment. Hydrostatic test for all pressure piping shall be carried out. Water piping, fittings shall be tested to hydraulic test pressure of at-least one and half (1.5) times the maximum operating pressure, but not less than 10 bar, for a period of not less than 24 hours. Any leaks, defects shall be rectified and re-tested in same manner. After completion of the installation, all water system shall be adjusted and balanced to deliver the water as specified.

2.5. ACCEPTANCE

System components or system as a whole shall be tested for performance as per the approved technical specifications. System can be accepted and taken-over by IPR for regular operation only after satisfactory performance testing in all respect. Flow balancing and flow test will be completed with shorting the supply and return lines of each subsystem by appropriate size and length of nylon braided flexible PVC/ Rubber hose pipes and worm type hose clamps. All the system components shall meet the guaranteed performance requirements to the satisfaction of IPR.

Necessary replacement / modification / rectification shall be carried out with the approval of Engineer-in-Charge. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Engineer-in-Charge.

2.6. COMPLETION OF ERECTION & COMMISSIONING

All equipment shall be installed to have ease of operation and maintenance.

- **Painting:**

All MS parts/ piping shall be supplied with approved finish, shop coat of paint that have become marred during transportation or erection, shall be cleaned off with mineral, spirits, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the adjoining areas or as directed by Engineer-in-Charge.

2.7. HANDING OVER:

- **Site clearance:**

The Scope of work includes site clearance (after completion of job), hence all the area shall be cleared of debris and excess material left due to the contract and related work.

- **Handing over documents:**

On completion of the work in all respects, the contractor shall furnish 4 Nos. handing over documents in a good quality box - file containing minimum of:

- System description
- Design calculations and selection criteria or details
- Equipment technical data, Material test reports, Rating charts, Performance curves etc.
- Inspection and performance test reports
- List of recommended spares and cost.
- Complete set of detail as-built drawings on approved scale.

2.8. GUARANTEE

The contractor shall guarantee that all the equipment installed shall maintain the specified performance at least for 12 months after SITC and satisfactory acceptance. During warranty period, all complaints shall be attended within 24 hours of receiving call from user. Any repair / replacement / services shall be provided at no extra cost to the owner during this period.

2.9. MEASUREMENT OF WORKS

- **For all payment purposes physical measurements will be taken by contractor as per respective method as specified in the tender and relevant BIS code, in presence of IPR representative, in units indicated in SOQ. Payment shall be made on actual measurements.**
- **Measurement of weights will be in metric tons corrected to the nearest kilogram.**
- **Linear measurement will be in meters corrected to the nearest Centimeter.**
- **Measurement for supply of items shall be made as per units and quantities indicated item-wise in SOQ.**
- All materials / equipments issued by the owner shall be stored properly. Any damage to free issue material shall be recovered from the contractor.

Measurement for Piping:

Unless otherwise specified, measurement for piping for the project shall be on the basis of centre line measurements described herewith. Piping shall be measured in units of length corrected to centimeter along the centre line of installed pipes including all pipe fittings, flanges (with gaskets, nuts, and bolts for jointing), unions, bends, elbows, tees, concentric and / or eccentric reducers, inspection pieces, expansion loops etc. The above accessories shall be measured as part of piping length along the centre line of installed pipes, and no special multiples of pipe lengths for accessories shall be permitted. The quoted rates for centre line linear measurements of piping shall include all wastage allowances, pipe supports including hangers, MS/SS channel, wooden haunches, nuts, check nuts, vibration isolator suspension where specified or required, and any other item required to complete the piping installation as per the specifications. None of these items will be separately measured nor paid for. However, all valves (globe / check / butterfly / ball),

thermometers, pressure gauges shall be separately counted and paid as per their individual unit rates, which shall also include their insulation as per specifications. Piping measurements shall be taken before application of the insulation. Fabrication of all types of pipe supports, provided as per the instruction of Engineer-in-Charge, will be paid on weight basis, excluding weight of fasteners. All temporary lines or equipment required for flushing, testing, draining or drying should be provided, installed and dismantled by the contractor within his quoted rates. Open end of the pipes shall be blanked within his quoted rates.

Radiography charges shall be born by contractor. Additional radiography required due to poor quality of contractor's welder, will be done at contractor's cost.

2.10. PAINTING - COLOUR CODE;

All MS equipments /piping shall be supplied/ painted with approved finish, shop coat of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with two coats of enamel paint. Pump base plate / piping supports subject to water exposure to be painted with rubber paint using zinc base primer. All painting colour code shall be approved before execution. No separate payment shall be made for painting work. Reputed make like Asian/Berger etc are only to be used.

3. DESIGN BASIS

The main objective the Cooling Water System is effective utilisation and distribution of cooling water according to the requirement of the experiments.

There will be two water circuits which will be coupled through a PHE. The heat collected by the DM water from individual sub system of TBM (LLMHD and ECHCL) are dumped into the PHE, which is in turn dissipated into the atmosphere through a cooling tower.

Water in the primary circuit will flow in parallel through individual sub systems. In case of LLMHD, water will traverse in copper conductor, through 32 mm diameter through-hole. This will generate a flow rate in the range of 105 lpm in each circuit and maximum 480 lpm in total for all sub systems.

The proposed cooling water system will have a header from where DM water of $\leq 1 \mu\text{S}/\text{cm}$ will flow at rated pressure, temperature in each sub systems and heat dumped into the water will be extracted by PHE, which in turn will be further dissipated into the atmosphere through a secondary circuit containing a cooling tower. The details of the water distribution system are mentioned in this tender.

Hence, to meet the above objective, the system offered must be ease of operation and maintenance, minimum noise level, reliability, simplicity, compactness, modularity and interchangeability. The system offered with better parameters as mentioned above and satisfying all functional aspects shall be preferred.

Draining operation: For Draining purpose, the drain lines with vent valve shall be provided at appropriate places. Also, whenever the components need servicing, the water contained in them shall be removed through drain lines after isolating the components from the branch lines. Each header is having its own drain line with vent valve and the draining is done by the common drain line of 20 NB. 15 NB and 20 NB screw end ball valves should be provided at all top and bottom points of pipe lines for vent and drain respectively. The other free end of ball valve fitted with dummy SS plug. **There is no extra payment for drain / vent**

provision with isolation ball valve in the pipe lines. The cost of drain/ vent shall be included in piping works.

Please refer DWG. No.: IPR/CWS/TBM/01/R0 for process flow and refer component wise requirement below:

Sr. No.	System Description	Flow (lpm)	Inlet Pressure (bar)	Pressure Drop (bar)	Design Pressure (bar)	Heat Load (kW)
1.	LLMHD Magnet-I	105	3.0	1.2	4	275
2.	LLMHD Magnet-II	105	3.0	1.2	4	275
3.	He-Heat Exchanger	90	3.0	1.2	5	100
4.	Miscellaneous	90	3.0	1.2	5	100

Cooling Tower Design Basis:

Wet Bulb Temp. : 29 °C
 Approach : 3 °C
 Inlet/ Outlet Temp. : 45 °C / 32 °C
 Range : 13 °C
 Water flow rate : 990 LPM
 Capacity : 975 kW (Should be design to remove for 975 kW heat load by increasing the flow rates with keeping the in/out temperature as per above)

PHE Design Basis:

Hot Side Inlet / Outlet Temp. : 63 °C / ≤ 35 °C
 Hot Side Flow : 390 lpm
 Hot Side max. inlet temp. : **73 °C @ 210 LPM for 550 kW**
 Cold Side Inlet / Outlet Temp. : ≤ 32 °C / 45 °C
 Cold Side Flow : 990 lpm
 PHE Approach : 3 °C
 PHE Capacity : 900 kW (Should be design to transfer for 900 kW heat load by increasing the flow rates in hot/cold side with keeping the in/out temperature as per above)
 Fouling factor : ≤ 0.0005 (FPS unit)
 Max. Pressure drop : ≤ 5 MWC.
 Max. working pressure : ≤ 6 Bar.

4. TECHNICAL SPECIFICATIONS

Following components are to be interconnected to satisfy the system requirements. **Bidder has to provide a separate sheet confirming to the following specifications. Change in the specifications will not be accepted.**

4.1 SPECIFICATIONS OF COMPONENTS

PIPES & FITTINGS / ACCESSORIES AND VALVES:

For DM water application:

Pipes:

To be used to interconnect the system components for circulation of DM water through the water loops. It is proposed to install SS 304 / Sch. 10 / 40 piping with accessories as per system requirements mentioned in SOQ as per standards.

The pipe sizes shall be as required for the individual fluid flows. Various pipe sizes have been indicated in the drawings, these are for Contractor's guidance only and shall not relieve responsibility of contractor for providing smooth noiseless balanced circulation of fluids.

The SS piping should be as per ASTM - A312 specification.

Pipe Joints:

All joints in the pipe system shall generally be done by welding, unless otherwise mentioned, or directed at site. All welding shall be done by qualified welders and shall strictly conform to BIS Code of practice. First butt weld of each welder shall be fully radiographed for testing purposes. Upon approval of welding joints the concerned welder shall be allowed to carry further welding of the pipes. Rest of the welds shall have 100% visual inspection. Before welding of pipes, make proper 'V' notch at the joints by chamfering the end of pipe with surface grinder. All electrodes shall be selected to match the mechanical and chemical properties of the parent material. The welding rods shall be selected as per AWS-E-7018 or Equivalent BIS code, subject to Purchaser's approval.

Pipe flanges, fastener and gaskets:

All flanges including flanges of valves are to be slip on serrated raise face (SORF) finished flanges of respective pressure class. Set of fasteners will be **metric thread stud** type with nuts and washer of Stainless Steel. All gaskets are of Teflon/ PTFE of 3 mm thick with standard sizes.

Butterfly Valves (Manual):

Butterfly valves are to be used for isolation of equipments / components in DM water lines.

- The valves should be of wafer type with total SS 304/ CF8 construction, pressure class PN 10 or class 150 as per the details in SOQ. Design standard: API 609
- The valves shall have mounting flange as per ISO 5211, centering lugs, locking lever handle. Preferably, the valves will be of single-piece body.
- The disc should provide bubble tight shut off (class VI leak tightness) in both flow directions with minimum torque and longer seat life.
- The valves should give higher Cv values. The valves should be with SS 316 disc & stem, replaceable EPDM seat.

Butterfly valves are to be used for isolation of equipments / components in Soft water lines.

- The valves should be of wafer type with CI/ CS body, pressure class PN 10 or class 150 as per the details in SOQ. Design standard: API 609
- The valves shall have centering lugs, locking lever handle. Preferably, the valves will be of single-piece body.

- The disc should provide bubble tight shut off (class VI leak tightness) in both flow directions with minimum torque and longer seat life.
- The valves should give higher Cv values. The valves should be with SS 316/ SS 304 disc & stem, replaceable EPDM seat.

Ball Valves (Manual):

a. Ball valves are to be used in process pipeline.

- The valves should be of flange ended (class 150 or PN 10) with total SS 304 construction.
- End connections shall be as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The valves should be of 3-Piece Design for easy In-line Maintenance, full bore design only and the seat will be of PTFE.
- The disc should provide bubble tight shut off (class VI leak tightness) in both flow directions with minimum torque and longer seat life.
- MOC of handle should be MS/ MI with plastic cover.
- The valve design shall be as per BS: 5351/ API: 6D

b. Ball valves are to be used for drain and vent the pipelines.

- The valves should be of female thread end (class 150) with total SS 304 construction.
- The valves shall be of full bore design only and the seat will be of PTFE.
- MOC of handle should be MS/ MI with plastic cover.
- The valve design shall be as per BS: 5351/ API: 6D

Globe Valves:

Globe valves are used for manual flow control and should provide bubble tight throttling.

- The valves should be of CF8/ SS 304 construction, class 150 as per the details in SOQ.
- End connections shall be as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The disc should provide bubble tight shut off (class VI leak tightness) with minimum torque and longer seat life.
- The bonnet / disc should be of SS 304. Preferably, the bonnet will be of removable type.
- The valve design shall be as per BS: 1873/ API: 600/ ASME / ANSI B16.34

Non Return Valves (SS) for DM Water:

Self-acting wafer type non-return valves to be used to prevent reverse flow.

- Wafer type swing check valve suitable to sandwich between ASME B16.5, class 150 SORF flanges.
- The body/ hinge should be of ASTM A351Gr. CF8 / SS 304 / 316 constructions, pressure class PN 10/ PN 16 as per the details in SOQ.
- The valves shall be of flapper / Single plate swing / dual plate spring type as per in SOQ.
- The disc will of SS material and seat O-ring / gasket shall be of 3 mm thick PTFE and / or EPDM. The spring and hinge/stop pin shall be SS.
- Operating temperature: 15 – 80 °C
- Seat leakage: Bubble tight shut-off (Class VI) as per API 598, Design standard: API 6D/ / ASME B 16.10

Non Return Valves (CI) for Soft/ Raw Water:

Self-acting wafer type non-return valves to be used to prevent reverse flow.

- Wafer type swing check valves suitable to sandwich between ASME B16.5, class 150 SORF flanges
- The body should be of CI constructions, pressure class PN 10/ PN 16 as per the details in SOQ.

- The valves shall be of flapper / Single plate swing / dual plate spring type as per in SOQ.
- The hinge / disc will of SS material and seat O-ring / gasket shall be of 3 mm thick EPDM and or PTFE. The spring and hinge/stop pin shall be SS.
- Operating temperature: 15 – 80 °C
- Seat leakage: Bubble tight shut-off (Class VI) as per API 598, Design standard: API 6D/ ASME B 16.10

Balancing Valves (CI):

Balancing valves are used for manual flow control and should provide bubble tight throttling.

- The valves should be of CI construction, class 150 as per the details in SOQ.
- End connections shall be flange ended as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The disc should provide bubble tight shut off (class VI leak tightness) with minimum torque and longer seat life.
- An extension connection to manometer for measuring the flow.
- The bonnet will be of removable type.
- The valve design shall be as per BS: 1873/ API: 600/ ASME / ANSI B16.34

Y-Strainers for DM Water:

Y-Strainers are used for filtering of DM water before entering to the system.

- The Y-Strainer should be of casted body CF8 / SS 304 construction, class 150 as per the details in SOQ.
- End connections shall be flange end as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The filter elements of 100 mesh SS 304/ 316 wire mesh with low pressure drop.

POT-Strainers for Soft Water:

Pot-Strainers are used for filtering of soft water before entering to the PHEs or system.

- The Pot-Strainer should be of casted body CI construction, class 150 as per the details in SOQ. Fabricated body not acceptable.
- End connections shall be flange end as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The filter elements of 20 mesh SS 304/ 316 wire mesh with low pressure drop.

Self-acting pressure reducing valves:

Self-acting pressure reducing valves are used for protecting the system components against higher supply / inlet pressure by controlling / maintaining the downstream pressure at desired level.

- The controlled downstream pressure should remain constant irrespective of changes in the inlet pressure and / or flow rate.
- The valve should be of self-acting, pilot operated type.
- The valves should be of flange end connections as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The body and trim should be of SS 304 & SS 316 construction respectively. Pressure rating class 150 as per the details in SOQ. The disc/ diaphragm should be of EPDM/ Teflon/BUNA-N.
- The internal parts like valve disc, trim parts may be of easily replaceable type without removing the whole body from the line.
- The valves should be delivered with 'built-in safety provision' against high-pressure build-up in the inlet side, also '1/4 inch pressure gauge connection' with one set of 2” dial size pressure gauge connected for downstream pressure measurement.
- The valves should provide class VI leak tightness.

- Valve should be fitted with suitable Y-Strainer (1/2" size) in controlling tubing interconnection line.
- The set pressure as per in SOQ and should be easily adjustable by adjusting the spring setting.

Pressure relief safety valves:

The pressure relief valves are provided to release excess pressure in the line, when pressure in the water line exceeds the set value.

- The valves should be of SS 304 construction, class 150 or PN 10 as per the details in SOQ.
- The valves should be of flange end connections as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The valves should be of self-actuated quick release, close discharged type.
- The spring / pallet / piston / trim should be of SS. The seating can be of neoprene / EPDM / PTFE / equivalent
- The valves should provide class VI leak tightness.
- The set pressure as per in SOQ and should be easily adjustable by adjusting the spring setting

Vacuum relief valves:

The vacuum relief valves are provided on top of the storage tank for tank safety of squeezing, when pressure in the tank decreases than the atmospheric pressure at the set value.

- The valves should be of SS 304 construction, class 150 or PN 10 as per the details in SOQ.
- The valves should be of flange end connections as per ANSI/ ASME B16.5, 150 # R.F (SORF).
- The valves should be of self-actuated type.
- The seat shall be of PTFE with soft seated EPDM/ Nitrile/ neoprene seat.
- The valves should ensure tight shut off.
- The set pressure as per in SOQ. Maximum pressure of tank should be 2.5 bar.

NON CONDUCTIVE FLANGE ENDED RUBBER HOSE PIPES:

Rubber hoses are provided to interconnect the water distribution header to Magnet system.

- Size of Rubber Hose pipes: ID: 40 NB (38 mm)
- Working pressure: 10 bar.
- Min. Burst pressure: 19 bar
- Working temperature range: 10°C to 85 °C
- SS 304 matching size/ class flanges should be crimped at both ends.

INSTRUMENTS AND CONTROLS:

Necessary instruments, sensor- transmitters, are to be used for the purpose of process measurement, indication, providing required output signals for data acquisition- monitoring and control system for the integrated operation of water distribution system with communication to the system control rooms.

Temperature gauges:

Necessary dial type bimetallic temperature gauges are to be installed to measure the water temperature at the locations shown in the P & I diagram.

- Temperature gauge shall be dial type 100 mm dia. in aluminum white background with black markings.
- Temperature gauge should have SS 316 thermowell attachment.
- The case should be of SS 304/316 with screwed bezel rotatable on stem 90 degree to adjust at different angle.
- The windows should be of shatterproof glass.
- The weather proof protection should be provided as per IP-65 (IS:2147)
- Stem material / dia. / length: SS 316-L / 6-8 mm / 180 mm long (or to suit the pipeline). The gauge should be installed on lines as shown on the drawings and included in Schedule of Quantities. (Type/shape of capillary / stem to be selected as per the design requirement)
- The sensing element should be of chrome molybdenum.
- The mounting connection will be "all - angle" type to suit the piping.
- Range of scales can be 0- 100°C with 1°C scale spacing.
- The accuracy should be $\pm 1\%$ FSD with over-range 125% FSD
- The connection shall be 1/2" NPT (M) SS 316 with adjustable three piece compression fitting.
- The reset should be external.

Pressure gauges:

Necessary dial type pressure gauges are to be installed to measure the water pressure at the locations shown in the P&I diagram.

- Pressure gauges shall be dial type 100 mm dia. in aluminum white background with black markings.
- The gauges shall be connected to the pipes by SS siphon and needle valve for isolation.
- The bourdon should be of phosphor bronze / SS 316 Ti, socket should be of brass / SS 316.
- The case (glycerin filled type) can be of SS 304/ SS 316 with screwed bezel.
- The weather proof protection should be provided as per IP-65 (IS:2147)
- Range of scales should be 0-10 bar with 0.2/0.1 bar scale spacing
- The accuracy should be $\pm 1\%$ FSD with over-range 125% FSD
- Working temperature range can be 0- 100°C.
- The connection shall be 1/2 " NPT (M) / as per design requirement.
- Blow out disc should be provided.
- There should be zero point adjustment.
- Refer standard EN - 837.

Temperature transmitters:

Necessary two wires, PT 100 temperature sensors – transmitters can be installed for necessary data acquisition required for overall monitoring and control system in the water distribution system.

- The instrument should be of 4 - 20 mA current output transmitter type as mentioned in the SOQ.
- Cable length up to 5 m is to be included with each instrument / sensor.
- The sensor can be of SS 316 of diameter 6 to 8 mm and should be aluminum head mounted type and easily removable from head.
- Range of scales should be 0-50 / 80 / 100 degree C depending on design requirements.
- The accuracy should be $\pm 0.5\%$ FSD with over-range 125% FSD.
- The thermowell should be of SS as per requirement and can be of fabricated / barstock type.
- The weather proof protection should be provided as per IP-65 (IS:2147)

- The connection should be of screwed type / as per requirement.
- The transmitter should be compatible with 24 V DC supply with built -in electronic voltage stabilizer.
- Refer standard DIN - 43760, also CMRS certificate.

Pressure transmitters:

Necessary pressure sensors – transmitters can be installed for necessary data acquisition required for overall monitoring and control system in the water distribution system.

- The instrument should be of 4 - 20 mA current output transmitter type as mentioned in the SOQ.
- Cable length up to 5 m is to be included with each instrument / sensor.
- The sensor should be with ceramic / SS with viton / EPDM sealing.
- The connection should be of threaded nipple type.
- The response time should be less than 5 msec.
- The weather proof protection should be provided as per IP-65 (IS:2147)
- Range of scales should be 0-10 bar.
- The accuracy should be ± 0.5 % FSD.
- The sensor should have negligible sensitivity to temperature fluctuations and high resistance to extreme temperatures.
- The transmitter should be compatible with 24 V DC supply with built -in electronic voltage stabilizer.
- The sensor should be mounted with needle valve for process isolation.

Conductivity Meters:

Necessary Conductivity meters (sensor cum transmitter) to be installed to measure the conductivity of water at storage tank out let or out let Mixed Bed Polishing unit as indicated in P&I diagrams.

- The instrument should be with field mounted transmitter cum display unit type (panel mounted) with temperature.
- The instrument should be of 4-digit/ suitable LCD display, backlit type and suitable for 4 – 20 mA current output to Data Acquisition and Control System (DACS) for conductivity range ($\mu\text{S}/\text{cm}$) and cell constant as mentioned in SOQ. Cable length up to 8 m is to be included with each instrument / sensor. Temperature Compensation: Auto.
- The sensor to be fitted in SS 316 flow through chamber with $\frac{1}{2}$ "NPT (F) connections and sensor mounting provision with accessories should be supplied with conductivity meter. Process connection: $\frac{3}{4}$ " NPT(M)
- The accuracy should be ± 1 % FSD.
- The protection should be provided as per IP-65 (IS:2147)

The display unit should be compatible with Power Supply: 12 to 24 VDC

Calibration and Testing:

All automatic controls and instruments shall be factory calibrated and provided with necessary instructions for site calibration and testing. Various items of the same type shall be completely interchangeable and their accuracy shall be guaranteed by the manufacturer.

COOLING TOWERS:

Cooling Towers shall be induced draught type, single or double shell in accordance with requirement of Drawings and of the Schedule of Quantities **Fiber-reinforced plastic Cooling Towers** shall be suitable for outdoor use. Tower shall be vertical, induced draught, counter

flow type, fiber reinforcement plastic construction, in square, complete with fan, motor, surface and spray section, eliminators, steel supports, and sound attenuation equipment where called for in Schedule of Quantities.

a. **Capacity:**

The cooling tower capacities shall be as per the Drawings and Schedule of Quantities.

b. **Side Casing:**

This shall be made out of FRP with minimum resistance to air flow. It shall have sufficient structural strength to adequately withstand high wind velocities and vibration. The casing shall be installed in the fiberglass reinforced basin. The tower supporting structure shall be made out of hot dip galvanized frame. Air intake shall be all along the sides so that tower can be installed quite independent of prevailing wind direction. Anodized aluminum or PVC louvers integrated with fill shall be provided at air intake. Sufficient clearance between casing and water basin shall be provided to enable servicing and periodic cleaning.

c. **Cold Water Basin:**

Cold water basin shall be a deep fiberglass reinforced sump on which cooling tower super structure shall be supported. Basin fittings shall include the following:

- Bottom outlet.
- Screened suction assembly fixed to the casing.
- Drain at underside of suction side sheet.
- Overflow fixed to inside of casing side sheet.
- Ball type automatic makeup water valve.

d. **Distribution System:**

Hot water distribution system shall comprise of HDPE piping header and branch arms system with HDPE nozzle flow system.

e. **Fillings:**

Fillings shall be made of corrosion proof and rigid virgin PVC film in honey comb design and arranged in square / rectangular form or fill sheets shall be suspended from H.D.G steel structural tubing supported from the lower structure & shall be elevated above the floor of the cold water basin to facilitate cleaning and easy replacement. They shall be arranged in such a manner to ensure negligible resistance to air flow and to eliminate back water spots and prevent fouling through scales that may form. In order to reduce carry-over losses through entrapment of moisture drops in air stream, virgin PVC drift eliminator shall be installed.

f. **Mechanical Equipment:**

Fan shall be of the propeller type cast Aluminium alloy/ FRP, light-weight rotor fitted with multiple aerofoil blades. The entire fan assembly shall be made of Al casting/ FRP sandwich, statically and dynamically balanced. Fan shall be directly / gear-reducer driven by $415 \pm 10\%$ volts, 3 phase, 50 cycles, AC supply, 2 Speed, class of insulation "F", IP55, motor of approved make, totally-enclosed, fan-cooled, weather-proof construction, designed and selected to operate in humid air stream. Fan shall be protected by fan guard & shall be easily accessible for inspection and maintenance. A service ladder shall also be provided for greater convenience. The mechanical equipment assembly shall be adequately supported on a rugged steel base welded to tubular support assuring vibration-free support. Fan guard shall be provided to prevent birds from nesting during idling periods. Gear-reducer shall be of spiral bevel type. G.S.S / FRP canopy shall be provided over the fan motor for protection against rain water. Care shall be taken that fan air is not restricted. Motor terminal box shall be made water tight.

PUMP SETS:

Pump performance curves and power consumption with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation.

Pump performance shall be computed from the pump curves provided by manufacturer.

Pump casing shall be close-grained cast iron / SS of heavy section, BPO (back pull out) /Vertical type/ Split case/ Mono block, making possible complete servicing of rotating parts without breaking piping as indicated in Schedules of Quantities. Motor to pump connection shall be of the flexible coupling type. Suction passages shall be volute in form, promoting smooth entry to impeller and increased efficiency. Impeller shall be SS / bronze or gun metal, enclosed type, hydraulically balanced and passages smooth-finished for minimum friction and Maximum efficiency. Shaft shall be SS 304 / SS 316 / SS 410, protected by gunmetal / SS sleeves extending through stuffing boxes. Stuffing boxes shall be supported in ball /journal bearings, grease lubricated, contained in easily removable housing. Pumps shall be fitted with an air valve, two grease lubricators, drain plug and water seal connections. Mechanical seals shall be provided, as indicated in Schedules of Quantities

Motor shall be totally enclosed, fan-cooled, class of insulation "F", IP55, of approved make as per section "ELECTRICAL INSTALLATION". Motor shall be specially designed for quiet operation. **The motor rating shall be such as to ensure non overloading of the motor throughout its capacity range including the pumps operating in parallel. Motor shall be suitable for 415 ± 10% volts, 3 phase, 50 cycles AC, and power supply.** A guard mounted on the common base shall protect flexible coupling. Heavy gauge GI sheet canopy for motor protection from weather shall be provided for all pump motors.

The pump shall be installed on a concrete foundation with vibration isolator between the base and the concrete foundation. The concrete foundation shall be further isolated from the adjoining structure/floor through 5 cm thick layer of sand all around, topped with bitumen. Alternatively, pre-cast concrete blocks with complete vibration isolation shall be used as foundation. In case of chilled water pumps, the quoted price should be inclusive of necessary insulation as shown in Approved-for-Construction / execution / shop drawings

HEAT EXCHANGERS:

To be used to isolate and transfer the heat load from primary to secondary water loops. It is proposed to use Plate type Heat Exchangers (PHE), normally made of SS 316 plates with NBR/ suitable gasket materials, being compact, efficient, economical, easily maintainable, and expandable (capacity) as indicated in Schedules of Quantities. SS PHEs are most compatible for maintaining water quality in the primary loops. In the primary water loops the PHEs are subject to the transient heat load with changing LMTD. Hence the PHEs to be selected as per Temp.-Load profile, for the most stringent duty. The PHE should be installed on the RCC foundation. **PHE Hot side (primary loop) will be connected to SS line and cold side (secondary loop) connected to MS line of Cooling Tower. The pressure drop across the PHE should be less than 0.5 bar and fouling factor ≤0.0005 (FPS unit).** Necessary work for proper installation of PHE will be carried out by the contractor.

MIXED BED POLISHING UNIT:

A separate MB pump circulates @ 6 % (Max. 10%) of the main flow through the Mixed Bed Polishing Unit, in order to maintain the water conductivity below 1 µS/cm. MSRL (MS Rubber lined)/ FRP body MIXED BED on-line polishing unit with flow and pressure measuring instruments, first charge of resins, necessary type, size and length of frontal piping, valves, other accessories, supports, vibration isolation with following water quality requirement. Pressure drop across process vessels not to exceed 6 MWC. DM water output

quality $\leq 1\mu\text{S}/\text{cm}$ at Max. water treatment rate of $1.8\text{ m}^3/\text{hr}$. with DM water at @ 30-40 $\mu\text{S}/\text{cm}$, OBR (Out Put between Regeneration): 30 m^3 per MB unit, inlet temp. $< 60^\circ\text{C}$.

DM WATER STORAGE TANK:

DM Water storage tank in primary loop is used to store the DM water and also full fill the function of expansion tank in close loop circulation and also provide protection for thermal expansion due to the temperature variation of water. Scope of work includes design, fabrication, installation and testing of SS construction DM water storage tank required for Water cooling system and specified in SOQ. The volume can be determined, based on water leakage and required minimum expansion volume. Necessary purge points shall be provided at the highest operating level. All accessories, manholes, drain / overflow/ inlet / out let / purge connections / nozzles, instrument mountings, supports etc., shall be as per enclosed drawings and as specified in SOQ. Welding procedure, testing and inspection shall be as per respective IS codes. The weld joints are subjected to 100 % Visual inspection with DP test and required 10 % radiography. Welding of SS to SS is to be done by TIG process. All but-weld, exposed to inside surface are ground flush and polished to 240 Grit finish. All external welds (under insulation cover) to be left un-ground but free from cuts & crevices.

Dimensional limitations, type of tank, material of construction etc. are as specified in the SOQ. The storage tank will be designed according to BIS: 2825 and ASME section VIII for Un-fired Pressure vessels.

INSULATION

Insulation shall be applied only after the piping system has been satisfactorily tested for leaks at 1.5 times the working pressure or at minimum 10 bar test pressure.

Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values and density. Samples of insulation material from each lot delivered at site shall be selected at random for approval and shall be got tested for thermal conductivity values.

The insulation shall be continuous over the entire run of piping, fittings and valves as indicated in P&ID and instructed by IPR Engineer-in-Charge. Insulation shall be finished in neat and clean manner to achieve true surface. Skilled workmen specially trained in this kind of work shall carry out all insulation work.

All water piping shall be insulated in the manner specified herein. Before applying insulation, all pipe work and fittings shall be brushed and cleaned, and dust, dirt, mortar and oil removed. Thermal insulation shall then be applied as follows:

Lines for "DM water" applications inside and outside of the lab:

The insulation shall be flexible and lightweight elastomeric EPDM/ Nitrile material. The thermal conductivity of the material shall not exceed $0.04\text{ W}/\text{m}^\circ\text{C}$. at 10°C mean temperature. Thickness of the insulation shall be as specified in Schedule of Quantity. The insulation material can be readymade pipe section. Cold adhesive or equivalent can be used for setting the insulation on the pipes. Insulation shall be aluminium cladding with 26 SWG gauge thickness.

Pre-moulded pipe sections shall be placed over the pipes, the joints of these pipe sections shall be sealed with cold adhesive compound and self-adhesive rubber tape.

4.2 SPECIFICATION FOR PIPING INSTALLATION:

Tender drawings indicate schematically the size and location of pipes. The Contractor, on award of the work, shall prepare detailed shop drawings, showing the cross-section, longitudinal sections, details of fittings, locations of various valves, and all pipe supports. He must keep in view the various equipments installed nearby.

Piping shall be properly supported on, or suspended from, stands, clamps, and hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. All pipes shall be supported with MS/SS structural steel like C-channel, I-Beam, angle and M S Class 'C' pipes, supported from floor or column. Where pipe and clamps are of dissimilar materials, a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe size	Spacing between supports
Up to 12 mm	1.5 Meter
15 to 25 mm	2.0 meter
30 to 150 mm	2.0 meter
Over 150 mm	2.5 meter

All piping work shall be carried out in a workman like manner, causing minimum disturbance to the existing services, buildings and structure. The entire piping work shall be organized, in coordination with other agency's work, so that laying of pipe supports, pipes and pressure testing for each area shall be carried out in one stretch.

The Contractor shall make sure that the clamps, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints wherever required.

All pipes shall be accurately cut to the required size in accordance with relevant BIS Codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used. The provision for vent and drain should be provided at all top and bottom point of pipelines respectively with ball valve for isolation. The cost of provision for vent and drain should be included in piping works. The size of ball valves for vent and drain will be 15 NB and 20 NB respectively and free end of ball valves fitted with dummy plug.

4.3 SPECIFICATIONS FOR FLOW BALANCING:

After completion of the installation, all systems shall be adjusted and balanced to deliver the water quantities as specified, quoted, or as directed. Water circuit shall be adjusted by balancing the valves, these shall be permanently marked after balancing is completed so that they can be restored to their correct positions, if disturbed. Complete certified balancing report shall be submitted for evaluation and approval. Upon approval, four copies of the balancing report shall be submitted with the as-installed drawings and completion documents.

4.4 ELECTRICAL SPECIFICATIONS:

- **Scope**

The scope of this section comprises of design, fabrication, supply, erection, testing and commissioning of electric control panels, cabling and earthing for DM water pumps,

CT pumps, MB Pump, CT fan motor, control valves and accessories that is in the scope of the tender.

- **General**

The scope of work shall be carried out in accordance with the Specifications, Local Rules, Indian Electricity Act 1910 as amended up to date, and rules issued there under, Regulations of the Fire Insurance Company and relevant BIS Codes of Practice. The control panels shall be BIS approved and manufactured by a reputed manufacturer. The ingress protection class shall not be less IP 54.

- **Construction Features:** The control panel shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket and padlocking arrangement shall be provided. Panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. The control panel shall be of adequate size with a provision of spare space to accommodate possible future switch. Cabinet shall be provided with Trafolyte or engraved metal name plates. Panel shall be provided with circuit diagram engraved on PVC sheet.

- **Wiring System:**

All power cabling between MCCB and motors shall be carried out with 1100 volts grade PVC insulated, overall PVC sheathed aluminum conductor, steel armoured cables. Cables shall be sized by applying proper derating factor for the service conditions they are required. All control wiring shall be carried out by using 1100 volts PVC insulated copper conductor wires in race ways or in conduit.

- **Selector Switch** Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

- **Moulded Case Circuit Breakers:** Moulded Case circuit Breaker shall be of motor duty and shall be suitable for continuous load, manufactured in accordance with relevant BIS Codes, well coordinated with the upstream circuit.

- **Starters:** Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant BIS Codes. All Star Delta and ATS Starters shall be fully automatic. Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta / Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E".

Operating coils of contactors shall be suitable for 415 + 10% volts, 50 cycles supply system. The contactors shall drop out when voltage drops to 90% of the rated voltage. The housing of the contactors shall be heat resistant and having high impact strength. Each starter shall have thermal overload protection on all three phases.

- **Over Load Relays:** Contactors shall be provided with a three element, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be directly connected for motors up to 35 HP capacities. C.T. operated relays shall be provided for motors above 35 HP capacity.

- **Single Phase Preventers:** Single phase preventers shall be current **sensing**. Single Phase preventers shall be in conformity with relevant BIS standards. Single phase preventers shall act when the supply voltage drops down to 90% of the rated voltage or on failure of one or more phases.

- **Indicating Lamp and Metering:** All meters and indicating lamps shall be in accordance with BS 37 and BS 39. The meters shall be flush mounted type. The indicating lamp shall be of low wattage. Each main panel shall be provided with voltmeter 0-500 volts with three ways and off selector switch, CT operated ammeter of suitable range with three nos. CTs of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase

indicating lamp shall be backed up with min. 2 amps fuse. Other indicating lamps shall be backed up with fuses as called for.

- **Push Button Stations:** Push button stations shall be provided for manual starting and stopping of motors / equipment as called for Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

4.5 SPECIFICATIONS FOR CONTROL CABLES:

Control cables shall be of 1100 Volts grade, annealed solid copper conductor, PVC insulated, extruded FRLC PVC inner sheathed, overall FRLS PVC sheathed conforming to IS 1554/Pt.I/1988.

Cables laid on trays and risers shall be neatly dressed and clamped at an interval of 1500 mm and 900 mm for horizontal and vertical cable runs. The vendor shall supply the required cable trays of suitable size. The cable trays shall be of suitable size and material.

Each cable run shall be tagged with number that appears in the cable schedule. Cables shall be tagged at their entrance, every 30 m and exit from any equipment, junction box. The tags shall be of aluminum with number punched on it and securely attached to the cable by not less than two turns of 16 SWG GI wire.

The termination and connection of cables shall be done strictly in accordance with drawing and/ or directed by the Engineer. The work shall include all clamping, glanding, fitting, fixing, tapping, crimping and grounding as required. The vendor shall perform all drilling, cutting on the gland plate and any other modification required and plugging the extra holes. The vendor shall provide on control cable cores at all terminations. Termination and connections shall be carried out in such a manner as to avoid strain on the terminals.

The vendor shall supply the required cable glands of suitable type and size. Cable glands shall be of heavy duty, tinned brass, and single/ double compression type complete with necessary armor, clamp and tapered washer etc. Cable gland shall match with the size of different control cables. They shall provide dust and leak proof terminations. The vendor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed 2.5 % for total quantity of cable supplied.

The scope of the EMS vendor shall also include:

- a. Submission of cable schedules, wiring schedules, test reports, final "AS BUILT" drawings etc.
- b. Handing over the system as a whole after becoming fully operational to IPR.

Although it may not be specified here, but all other work required for successful installation, testing and commissioning shall be in vendor's scope. The system shall be deemed to have been handed over only after IPR's final acceptance.

No.	Equipment	Cable Size
1.	Transmitters like Pressure, Temperature, pH, Conductivity, Flow transmitters (2 wire type).	2C x 1.0 sq. mm Cu screened & shielded cable (includes power signal also).
2.	Solenoid Valves and for ON/OFF status signals from Panel and Controller.	2C x 1.5 sq. mm Cu armored cable for each signal.

5. TECHNICAL DATA SHEETS

(List of technical information's to be furnished by the bidder to IPR)

Notes:

- Separate technical data sheets shall be furnished for different type/ model/ configuration for different items.
- Take copies of the data sheet for different sizes/ category and furnish the information asked for.
- All the data sheets shall be endorsed with stamp and signature by the bidder.
- Bidder has to provide minimum technical details as enclosed herewith, however shall also provide remaining / additional details. All the Items shall be ordered only after Technical specification approval.
- Attach Technical leaflets, performance curves, etc. for all products / system parts offered.
- Please refer technical specifications asked for before filling the blank data sheets

➤ **COOLING TOWER:**

Description	IPR Specificatio n	Filled by bidder
• Type	Induced draught counter flow	
• Make / Model	--	
• Nominal Capacity (kW)	975	
• Water flow Rate (LPM)	990	
• Range (°C) / Approach (°C)	13 / 3	
• Casing Material	FRP	
• Basin Material	FRP	
• Piping material and size	HDPE/ Equiv.	
• Support	HDG steel	
• Fill Material/ Eliminators Material	Vergin PVC	
• Ladder Material	HDG / Equiv.	
• Fan Dia. and RPM	--	
• Fan Motor		
Type/Make	--	
HP/RPM / efficiency	--	
Class of insulation	F	
Grade of protection (IP)	IP55	
Electric Characteristics	415 ±10% VAC	
• Water Losses: Drift losses % of water flow		
Evaporative losses %	--	
Other losses if any %	--	
Total Losses %	--	
• Overall Dimensions (mm) (LXWXH)	--	

• Shipping / Operating Weight (kg)	--	
• Type of vibration Isolation.	--	
• Noise level dBA at 10 m horizontal distance	--	

➤ **PLATE TYPE HEAT EXCHANGER:**

• Type	Plate type	
• Make / Model	--	
• Capacity (kW)	900	
• Plate Material/ No. of plates	SS 316/ --	
• Plate Size (mm x mm)	--	
• Area/plate (m ²)	--	
• Gasket Material	EPDM/ Suitable	
• Fouling factor (FPS unit)	≤0.0005	
• Water flow in Hot/ Cold side (LPM)	390/ 990	
• Max. working/ design pressure (bar)	6/ --	
• Temperature hot side in/out (°C)	63 / 35	
• Temperature cold side in/out (°C)	32 / 45	
• LMTD (°C)	--	
• Heat transfer Co-efficient (Kcal / Hr. m ² °C)	--	
• Pressure Drop. at Nominal flow (bar)	<0.5	
• Overall Size (mm)	--	
• Shipping & Operating weight (kg)	--	

➤ **DM WATER PUMPSETS (SS): (enclose Performance Curve)**

• Type	BPO / VMS	
• Make / Model	--	
• Material of construction of		
Casing	CF8/ SS 304	
Impeller	CF8/ SS 304	
Shaft	SS 304/ 410	
• Impeller dia. (mm)	--	
• Capacity (LPM)	390	
• Head (MWC)	35	
• NPSH required (MWC)	--	
• Shutoff head for selected Impeller dia. (MWC)	--	
• Power consumption BkW at design point.	--	
• Max. BkW for any combination of flow and head.	--	
• Pump efficiency at design point (%)	--	
• Suction x Discharge size (mm)	--	
• Type of water sealing (Mechanical / Gland)	Mechanical	

• Pump Motor (with overloading consideration)		
Type/Make / model	TEFC	
HP/ kW	--	
Electric Characteristics	415 ±10% VAC	
Type of starter	S/D	
Class of insulation	F	
Grade of protection (IP)	IP55	
• Others	--	
• Overall Dimensions (mm)	--	
• Operating weight (kg)	--	

➤ **MB WATER PUMPSET (Mono block): (enclose Performance Curve)**

• Type	Mono block/ BPO	
• Make / Model	--	
• Material of construction of		
Casing	CF8/ SS 304	
Impeller	CF8/ SS 304	
Shaft	SS 304/ 410	
• Impeller dia. (mm)	--	
• Capacity (LPM)	30	
• Head (MWC)	30	
• NPSH required (MWC)	--	
• Shutoff head for selected Impeller dia. (MWC)	--	
• Power consumption BkW at design point.	--	
• Max. BkW for any combination of flow and head.	--	
• Pump efficiency at design point (%)	--	
• Suction x Discharge size (mm)	--	
• Type of water sealing (Mechanical / Gland)	Mechanical	
• Pump Motor (with overloading consideration)		
Type/Make / model	TEFC	
HP/ kW	--	
Electric Characteristics	--	
Type of starter	DOL	
Class of insulation	F	
Grade of protection (IP)	IP55	
• Others	--	
• Overall Dimensions (mm)	--	
• Operating weight (kg)	--	

➤ **COOLING TOWER PUMPSETS (CI): (enclose Performance Curve)**

• Type	BPO	
• Make / Model	--	
• Material of construction of Casing	CI	
• Impeller	Gun Metal/ Bronze	
• Shaft	SS 304/ 410	
• Impeller dia. (mm)	--	
• Capacity (LPM)	990	
• Head (MWC)	25	
• NPSH required (MWC)	--	
• Shutoff head for selected Impeller dia. (MWC)	--	
• Power consumption BkW at design point.	--	
• Max. BkW for any combination of flow and head.	--	
• Pump efficiency at design point (%)	--	
• Suction x Discharge size (mm)	--	
• Type of water sealing (Mechanical / Gland)	Mechanical	
• Pump Motor (with overloading consideration)		
Type/Make / model	TEFC	
HP/ kW	--	
Electric Characteristics	415 ±10 VAC	
Type of starter	S/D	
Class of insulation	F	
Grade of protection (IP)	IP55	
• Others	--	
• Overall Dimensions (mm)	--	
• Operating weight (kg)	--	

➤ **MIXED BED POLISHING UNIT:**

• Type	Resin based	
• Make / Model	--	
• MOC of casing	MSRL/ FRP	
• Treatment flow rate (m3/hr.)	1.8 (30 LPM)	
• Conductivity inlet / outlet (µS/cm)	30-40 / ≤1	
• OBR (m3)	30	
• Inlet water temp. (°C)	<60	
• Max. / Min. operating inlet pressure (bar)	--	
• Max. / Min. operating temperature (°C)	--	

• Pressure drop at rated flow (MWC)	<6	
• Regenrants material	--	
• Regenrants qty. (kg)	--	
• Overall Dimensions (mm)	--	
• Operating weight (kg)	--	

➤ BUTTERFLY VALVES (SS) for DM Water:

• Type / Class	Wafer/ PN10	
• Make / Model	--	
• MOC of all body parts: (Enclose details)		
Body	CF8/ SS 304	
Seat	EPDM	
Disc/ Stem	SS 316/ CF8M	
Bearing/ sleeve	--	
Operating lever.	MS	
Fasteners	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	up to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Flange standard conformity	ASME B16.5, class 150 SORF flanges	
• Leakage class (Testing as per API 598)	VI	
• Locking handle/ Lever	Yes	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> • The valves should be of wafer type with total SS 304 construction, disc & stem should be SS 316, pressure class PN 10 or class 150 as per the details in SOQ. • The valves shall have centering lugs, locking lever MS handle. • The disc should provide bubble tight shut off (class VI) in both flow directions with minimum torque and longer seat life. • The valves should give higher Cv values with replaceable EPDM/ Teflon seat. • The valve design shall be as per API 609 & leakage shall be tested as per API 598. 		

➤ BUTTERFLY VALVES (CI/ CS) for SOFT Water:

• Type / Class	Wafer/	
----------------	--------	--

	PN10	
• Make / Model	--	
• MOC of all body parts: (Enclose details)		
Body	CI/ CS	
Seat	EPDM	
Disc/ Stem	SS 316/ CF8M	
Bearing/ sleeve	--	
Operating lever.	MS	
Fasteners	--	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	up to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Flange standard conformity	ASME B16.5, class 150 SORF flanges	
• Leakage class (Testing as per API 598)	VI	
• Locking handle/ Lever	Yes	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> The valves should be of wafer type with CI/ CS body and disc & stem should be SS 316/ CF8M, pressure class PN 10 or class 150 as per the details in SOQ. The valves shall have centering lugs, locking lever MS handle. The disc should provide bubble tight shut off (class VI leak tightness) in both flow directions with minimum torque and longer seat life. The valves should give higher Cv values with replaceable EPDM/ Teflon seat. The valve design shall be as per API 609 & leakage shall be tested as per API 598. 		

➤ BALL VALVES (Full bore manual) for DM Water:

• Type / Class	3-Pecec/ 150#	
• Make / Model	--	
• Material of all body parts: (Enclose details)		
Body / Bonnet	CF8/ SS 304	
Ball	SS304	
Stem	SS 304/ 316	
Seat/ Stem seals/ Body seals	PTFE	
Operating lever.	MS	
Fasteners:	SS	

• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	up to 80 °C	
• Bore size (mm), Full-bore design	--, Full-bore	
• Cv value	--	
• Max. Shut of pressure	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• End connection	ASME B16.5, class 150 SORF flanges	
• Leakage	VI	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> The valves should be of flanged end (class 150) three piece construction/ socket welded / screwed type (class 400) three piece construction, with total SS 304 construction, as per the details in SOQ. The valves may have ISO 5211 mounting pad and double body sealing arrangement The valves shall be of full-bore design only with higher Cv values. The valves should provide class VI leak tightness. The seat will be of PTFE. The valve design shall be as per BS: 5351/ API: 6D and & leakage shall be tested as per API 598. 		

➤ GLOBE VALVES for DM Water:

• Type / Class	Globe/ 150#	
• Make / Model	--	
• Material of all body parts: (Enclose details)		
Body / Bonnet	CF8/ SS 304	
Seat / Disc	CF8/ SS 304	
Stem	SS 304/ 316	
Stem seals/ Body seals	PTFE	
Operating lever.	MS	
Fasteners:	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	up to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• End connection	ASME B16.5, class 150 SORF flanges	

• Leakage	VI	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> The valves should be of flanged end (class 150) socket welded/ screwed type (class 400) with total SS 304 construction, as per the details in SOQ. The valves may have ISO 5211 mounting pad and double body sealing arrangement. The bonnet / disc should be of SS 304. Preferably, the bonnet will be of removable type. The valves shall be with higher Cv values. The valves should provide class VI leak tightness. The valve design shall be as per BS: 1873/ API: 600/ ASME / ANSI B16.34 		

➤ NON RETURN VALVES (SS) for DM Water:

• Type / Class	Wafer/ PN10	
• Make / Model	--	
• MOC of all body parts: (Enclose details)		
Body	CF8/ SS 304	
Seat/ O-ring	EPDM	
Disc/ Hinge/ Stop pin	SS 316/ CF8M	
Fasteners	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Flange standard conformity	ASME B16.5, class 150 SORF flanges	
• Leakage class (Testing as per API 598)	VI	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> The valves should be of self acting wafer type with total SS 304 construction, disc & stem should be SS 316, pressure class PN 10 or class 150 as per the details in SOQ. The disc should provide bubble tight shut off (class VI) with longer seat life. The valves should give higher Cv values 		

with replaceable EPDM/ Teflon O-ring.		
• The valve design shall be as per API 609 & leakage shall be tested as per API 598.		

➤ NON RETURN VALVES (CI/ CS) for Soft/ Raw Water:

• Type / Class	Wafer/ PN10	
• Make / Model	--	
• MOC of all body parts: (Enclose details)		
Body	CI/ CS	
Seat/ O-ring	EPDM	
Disc/ Hinge/ Stop pin	SS 304/ CF8	
Fasteners	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Flange standard conformity	ASME B16.5, class 150 SORF flanges	
• Leakage class (Testing as per API 598)	VI	
• Locking handle/ Lever	Yes	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> • The valves should be of self acting wafer type with CI/ CS body construction, disc & stem should be SS 304/ CF8, pressure class PN 10 or class 150 as per the details in SOQ. • The disc should provide bubble tight shut off (class VI) with longer seat life. • The valves should give higher Cv values with replaceable EPDM/ Teflon o-rings. • The valve design shall be as per API 609 & leakage shall be tested as per API 598. 		

➤ BALANCING VALVE for SOFT Water:

• Type / Class/ Size	Flanged/ 150#	
• Make / Model	--	
• Material of all body parts:		
Body / Bonnet	CI / Bronze	
Flange specifications	ASME B16.5	
Seat / Disc	--	
Bearing/ sleeve	--	

Gland	--	
Operating wheel	CI/ MS	
Fasteners:	MS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• Leakage class	VI	
• Position indication	Yes	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> Balancing valves are used for manual flow control and should provide bubble tight throttling (class VI leak tightness). The valves should be of CI construction, class 150 as per the details in SOQ. Valves should be equipped with flow measurement accessories. Preferably, the bonnet will be of removable type. The valves should give higher Cv values. The valve design shall be as per BS: 1873/ API: 600/ ASME / ANSI B16.34 		

➤ PRESSURE REDUCING VALVES for DM Water:

• Type / Class	Pilot operated/ 150#	
• Make / Model	--	
• Material of all body parts: (Enclose details)		
Body / Bonnet	CF8/ SS 304	
Flange specifications	ASME B16.5	
Seat / Diaphragm	EPDM/ --	
Stem / Trim	SS 316	
Bearing/ sleeve	--	
Fasteners:	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Max. Shut of pressure	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• Leakage	VI	
• Local indication	--	
• Additional features if any:	--	

Description	Confirmation	Deviation
-------------	--------------	-----------

<ul style="list-style-type: none"> • The controlled downstream pressure should remain constant irrespective of changes in the inlet pressure and / or flow rate. • The valve should be of self acting, pilot operated type. • The body & trim should be of SS 304 and SS 316 construction respectively, class 150 as per the details in SOQ. The disc / diaphragm should be of neoprene / EPDM / teflon / equivalent • The internal parts like valve disc, trim parts may be of easily replaceable type without removing the whole body from the line. • The valves should be delivered with 'built-in safety provision' against high-pressure build-up in the inlet side, also '1/4 inch pressure gauge connection' with one set of pressure gauge (2" dial size) connected on downstream pressure measurement • The valves should be of flange ended. • The valves should provide class VI leak tightness. • The set pressure should be easily adjustable by adjusting the spring setting. 		
--	--	--

➤ PRESSURE RELIEF SAFETY VALVES for DM Water:

• Type / Class	Direct operated/ 150#	
• Make / Model	--	
• Material of all body parts: (Enclose details)		
Body / Bonnet	CF8/ SS 304	
Flange specifications	ASME B16.5	
Seat / Diaphragm	EPDM/ --	
Stem / Trim	SS 316	
Bearing/ sleeve	--	
Fasteners:	SS	
• Operating range & limits: Pressure (bar)	5 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• Leakage	VI	
• Local indication	--	
• Additional features if any:	--	

Description	Confirmation	Deviation
• The valve should be of self acting, direct		

<ul style="list-style-type: none"> operated spring loaded type. The body & trim should be of SS 304 and SS 316 construction respectively, class 150 as per the details in SOQ. The internal parts like valve disc, trim parts may be of easily replaceable type without removing the whole body from the line. The valves should be of flange ended. The valves should provide class VI leak tightness. The set pressure should be easily adjustable by adjusting the spring setting. 		
---	--	--

➤ VACUUM RELIEF SAFETY VALVES for DM Water:

• Type / Class	Direct operated/ 150#	
• Make / Model	--	
• Material of all body parts: (Enclose details)		
Body / Bonnet	CF8/ SS 304	
Flange specifications	ASME B16.5	
Seat / Diaphragm	EPDM/ PTFE/--	
Stem / Trim	SS 316/--	
Bearing/ sleeve	--	
Fasteners:	SS	
• Operating range & limits: Pressure (bar)	10 bar	
• Operating range & limits: Temp. (°C).	15 to 80 °C	
• Cv value	--	
• Test Pressure (Hydro – air) Shell / seat	--	
• Local indication	--	
• Additional features if any:	--	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> The valve should be of self acting, direct operated. The body & trim should be of SS 304 and SS 316 construction respectively, class 150 as per the details in SOQ. The internal parts like valve disc, trim parts may be of easily replaceable type without removing the whole body from the line. The valves should be of flange ended. The valves should provide class VI leak tightness. The set pressure should be easily adjustable by adjusting the spring setting. 		

➤ Y-STRAINER for DM Water:

• Type / Make	Y-Type/ --	
• MOC of body	CF8/ CF8M	
• MOC of filter elements	SS 304/SS316	
• Pressure class	150#	
• End connection	Flange end	
• Pressure drop at nominal flow (bar)	--	
• Filter element mesh size	100 mesh	
• Filtration capacity (μ)	--	

➤ POT-STRAINER for SOFT Water:

• Type / Make	Pot type/ --	
• MOC of body	CI/ CS	
• MOC of filter elements	SS 304	
• Pressure class	150#	
• End connection	Flange end	
• Pressure drop at nominal flow (bar)	--	
• Filter element mesh size	20 mesh	
• Filtration capacity (μ)	--	

➤ NON CONDUCTIVE RUBBER FLEXIBLE HOSE PIPES:

• Size of Rubber hose pipes: ID	40 NB (38 mm)	
• Working pressure (bar)	10	
• Min. Burst pressure (bar)	19	
• Working temperature range (°C)	10 to 85	
• End connections (Mating crimped flanges)	Flanged end	
• MOC of end flanges	SS 304	

Description	Confirmation	Deviation
<ul style="list-style-type: none"> • Size of Rubber hose: 40 NB (38 mm ID) • Working pressure (Min. 10 bar) • Min. Burst pressure (19 bar) • Working temperature range (10 to 85 °C) • The seat will be of PTFE/ equivalent 		

➤ **STORAGE TANK / PROCESS TANK:**

• MOC of tank	SS 304	
• Capacity (Ltr.)	2500	
• Max. internal operating / Design pressure (bar)	2.5 / --	
• Plate thickness (mm)	5	
• Other accessories (Nozzle, in/out, vent, drain etc.)		
• Overall size (mm)	--	

• Empty weight (kg)	--	
• Operating weight (kg)	--	

➤ **PIPING FOR DM WATER APPLICATION:**

• Material:	SS 304	
• Make:	--	
• Schedule:	10 / 40	

➤ **INSTRUMENTS & CONTROLS:** (Enclose Leaflets)

TEMPERATURE SENSOR CUM TRANSMITTER:

• Type	RTD 2 wire	
• Make / Model / Size	--	
• Material of construction of all parts	SS 316	
• Type of sensor & Transmitters.	PT 100 RTD	
• Measuring & Operating Range (°C)	0 to 100	
• Accuracy	±0.5% FSD	
• Response time	<5ms	
• Type of enclosures	Casted Alu.	
• Mounting detail	Head mounted	
• Signal out put	4-20 mA	
• MOC of Stem/ size	SS 316/ 6-8 mm	
• Connection type and size.	½" NPT (M)	
• MOC of Thermowell/ size	SS 316/ ½" NPT	
• Power supply required	24 V DC	
• Accessories Included (like terminal box, flanges etc)	--	
• Dimension (mm)	--	

PRESSURE SENSOR CUM TRANSMITTER:

• Make / Model / Size	-- / -- / ½" NPT(M)	
• Material of construction of all parts	SS 316	
• Type of sensor & Transmitters.	--	
• Measuring & Operating Range (bar)	0 to 10	
• Accuracy	±0.5% FSD	
• Response time	<5ms	
• Working limits	--	
• Type of enclosures	--	
• Signal out put	4 -20 mA	
• Connection type and size.	½" NPT (M)	
• Isolation needle valve MOC / size	SS 304 / ½" NPT (F)	
• Power supply required	24 V DC	
• Dimension (mm)	--	
• Weight (kg)	--	

PRESSURE GAUGES:

• Type	Dial	
• Make / Model	--	
• Material of construction of all parts	SS 316/ --	
• Measuring & Operating Range (bar)	0 to 10	
• Accuracy	±1% FSD	
• Working limits	--	
• Dial size (mm)	100	
• Type of enclosures	SS/ Al.	
• Mounting detail	Syphon mounted	
• Connection type and size.	½" NPT (M)	
• Isolation needle valve MOC / size	SS 304 / ½" NPT (F)	
• Weight (kg)	--	

TEMPERATURE GAUGES:

• Type	Dial	
• Make / Model	--	
• Material of construction of all parts	SS 316/ --	
• Type of sensor	Bimetallic	
• Measuring & Operating Range (°C)	0 to 100	
• Accuracy	±1% FSD	
• Response time	--	
• Working limits	--	
• Type of enclosures	SS/ Al.	
• Dial size (mm)	100	
• Mounting detail	Head mounted	
• Connection type and size.	½" NPT (M)	
• MOC of Thermowell/ size	SS 316/ ½" NPT	
• Weight (kg)	--	

CONDUCTIVITY METERS:

• Make / Model	--	
• Material of construction of sensor	SS 316	
• Type of sensor & Transmitters.	--	
• Measuring & Operating Range (µS/cm)	0 to 2 / 0 to 10	
• Cell constant "K"	0.01	
• Accuracy	±1% FSD	
• Response time	--	
• Type of Indication – No. of digits	--	
• Working limits	--	
• Type of enclosures	--	

• Mounting detail of sensor	Inline/ Flow through	
• Mounting detail of Display	Panel mounted	
• Signal out put	4 -20 mA	
• Calibration requirement	--	
• Sensor Connection type and size.	½" NPT (M)	
• Process Connection type and size.	¾" NPT (M)	
• Power supply required	12-24 VDC	
• Accessories Included (like flow through, isolation needle valves, terminal box, hose piping and fittings etc.)	Flow through chamber & needle valves with hose piping	
• Dimension (mm)/ Weight (kg)	--	

6. APPROVED MAKES

The following makes are approved by IPR. Deviations in the approved make will not be allowed. So, the vendor has to consider this while submitting price bid. Also, refer technical specifications, accordingly select approved makes.

Description of item	Approved makes
1. Piping	
▪ SS pipe (Seamless / ERW)	Ratnamani/ Remi/ Jindal/ Surya/ Suraj/ NFC/ Sandvik/ *
▪ MS/GI pipe	Tata / Jindal / Surya/ Sail/ ISMT
▪ PVC/ cPVC pipes	Astral/ Finolex/ Supreme/ Dutron
▪ Braided PVC pipe / Rubber hose/ fittings	Parker/ Duplon/ Semsonex/ Libra Flex / Micron Eagle/ Padmini/ Polyhose/ Paras/ *
▪ Flexible metal hose / fittings	Pacific Hoseflex/ Pankaj Flexible/ Hydroflex/ Metline/*
2. Valves & Strainers (DM water / CT water applications)	
▪ Butterfly (manual)	L&T/ Intervolve / Weir-BDK / CRI/ Virgo/ Fisher control / AMRI/ Technova /Advance / Saunders / Crescent/ Deltech
▪ Globe (manual) / Balancing valves	L&T/ Forbes Marshall/ Advance / Danfoss/ Honeywell/ CRI/ Saunders / Weir-BDK / Trishul / ITT/ Indian/ Crescent/ Unimac
▪ Ball Valves (manual)	L&T/ Forbes Marshall/ Virgo/ Velan / Saunders / Accuflow / Weir-BDK /Trishul /Indian / Crescent/ Unimac/ CRI
▪ Non-Return Valves	L&T/ Forbes Marshall/ Advance/ Intervolve/ Danfoss/ CRI/ BDK
▪ Control Valves and Actuators (2-way & 3-way)	L&T/ Forbes Marshall/ Rotex/ Samson/ Honeywell/ Johnson Control/ MIL/ Sauter/ Siemens/ Bellimo/ Kitz/ *
▪ Needle valves	Trishul/ Accuflow / Unimac/ Panam/ Aptech/ PMT/ G-Tech/ *
▪ Pressure reducing valves	Nirmal / Darling Muesco / Crescent / Forbes Marshall
▪ Pressure/ Vacuum relief	Nirmal / Darling Muesco / Forbes Marshall/

valves	Samson/ Fainger-Leser
▪ Water Strainers	Trishul/ Triveni/ Sant/ Emerald/ Leader/ Advance/ Flowtech/ Crescent valves/ Flairs/ Emerald/ Unimac *
3. Cooling Tower	Paharpur / Mihir / Advance 20-20/ Bell
4. PHE	Alfa Laval / Tranter / GEA/ Sondex
3. MB Units	Ion Exchange/ Indian Ion Exchange/ Doshion/ *
5. Pump (Centrifugal BPO) SS/ CI	KBL/ Grundfoss/ CRI/ M&P/ Johnson/ Flowchem/ Beacon/ Crompton/ ITT
6. Pump Motor	Siemens/ CG/ Kirloskar/ ABB/ Bharat Bijlee/ NGEF/ Havells
7. VFDs	Danfoss-VLT/ L&T Yaskawa/ ABB/ Siemens/ Schneider
7. Electrical Accessories	ABB/ Siemens/ Schneider/ Telemecanique/ *
8. Instruments & Controls (DM water / CT water applications)	
▪ Temperature / Pressure gauges	WIKA / Baumer/ Forbes Marshall/ Emerald/ Fiebig/ Emerson/ Star
▪ RTD / Pressure Transmitter	WIKA/ Baumer/ Siemens/ Forbes Marshall/ E+H/ Honeywell/ Rosemount/ Danfoss/ Yokogawa
▪ Conductivity meter	Cole-Parmer / Forbes Marshall / Baumer/ ABB/ E+H/ Thermo Scientific Alpha/ Yokogawa
▪ Flow meter	Rockwin / Sanvij / Hoffer/ RR/ Honeywell/ Forbes Marshall/ E+H/ Siemens/ Yokogawa/ Rosemount

* Subject to IPR approval

7. STANDARDS/ CODES

*Relevant of the following IS specifications and codes with all amendments will be applicable for the work.

- | | |
|---------------------|---|
| IS : 3615 – 1967 | ▪ Glossary of terms used in Refrigeration and Air-conditioning. |
| IS : 659 - 1964 | ▪ Safety code for Air conditioning. |
| IS : 7896 - 1975 | ▪ Data for outside Summer design conditions for air-conditioning. |
| IS : 8148 - 1976 | ▪ Specification for packaged air conditioning units. |
| IS : 660 - 1963 | ▪ Safety code for Mechanical Refrigeration. |
| IS : 732 III - 1982 | ▪ Inspection and testing of installation. |
| IS : 2379 - 1963 | ▪ Colour code for identification of pipelines. |
| IS : 6272 - 1987 | ▪ Industrial Cooling Fans |
| IS : 4894 -1987 | ▪ Test code for Centrifugal fan. |
| IS : 3103 -1975 | ▪ Code of practice for Industrial Ventilation. |

- IS :778 , 780 - 1980, 210, 318, 5312 ▪ Gun metal gate, globe and check valves for general purpose.
- IS : 8092 : 1992 ▪ Inspection of Steel Castings.
- IS : 12992 : 1993 ▪ Safety relief Valves
- IS : 13095 : 1991 ▪ Butterfly valve for general purpose
- IS : 9542 : 1980 ▪ CF Monobloc pumps
- IS : 5659 : 1970 ▪ Pumps for process water
- IS : 10596 : 1983 ▪ Installation , operation and maintenance of pumps
- IS : 5111 – 1969 ▪ Code of practice and measurement procedure for testing Refrigerant Compressors.
- IS : 1520 ▪ Horizontal Centrifugal pumps for clear, cold and fresh water.
- IS : 1239 I & II - 1982 ▪ MS / GI tube, pipes, tubular and other wrought steel fittings. Hot-dip zinc coatings on steel tubes.
- IS : 10773 : 1995 ▪ Wrought copper tubes for Ref. & AC purposes.
- IS : 4736 - 1968 ▪ Code of procedure for manual metal arc welding of MS.
- IS : 3589 ▪ Electrically welded steel pipe for water, gas and sewage. Above: 200 NB, ANSI B 16.9 for pipe fittings.
- IS : 3656 ▪ Welds testing by DP
- IS : 1536 – 1976 ▪ Flanges configuration. (ANSI B 16.5 for SS flanges).
- IS : 6392 - 1971 ▪ Steel pipe flanges.
- IS : 210 ▪ Standard for CI material.
- IS : 1538 ▪ CI fittings for Pressure piping
- IS : 226 ▪ Structural Steel.
- IS : 638 ▪ Gaskets
- IS : 628 ▪ Rubber gasket, Teflon gasket for SS piping.
- IS : 554 – 1975 ▪ Dimensions for pipe threads for pressure tight joints
- IS : 3016 - 1982 ▪ Code of practice for fire precautions in welding and cutting operations.
- IS : 655 – 1963 ▪ Metal air Ductwork.
- IS : 277 - 1977 ▪ Galvanised steel wire sheets.
- IS : 3069 ▪ Glossary of Items symbols and units relating to thermal materials.
- IS : 702 ▪ Industrial Bitumin.
- IS : 4671 – 1984 ▪ Expanded polystyrene for thermal insulation purpose.

IS : 7240 - 1981 7413 - 1981	<ul style="list-style-type: none"> ▪ Code for practice for application and finishing of thermal insulation material at temp. From -80°C to 40°C. & 40°C to 700°C. ▪ Specifications for Bonded Mineral Wool.
IS : 8183 - 1976	
IS : 10556 : 1993	<ul style="list-style-type: none"> ▪ Storage and handling of insulation material
IS : 11246 : 1992	<ul style="list-style-type: none"> ▪ Glass fibre reinforced polyester resin.
IS : 12436 : 1988	<ul style="list-style-type: none"> ▪ Preformed rigid polyurethane thermal insulation
IS : 13204 : 1991	<ul style="list-style-type: none"> ▪ Rigid Phenolic foams thermal insulation
IS : 13205 : 1991 IS : 3624	<ul style="list-style-type: none"> ▪ In-situ pouring of Rigid Phenolic foams thermal insulation ▪ Bourden tube pressure and vacuum gauges.
IS : 1367	<ul style="list-style-type: none"> ▪ Bolts, nuts, and studs./ threaded fasteners.
IS : 2825 - 1969	<ul style="list-style-type: none"> ▪ Code for unfired pressure vessels.
IS : 7403	<ul style="list-style-type: none"> ▪ Cooling tower structure.
IS : 875, 1893	<ul style="list-style-type: none"> ▪ V belts, and pulleys for Industrial purpose.
IS : 5141	<ul style="list-style-type: none"> ▪ Code for shell and tube type heat exchanger.
IS : 325- 1970	<ul style="list-style-type: none"> ▪ Specification for three phases Induction motor.
IS : 4029	<ul style="list-style-type: none"> ▪ Testing of three phase Induction motor.
IS : 900	<ul style="list-style-type: none"> • Code of practice for installation of Induction motor.
IS : 996	<ul style="list-style-type: none"> ▪ Single phase small AC and universal motors.
IS : 4064 1978 -II	<ul style="list-style-type: none"> ▪ Switches for domestic & similar purpose.
IS : 2959 : 1975	<ul style="list-style-type: none"> ▪ Contractors for AC up to 1100 V.
IS : 2516- I &II	<ul style="list-style-type: none"> ▪ ACB
IS : 3854 – 1969	<ul style="list-style-type: none"> ▪ Accessories for electrical wiring
IS : 3837 – 1976	<ul style="list-style-type: none"> ▪ Code of practice for electrical wiring and fitting for building.
IS : 732 –1963 , 1973	<ul style="list-style-type: none"> ▪ Code for practice for installation and Testing of electrical wiring.
IS : 694 - 1977	<ul style="list-style-type: none"> ▪ PVC insulated electric cable for working up to and including 1100 volts.
IS : 1554 : 1981	<ul style="list-style-type: none"> ▪ PVC insulated (HD) electric cable for working up to 1.1 kV and 11kV volts.
IS : 1248	<ul style="list-style-type: none"> ▪ Direct acting electrical indicating instruments.
IS : 1822	<ul style="list-style-type: none"> ▪ Starters.
IS : 8544 - I to IV 1979	<ul style="list-style-type: none"> ▪ Motor starters for voltage not exceeding 1000 Volts.

- IS : 2208 - 1979 ▪ HRC fuse and links, up to 650 Volts.
- IS : 2147 – 1962 ▪ Degree of protection provided by enclosures for low voltage switch gear and control gears.
- IS : 10118: 1982 ▪ Code of practice for installation and maintenance of Switchgear.
- IS : 3043 : 1966 • Earthing.
- ISO R281 ▪ Rolling Bearings - Dynamic Load Ratings and Rating Life.
- IS : 4758 : 1968 ▪ Methods of measurement of noise emitted by machines.
- IS : 14280 : 1995 ▪ Mechanical vibration – balancing.
- IS : 12065 : 1987 ▪ Permissible limits of noise level for rotating electrical machines

Other / Equivalent Applicable Codes:

- ARI 550 -1998 ▪ Air -Conditioning and Refrigeration Institute Standard for Centrifugal or rotary Screw Water Chilling Packages (General) Specifications, Testing and rating.
- ARI 575 ▪ Air Conditioning and Refrigeration Institute. Standard Method of Measuring Machinery Sound within Equipment Rooms (Basis of all data presented or field testing of equipment, with relation to sound requirements).
- ASME Code ▪ All applicable / equivalent American Society of Mechanical Engineers’
- ANSI - B89.1 ▪ American National Standards Institute Safety Code for Unfired Pressure Vessels - Section VIII (Design, construction, testing and certification of pressure vessels).
- ANSI - B31.5 ▪ American National Standards Institute Safety Code for Mechanical Refrigeration (Overall general safety requirements, relief device sizing. etc.)
- ANSI - B31.1 ▪ American National Standards Institute- Code for Pressure Piping.
- ANSI - B31.3 ▪ American National Standards Institute- Code for Process Piping.
- ANSI - B36.19 ▪ Stainless Steel pipe.
- TEMA Code ▪ Tubular Exchanger Manufacturer’s Association.
- HTRI Code ▪ Heat Transfer Research Inc. guidelines for plate type heat exchanger.

8. QUALITY ASSURANCE PLANS

Following sample quality assurance plans are enclosed for maintaining quality of procurement items. These are guidelines. The final QAPs will be prepared based on the above for execution.

Before proceeding for manufacture of these items bidder must get approval for these items.

- 1) QAP for SS Butterfly valves
- 2) QAP for CI Butterfly valves
- 3) QAP for SS Ball Valves
- 4) QAP for SS Globe Valves
- 5) QAP for SS Pressure reducing valves
- 6) QAP for SS Pressure relief safety valves
- 7) QAP for Instruments & controls
- 8) QAP for SS pipes

9. DRAWINGS

The following drawings are enclosed with this tender document.

A. P&I DIAGRAMS: Dwg. No.: IPR/CWS/TBM/01

B. Layout Drawing: Dwg. No.: IPR/CWS/TBM/02/LAYOUT

SAMPLE COPY

<u>IPR</u>		CONTRACTOR		MANUFACTURING QUALITY PLAN				Job.: IPR Water Cooling system				
		SUB-CONTRACTOR:		ITEM: SS BUTTERFLY VALVES				Contract No:				
								Contractor:				
NO	COMPONENT & OPERATION	CHARACTERISTIC S	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			R
									M	C	I	
2		3	4	5	6	7	8	9	10			11
1	MATERIALS: BODY, SEAT, DISC, SPINDLE, BONNET, STUDS & NUTS	PHYSICAL CHEMICAL PROPERTIES	MAJOR	PHYSICAL & CHEMICAL TESTS	100 %	TECHNICAL SPEC	TECHNICAL SPEC	TEST CERTIFICATE	P	V	W1	
	TESTING											
	1) BODY	LEAK TIGHTNESS	CRITICAL	HYDRAULIC TEST	100 %	TECHNICAL SPEC	NO LEAKAGE	TEST CERTIFICATE	P	V	W2	
2) SEAT	LEAK TIGHTNESS	CRITICAL	HYDRAULIC TEST	100 %	TECHNICAL SPEC	NO LEAKAGE	TEST CERTIFICATE	P	V	W2		
2	FINAL INSPECTION (ASSEMBLED VALVE)	CLEANLINESS & OVER ALL DIAMENSIONS COMPLETENESS & WORKMANSHIP	MAJOR	VISUAL	100 %	APPROVED DRG. TECHNICAL SPEC	APPROVED DRG. TECHNICAL SPEC	INSPECTION REPORT	P	V	W2	
			REV - 0							DOCUMENT NO.		
MANUFACTURER		CONTRACTOR				REVIEWED BY						
SIGNATURE		SIGNATURE								NAME AND SIGN OF APPROVING AUTHORITY		

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

<u>IPR</u>		CONTRACTOR		MANUFACTURING QUALITY PLAN				Job.: IPR Water Cooling system				
		SUB-CONTRACTOR:		ITEM: CI BUTTERFLY VALVES				Contract No:				
								Contractor:				
NO	COMPONENT & OPERATION	CHARACTERISTIC S	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			R
									M	C	I	
2		3	4	5	6	7	8	9	10			11
1	MATERIALS: BODY, SEAT, DISC, SPINDLE, BONNET, STUDS & NUTS	PHYSICAL CHEMICAL PROPERTIES	MAJOR	PHYSICAL & CHEMICAL TESTS	100 %	TECHNICAL SPEC	TECHNICAL SPEC	TEST CERTIFICATE	P	V	W1	
	TESTING											
	1) BODY	LEAK TIGHTNESS	CRITICAL	HYDRAULIC TEST	100 %	TECHNICAL SPEC	NO LEAKAGE	TEST CERTIFICATE	P	V	W2	
2) SEAT	LEAK TIGHTNESS	CRITICAL	HYDRAULIC TEST	100 %	TECHNICAL SPEC	NO LEAKAGE	TEST CERTIFICATE	P	V	W2		
2	FINAL INSPECTION (ASSEMBLED VALVE)	CLEANLINESS & OVER ALL DIAMENSIONS COMPLETENESS & WORKMANSHIP	MAJOR	VISUAL	100 %	APPROVED DRG. TECHNICAL SPEC	APPROVED DRG. TECHNICAL SPEC	INSPECTION REPORT	P	V	W2	
			REV - 0							DOCUMENT NO.		
MANUFACTURER		CONTRACTOR				REVIEWED BY						
SIGNATURE		SIGNATURE								NAME AND SIGN OF APPROVING AUTHORITY		

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

CONTRACTOR		MANUFACTURING QUALITY PLAN						Job.: IPR Water cooling system				
SUB-CONTRACTOR :		ITEM: SS BALL VALVES						Contract No:				
CONTRACTOR		Contractor:				Contract No:						
1	2	3	4	5	6	7	8	9	10			11
									M	C	I	
1	MATERIALS: BODY, SEAT, DISC, SPINDLE, BONNET, STUDS & NUTS TESTING 1) BODY 2) SEAT	PHYSICAL CHEMICAL PROPERTIES LEAK TIGHTNESS LEAK TIGHTNESS	MAJOR CRITICAL CRITICAL	PHYSICAL & CHEMICAL TESTS HYDRAULIC TEST HYDRAULIC TEST	100 % 100 % 100 %	TECHNICAL SPEC TECHNICAL SPEC TECHNICAL SPEC	TECHNICAL SPEC NO LEAKAGE NO LEAKAGE	TEST CERTIFICATE TEST CERTIFICATE TEST CERTIFICATE	P P P	V V V	W1 W2 W2	
2	FINAL INSPECTION (ASSEMBLED VALVE)	CLEANLINESS & OVER ALL DIAMENSIONS COMPLETENESS & WORKMANSHIP	MAJOR	VISUAL	100 %	APPROVED DRG. TECHNICAL SPEC	APPROVED DRG. TECHNICAL SPEC	INSPECTION REPORT	P	V	W2	
			REV - 0					P - Performer V - Verifier M - Manufacturer C - Contractor I - IPR		DOCUMENT NO.		
MANUFACTURER		CONTRACTOR				REVIEWED BY						
SIGNATURE		SIGNATURE						NAME AND SIGN OF APPROVING AUTHORITY				

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

CONTRACTOR		MANUFACTURING QUALITY PLAN						Job.: IPR Water cooling system				
SUB-CONTRACTOR :		ITEM: SS GLOBE VALVES						Contract No:				
CONTRACTOR		Contractor:				Contract No:						
1	2	3	4	5	6	7	8	9	10			11
									M	C	I	
1	MATERIALS: BODY, SEAT, DISC, SPINDLE, BONNET, STUDS & NUTS TESTING 1) BODY 2) SEAT	PHYSICAL CHEMICAL PROPERTIES LEAK TIGHTNESS LEAK TIGHTNESS	MAJOR CRITICAL CRITICAL	PHYSICAL & CHEMICAL TESTS HYDRAULIC TEST HYDRAULIC TEST	100 % 100 % 100 %	TECHNICAL SPEC TECHNICAL SPEC TECHNICAL SPEC	TECHNICAL SPEC NO LEAKAGE NO LEAKAGE	TEST CERTIFICATE TEST CERTIFICATE TEST CERTIFICATE	P P P	V V V	W1 W2 W2	
2	FINAL INSPECTION (ASSEMBLED VALVE)	CLEANLINESS & OVER ALL DIAMENSIONS COMPLETENESS & WORKMANSHIP	MAJOR	VISUAL	100 %	APPROVED DRG. TECHNICAL SPEC	APPROVED DRG. TECHNICAL SPEC	INSPECTION REPORT	P	V	W2	
			REV - 0					DOCUMENT NO.				
MANUFACTURER		CONTRACTOR				REVIEWED BY	P - Performer V - Verifier M - Manufacturer C - Contractor I - IPR					
SIGNATURE		SIGNATURE						NAME AND SIGN OF APPROVING AUTHORITY				

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

CONTRACTOR: IPR		MANUFACTURING QUALITY PLAN						Job.: IPR Water cooling system Contract No: Contractor:				
		ITEM: SS PRESSURE REDUCING VALVES										
SUB CONTRACTOR:		CHARACTERISTIC 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY			R 11
No.	COMPONENT & OPERATION 2								M	C	N	
1	2	3	4	5	6	7	8	9	10			
1.1	BODY MATERIAL	COMPOSITION	MAJOR	CHEMICAL ANALYSIS	ONE /HEAT	APPROVED G.A DRG.	APPROVED G.A. DRG.	TEST CERTIFICATE	P	V	W1	
		MECHANICAL	MAJOR	MECH. TEST	ONE /HEAT	APPROVED G.A DRG.	APPL.MATERIAL SPEC.	TEST CERTIFICATE	P	V	W1	
1.2	TRIM MATERIAL	COMPOSITION	MAJOR	CHEMICAL ANALYSIS	ONE / LOT	APPROVED G.A DRG.	APPROVED G.A. DRG.	TEST CERTIFICATE	P	V	W1	
2.1	PRESSURE TEST	BODY	CRITICAL	VISUAL	100 %	APPROVED TECH SPEC.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
2.2	LEAK TEST	SEAT LEAKAGE	CRITICAL	VISUAL	100 %	APPROVED TECH SPEC.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
3.1	LEAK TEST	WITH SOAP WATER AT MAX. INLET PRESSURE	CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
3.2	FUNCTIONAL TEST	SET POINT TEST	CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	APPROVED G.A DRG.	INSPECTION REPORT	P	V	W2	
3.3	DOCUMENT	HISTORY DOCKET	MAJOR	RECORDS VERIFICATION	100 %	APPROVED SPEC.	APPROVED SPEC.	HISTORY DOCKET	P	V	W2	
MANUFACTURER		CONTRACTOR		REV - 0		REVIEWED BY	P - Performer V - Verifier M - Manufacturer C - Contractor I - IPR					
SIGNATURE								NAME AND SIGN OF APPROVING AUTHORITY				

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

CONTRACTOR: IPR		MANUFACTURING QUALITY PLAN						Job.: IPR Water cooling system Contract No: Contractor:				
		ITEM: SS PRESSURE RELIEF SAFETY VALVES										
SUB CONTRACTOR:		CHARACTERISTIC 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY			R 11
No.	COMPONENT & OPERATION 2								M	C	N	
1	2	3	4	5	6	7	8	9	10			
1.1	BODY MATERIAL	COMPOSITION	MAJOR	CHEMICAL ANALYSIS	ONE /HEAT	APPROVED G.A DRG.	APPROVED G.A. DRG.	TEST CERTIFICATE	P	V	W1	
		MECHANICAL	MAJOR	MECH. TEST	ONE /HEAT	APPROVED G.A DRG.	APPL.MATERIAL SPEC.	TEST CERTIFICATE	P	V	W1	
1.2	TRIM MATERIAL	COMPOSITION	MAJOR	CHEMICAL ANALYSIS	ONE / LOT	APPROVED G.A DRG.	APPROVED G.A. DRG.	TEST CERTIFICATE	P	V	W1	
2.1	PRESSURE TEST	BODY	CRITICAL	VISUAL	100 %	APPROVED TECH SPEC.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
2.2	LEAK TEST	SEAT LEAKAGE	CRITICAL	VISUAL	100 %	APPROVED TECH SPEC.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
3.1	LEAK TEST	WITH SOAP WATER AT MAX. INLET PRESSURE	CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
3.2	FUNCTIONAL TEST	SET POINT TEST	CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	APPROVED G.A DRG.	INSPECTION REPORT	P	V	W2	
3.3	DOCUMENT	HISTORY DOCKET	MAJOR	RECORDS VERIFICATION	100 %	APPROVED SPEC.	APPROVED SPEC.	HISTORY DOCKET	P	V	W2	
MANUFACTURER		CONTRACTOR	REV - 0				P - Performer V - Verifier M - Manufacturer C - Contractor I - IPR		NAME AND SIGN OF APPROVING AUTHORITY			
SIGNATURE					REVIEWED BY							

SAMPLE COPY
IPR

		CONTRACTOR		MANUFACTURING QUALITY PLAN			Job.: IPR Water cooling system				
				ITEM: INSTRUMENTS & CONTROLS			Contract No:				
							Contractor:				
No. 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	TYPE OF CHECK 4	QUANTUM OF CHECK 5	REFERENCE DOCUMENT 6	ACCEPTANCE NORMS 7	FORMAT OF RECORD 8	AGENCY			R 10
								M	C	I	
								9			
1	COMPLETED ASSEMBLY	A) SPECIFICATION	VERIFICATION	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	V	
		B) APPEARANCE	VISUAL	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	V	
		C) DIMENSIONS	MEASUREMENT	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	W3	
		E) RANGE & CALIBRATION	MEASUREMENT	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	W3	
		F) ACCURACY	PERFORMANCE	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	W3	
		G) OTHER FUNCTIONAL & OPTIONAL	PERFORMANCE	100%	PURCHASE ORDER	PURCHASE ORDER	TEST CERTIFICATE	P	V	W3	
		REV – REV .0				P-PERFORMER V-VERIFIER W-WITNESS M-MANUFACTURER C-CONTRACTOR I-IPR	DOCUMENT NO. REV – 0				
MANUFACTURER		CONTRACTOR			REVIEWED BY						
SIGNATURE							NAME AND SIGN OF APPROVING AUTHORITY				

W1 = No CHP, W2 = 100 % CHP, W3 = 10 % CHP, (CHP = CUSTOMER HOLD POINT)

SAMPLE COPY

IPR		CONTRACTOR SUB CONTRACTOR / SUPPLIER		MANUFACTURING QUALITY PLAN ITEM: SS 304 / SS 316 PIPES			Job.: IPR Water cooling system Contract No: Contractor:				
No.	COMPONENT & OPERATION	CHARACTERISTI CS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			R
								M	C	I	
1	2	3	4	5	6	7	8	9			10
1	Identification of Raw Material	Chemical composition	Tests	100%	ASTM A312, TP304, Mill TC	ASTM A312, TP304	TEST CERTIFICATE	P	V	W1	Test Report Review
2	Final Heat Treatment & temperature Record	Temperature & RPM	Heat treatment	100%	ASTM A312, TP304, Mill TC	ASTM A312, TP304	TEST CERTIFICATE	P	V	W1	-
3	Final pickling & Passivation	Bath Concentration, Surface cleanliness	Visual	100%	SSSL Procedure	ASTM A312, TP304	TEST CERTIFICATE	P	V	W1	-
4	Sampling / Stamping & Mechanical Test	Tension Flattening	Mechanical	Sample	ASTM A312, TP304, Mill TC	ASTM A312, TP304	TEST CERTIFICATE	P	W3	W3	-
5	Hydro Testing	Pressure & Leak Testing	Pressure Test	100%	ASTM A312, TP304	ASTM A312, TP304	TEST CERTIFICATE	P	W3	W3	-
6	Chemical Composition Test Product Analysis	Chemical Element	Chemical	Sample / Heat	ASTM A312, TP304	ASTM A312, TP304	TEST CERTIFICATE	P	W3	W3	-
7	Dimensional, Visual, and Marking	OD, Weight, Length, Cleanliness & Marking	Visual	100%	ASTM A312, TP304	ASTM A312, TP304	TEST REPORT	P	W2	W3	-
			REV 0				P-Performer V-Verifier W-Witness M-Manufacturer C-Contractor I-IPR		DOCUMENT NO.		
MANUFACTURER		CONTRACTOR				REVIWED BY					
SIGNATURE							NAME AND SIGN OF APPROVING AUTHORITY				

W1 = NO CHP, W2 = 100% CHP, W3 = 10% CHP, (CHP = CUSTOMER HOLD POINT)

