

# INSTITUTE FOR PLASMA RESEARCH

(AN AUTONOMOUS INSTITUTE OF DEPARTMENT OF ATOMIC ENERGY, GOVT. OF INDIA)

BHAT, GANDHINAGAR-382 428, INDIA

SUPPLY, INSTALLATION, TESTING AND  
COMMISSIONING OF NEGATIVE ION NBI WATER  
DISTRIBUTION SYSTEM AT IPR

(Please note that the bidder should sign on all pages)

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# **PART-A (TECHNICAL BID)**

## **1. PROJECT INFORMATION**

IPR is developing a negative Ion Neutral Beam Injection (NBI) heating System. The heat generated during the operation of negative ion NBI experimental system is to be removed and rejected to the atmosphere. The Cooling Water System will dissipate the heat rejected by various subsystems of Negative Ion NBI (N-NBI) to atmosphere. The proposed water distribution system of N-NBI experimental system will tap water from the main header (80 NB) of Loop-3 of Cooling Water System and shall leave the hot water back in the main header (300 NB) of Loop-3 of Cooling Water System. The details of negative ion NBI 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 SCOPE OF WORK**

**The scope of work is supply, fabrication (to suit site condition/ system layout), installation, testing and commissioning of Negative Ion NBI Water distribution system including piping, valves, instrumentation 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 water distribution system for this project is designed to provide and maintain necessary temperature, pressure, flow and quality of water to various sub systems of negative ion NBI 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.

#### **1.1.1 FREE ISSUE MATERIALS/ FACILITIES AND EXCLUSIONS**

IPR shall provide free power and 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 allow the free use of cranes / overhead crane.

IPR shall provide main incoming power supply.

IPR shall provide power supply to field instruments as required.

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 vendor's scope.

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

**List of items / works not covered if any, must be specified clearly by the Bidder.**

### **1.1.2 COMPLETION PERIOD:**

The total completion period is **4 months from the date of LOI/Purchase order**. This period includes the approval of drawings. 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 labor may have to work on 24 hours basis/ round the clock if required, with necessary prior permission. Necessary penalty shall be applied as per the Penalty /LD clauses in case of delay on part of Bidder. Any deviation bidder should indicate separately.

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

### **1.1.3 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.

**Within 2 weeks** 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. 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.

### **1.1.4 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 Incharge 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 Incharge, Copy of such orders shall be submitted for confirmation along with all specifications thereafter.

### **1.2 INSTRUCTION TO BIDDERS & ELIGIBILITY CRITERIA :**

The Bidder shall enclose following with the offer:

- i. The entire original tender documents and drawings duly endorsed.
- ii. Technical data sheet duly filled in without missing any details.
- iii. 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.
- iv. **Documentary evidence should be furnished in respect of following eligibility criteria:**
  1. Works similar in nature consisting of piping, instrumentation (flow meters, pressure transmitters, temperature transmitters, pressure gauges, temperature gauges, conductivity meters, pH meters, etc) duly executed: supply, installation, testing & commissioning either directly / or in collaboration / jointly in the last 3 years.
  2. **Out of above, highlight proof of quantum of only SS piping work including supply & installation of Rs. 20 lakhs and above, carried out at least in a single job in the last 3 years.**
  3. Provide details of purchaser (Contact person, phone/ Fax No.), Amount of contract, Period of completion against allowed period, Copy of orders, Performance certificates of completed jobs etc.
  4. Submit details of company management, technical manpower and service facilities available.
  5. Submit latest Income tax, Bank solvency certificates etc.
  6. Contractors handling process-piping jobs duly designed, mfg/supply, erection, testing & commissioning are preferable. Contractors handling only heating, ventilation & ducting works need not apply.

#### **1.2.1 DEVIATIONS:**

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

<b>Sr. no.</b>	<b>Tender condition</b>	<b>Deviation</b>	<b>Remark.</b>
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IPR reserves the right to include additional terms and conditions in the Contract documents and it will be binding on the Contractor.

**We agree to the above terms and conditions.**

**Signature and seal of Bidder**

**Place:**

**Date:**

### **1.3 INSPECTION, TESTING AND ACCEPTANCE:**

All materials and equipment shall confirm to the relevant Indian / equivalent standards and shall be of the approved make (Refer sections 5 & 6). 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.

#### **1.3.1 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.

#### **1.3.2 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. Physical at site.
  - b. Inspection / Pre-installation at site.
  - c. Welding joint inspection at site.
  - d. Pressure testing at factory.
  - e. Pressure testing at site.
  - f. Performance testing at site. (Capacity, Power consumption, Pressure drop, Vibration, etc.)
  - g. Calibration at site.

<b>Sr. No.</b>	<b>Item/ Equipment</b>	<b>Inspection /Test Involved.</b>
1	Piping and fittings	a, c, e, f
2	Valves	a, d, e, f
3	Instruments and controls	a, b, f, g
4	Insulation	a
5	MS structural work	a, c

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.

### **1.3.3 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/cm<sup>2</sup> 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.

### **1.3.4 WELDING: INSPECTION &ACCEPTANCE STANDARDS:**

Use of electrodes: Only reputed electrodes like Advani / ESAB / D & H 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 + 100 % 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:  $\pm 0.5\%$  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. (All piping shall be measured in units of length along the centerline including of all joints, bends, fittings, flanges, and other accessories).

### **1.3.5 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. 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.

### **1.3.6 COMPLETION OF ERECTION & COMMISSIONING**

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

- Painting:

All MS parts 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.

### **1.3.7 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.

### **1.3.8 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.

### **1.3.9 MEASUREMENT OF WORK;**

- 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.

#### **1.3.9.1 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 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 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 etc., will be done at contractor's cost.

### **1.3.9.2. Measurement for Insulation:**

Unless otherwise specified measurement pipe insulation for the project shall be on the basis of centerline measurements described herewith:

Pipe insulation shall be measured in units of length along the centerline of the installed pipe, strictly on the same basis as the piping measurements described earlier. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers are separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding and valves shall be considered strictly by linear measurements along the centerline of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

### **1.3.10 PAINTING - COLOUR CODE;**

All equipments shall be supplied 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.

## **2. DESIGN BASIS**

The main objective of negative ion NBI Water Distribution System is effective utilisation and distribution of cooling water according to the requirement of the experiments. Basically, this water distribution system taps water from the main supply & return headers of SST1- Water-cooling system.

The Water Distribution System shall cover to heat removal requirements of following subsystems:

- 1. NEGATIVE ION SOURCE SYSTEM**
- 2. RF GENERATOR SYSTEM**
- 3. PLASMA BOX SYSTEM**

The requirements for each subsystem are given below. Please refer enclosed P& I drawings and equipment layout 2D/ 3D furnished with the tender document before proceeding further.

### **NEGATIVE ION NBI COOLING WATER SYSTEM:**

The Negative ion NBI experimental system water distribution consists of 3 Nos. headers namely Header A, Header B and Header C.

The N-NBI experimental system consists of Negative Ion source, RF generator and Plasma Box systems. Three inlet headers (for Negative Ion source, RF generator and Plasma Box components) will feed the components with water of different inlet pressures and inlet temperatures. The inlet and outlet provisions to the various components have been provided from the vessel, housing the components. The outlets of all the groups (I, II& III) are connected to a common outlet header.

The system has to be operated for different flow rates within the mentioned flow ranges. The operation cycle of water circulating is continuously ON during the experiments time.

**ON operation:** Prior to actual ON operation, the whole piping system will be air-purged using the vent valves so as to ensure there is no air trapped inside the system. During normal ON operation, the bypass line is closed. The isolation valves remain open. The water with required hydraulic parameters flow through the component. After passing through the components the water enters the common outlet header, which has to be maintained at 2 bar (gauge) irrespective of different pressure drops across various components.

**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 component is having its own drain line with vent valve and the draining is done by the common drain line of 25 NB.

Please refer **DRG. SST1/WDS/N-NBI/01/R0** for process flow and refer component wise requirement in the table below.

Sr. No.	System Components	Flow Requirement (Liters per minute)	Pres. Drop ( $\Delta P$ ) (Bar)
<b>Negative Ion Source System (Header A)</b>			
1.	GB (Grid box)	-	-
2.	EG (Extractor Grid)	-	-
3.	GG (Ground Grid)	-	-
4.	RF Coil	-	-
5.	Calorimeter	-	-
<b>RF Generator System (Header B)</b>			
1.	RF Generator	4.8	-

2.	RF Oscillator	80	-
3.	RF Power Supply	4.8	-
4.	Dummy Load	56	-
<b>Plasma Box System (Header C)</b>			
1.	PB (Plasma Box)	-	-
2.	Back Plate	-	-
3.	Faraday Shield	-	-

### **3. 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.**

#### **3.1 SPECIFICATIONS OF COMPONENTS**

##### **3.1.1 PIPES & FITTINGS/ ACCESSORIES AND VALVES:**

**For DM water application:**

##### **3.1.1.1: Pipes:**

To be used to interconnect the system components for circulation of DM water through the water loops. It is proposed to install SS 316 / Sch. 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.

##### **3.1.1.2: 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.

##### **3.1.1.3: Pipe flanges:**

All flanges including flanges of valves are to be slip on serrated finished flanges.

##### **3.1.1.4: Butterfly Valves (Manual):**

Butterfly valves are to be used for isolation of equipments / components.

- The valves should be of wafer type with total SS 316 construction, pressure class PN 16 or class 300 as per the details in SOQ.

- The valves shall have mounting flange as per ISO 5211, centering lugs, locking lever handle. Preferably, the valves will be of two-piece body.
- The disc should provide bubble tight shut off in both flow directions with minimum torque and longer seat life.
- The valves should give higher Cv values. The valves should be with SS disc & stem, replaceable Teflon / EPDM seat.

#### **3.1.1.5: Ball Valves (Manual):**

Ball valves are to be used for isolation of equipments / components.

- The valves should be of flanged end (class 300) two piece construction, socket welded (or) screwed type (class 400) three piece construction, with total SS 316 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.
- The seat will be of PTFE.
- The valve design shall be as per BS: 5351/ API: 6D

#### **3.1.1.6: Globe Valves:**

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

- The valves should be of SS 316 construction, class 300 as per the details in SOQ.
- The bonnet / disc should be of SS. Preferably, the bonnet will be of removable type.

#### **3.1.1.7: 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 body & trim should be of SS 316 construction, class 300 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 connected or 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.

#### **3.1.1.8: Pressure relief valves:**

The 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 316 construction, class 300 as per the details in SOQ.
- 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 ensure bubble tight shut off.
- The valves should be of flange ended.

### **3.1.2 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.

#### **3.1.2.1 Temperature gauges:**

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

- Thermometers shall be dial type, 100 / 150 mm dia in aluminum white background with black markings.
- Thermometers should have thermowell attachment.
- The case can be of die cast aluminum with screwed bezel.
- The windows should be of shatterproof glass.
- The pointer should be of aluminum, coated with black colour.
- The weather proof protection should be provided as per IP-65 (IS:2147)
- Thermometers capillary / stem (SS 316, 6 / 8 mm dia. Or to suit the pipeline) shall be minimum 0.5 meters long (or to suit the pipeline) 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 may be "all - angle" type to suit the piping.
- Range of scales can be 0- 50 / 80 / 100 °C (as per requirement).
- 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.

#### **3.1.2.2 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 / 150 mm dia in aluminum white background with black markings.
- The gauges shall be connected to the pipes by 6 mm diameter SS / copper tubing through 6 mm dia SS valves, and SS U tube required for gauge protection during testing.
- The bourden should be of phosphor bronze / SS 316 Ti, socket should be of brass / SS 316.
- The case (glycerine filled type) can be of die cast aluminum with screwed bezel, epoxy painted black.
- The weather proof protection should be provided as per IP-65 (IS:2147)
- Range of scales should be 0-20 bar.
- The accuracy should be  $\pm 1\%$  FSD with over-range 125% FSD
- 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.

#### **3.1.2.3 Temperature transmitters:**

Necessary two wire, 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 ceramic and should be available in flameproof field mounting.
- SPAN-ZERO adjustments should be provided from outside.
- 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.

#### **3.1.2.4 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 0-20 bar.
- The accuracy should be  $\pm 0.5$  % 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.

#### **3.1.2.5 Flow meters:**

Necessary water flow meters (sensor cum transmitter) of turbine type are to be installed to measure the water flow mainly at inlet or out let of each system loads as indicated in P&I diagrams.

- The instrument should be of 'transmitter with display type'
- The instrument should be of 4-digit LCD display, backlit type and suitable for 4 – 20 mA current output to Data Acquisition and Control System (DACS) for sizes & flow range (lpm) mentioned in SOQ. Cable length up to 5 m is to be included with each instrument / sensor.
- The body should be of SS 316, rotor should be of teflon / SS, bearing should be ceramic bush.
- The accuracy should be  $\pm 0.5$  % FSD.
- The protection should be provided as per IP-65 (IS:2147)
- The pressure drop  $0.05 \text{ kg/cm}^2$  at 100% flow range.
- The connection should be flange ended, as per design requirement.
- The display unit should be compatible with  $230 \pm 10\%$  V, 50 Hz single phase AC supply with built -in electronic voltage stabilizer.

#### **3.1.2.6 Conductivity meters:**

Necessary two wire conductivity sensor – transmitter has to be installed at the location shown in the P & I diagram.

- The instrument should be of 'transmitter with display type'
- The sensor should be of 4 digit LCD display, backlit type and suitable for 4 – 20 mA current output to Data Acquisition and Control System (DACS) for sizes & ranges mentioned in SOQ. Cable length up to 5 m is to be included in the cost of each instrument / sensor.
- The weather proof protection should be provided as per IP-65 (IS : 2147)
- Range of scales should be 0-10  $\mu\text{S}$ .
- The accuracy should be  $\pm 0.5$  % FSD
- There should be provision for integral temperature compensation with Pt 100.
- The electrodes should be of SS 316 L / graphite
- The wetted materials can be of SS 316 L / epoxy, and enclosure can be of epoxy coated cast aluminum.

- There should be provision for cell constant adjustment.
- The terminals can be of screwed type / as per design requirement.
- Error of measurement:  $\pm 1\%$  of calibrated span.
- The display unit should be compatible with  $230 \pm 10\%$  V single phase AC supply with built -in electronic voltage stabilizer.

### **3.1.2.7 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. All automatic controls and instruments shall be tested at site for accuracy and reliability before commissioning the installation.

### **3.1.3 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  $10\text{-kg/mm}^2$ -test pressure.

Each lot of insulation material delivered at site shall be accompanied with manufacturer' 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. 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 out side the building:**

The insulation shall be pre-moulded pipe section of TF quality (flame retardant grade) expanded polystyrene (EPS) material. The thermal conductivity of the material shall not exceed  $0.04 \text{ W/m}^\circ\text{C}$ . at  $10^\circ\text{C}$  mean temperature and density should not be less than  $24 \text{ kg/ m}^3$ . Thickness of the insulation shall be as specified below for the individual applications. The insulation material can be readymade pipe section. Charcoal or equivalent can be used for fixing EPS insulation on pipe and aluminium cladding with 24 SWG gauge thickness.

<u>Pipe size (mm)</u>	<u>Thickness of insulation (mm)</u>
3" (80 NB)	50 mm

#### **Lines for "DM water" applications in side the building:**

The insulation shall be flexible and lightweight elastomeric EPDM material. The thermal conductivity of the material shall not exceed  $0.04 \text{ W/m}^\circ\text{C}$ . at  $10^\circ\text{C}$  mean temperature and density should not be less than  $60 \text{ kg/ m}^3$ . Thickness of the insulation shall be as specified below for the individual applications. The insulation material can be readymade pipe section. Cold adhesive or equivalent can be used for setting the insulation on the pipes.

<u>Pipe size (mm)</u>	<u>Thickness of insulation (mm)</u>
3" and below	9

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.

### **3.2: 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 galvanized steel channel and M S Class 'C' pipes, supported from floor only. 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 by blind flanges, 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.

### **3.3. 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. Isolation valves shall be set for full flow conditions during balance procedure. 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.

### **3.4 SPECIFICATIONS FOR CONTROL CABLES:**

Control cables shall be of 1100 Volts grade, annealed solid copper conductor, PVC insulated, extruded FRLC PVC inner sheathed, single galvanized steel armored, overall FRLS PVC sheathed confirming 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 14 SWG GI perforated type.

Each cable run shall be tagged with number that appears in the cable schedule. Cables shall be tagged at their entrance, every 5 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 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, Conductivity, Flow transmitters (2 wire type)	2C x 1.5 sq. mm Cu armored cable (includes power signal also)
2	Temperature sensors (RTD Pt-100)	2C x 1.5 sq. mm Cu armored cable

#### **4. 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

➤ **GLOBE VALVES ( manual) :**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
Flange specifications	
Seat / Disc	
Bearing/ sleeve	
Gland	
Operating lever.	
Fasteners:	
• Operating range & limits: Flow LPM / Pressure (Bar) / Temp. (°C).	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Local indication	•
• Additional features if any:	•

Description	Confirmation	Deviation
<ul style="list-style-type: none"> <li>• Globe valves are used for manual flow control and should provide bubble tight throttling.</li> <li>• The valves should be of SS 316 construction, class 300 as per the details in SOQ.</li> <li>• The bonnet / disc should be of SS. Preferably, the bonnet will be of removable type.</li> </ul>		

➤ **BUTTERFLY VALVES (manual):**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
Flange specifications	
Seat / Disc	
Stem / Trim	
Bearing/ sleeve	
Operating lever.	
Fasteners:	
• Operating range & limits: Pressure (Bar) / Temp. (°C).	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Local indication	•
• Additional features if any:	•

Description	Confirmation	Deviation
<ul style="list-style-type: none"> <li>• The valves should be of wafer type with total SS 316 construction, pressure class PN 16 or class 300 as per the details in SOQ.</li> <li>• The valves shall have mounting flange as per ISO 5211, centering lugs, locking lever handle. Preferably, the valves will be of two-piece body.</li> <li>• The disc should provide bubble tight shut off in both flow directions with minimum torque and longer seat life.</li> <li>• The valves should give higher Cv values. The valves should be with SS disc &amp; stem, replaceable Teflon / EPDM seat.</li> </ul>		

➤ **BALL VALVES ( manual):**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
End connection	
Seat / Ball	
Stem / Trim	
Stem seals/ Body seals	
Operating lever.	
Fasteners:	
• Operating range & limits: Pressure (Bar) / Temp. (°C).	•
• Bore	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Local indication	•
• Additional features if any:	•

Description	Confirmation	Deviation
<ul style="list-style-type: none"> <li>• The valves should be of flanged end (class 300) two piece construction, socket welded (or) screwed type (class 400) three piece construction, with total SS 316 construction, as per the details in SOQ.</li> <li>• The valves may have ISO 5211 mounting pad and double body sealing arrangement</li> <li>• The valves shall be of full-bore design only.</li> <li>• The seat will be of PTFE.</li> <li>• The valve design shall be as per BS: 5351/ API: 6D</li> </ul>		

➤ **PRESSURE REDUCING VALVES:**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
Flange specifications	
Seat / Diaphragm	
Stem / Trim	
Bearing/ sleeve	
Fasteners:	
• Operating range & limits: Flow LPM / Pressure (Bar) / Temp. (°C).	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Local indication	•
• Additional features if any:	•

Description	Confirmation	Deviation
<ul style="list-style-type: none"> <li>• The controlled downstream pressure should remain constant irrespective of changes in the inlet pressure and / or flow rate.</li> <li>• The valve should be of self-acting, pilot operated type.</li> <li>• The body &amp; trim should be of SS 316 construction, class 300 as per the details in SOQ. The disc / diaphragm should be of neoprene / EPDM / teflon. / equivalent</li> <li>• The internal parts like valve disc, trim parts may be of easily replaceable type without removing the whole body from the line.</li> <li>• 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 connected or downstream pressure measurement</li> <li>• The valves should be of flange ended.</li> <li>• The valves should provide class VI leak tightness.</li> <li>• The set pressure should be easily adjustable by adjusting the spring setting.</li> </ul>		

➤ **NEEDLE VALVES:**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
Flange specifications	
Seat	
Stem /Trim	
Bearing/ sleeve	
Seals	
Operating lever.	
Fasteners:	
• Operating range & limits: Pressure (Bar) / Temp. (°C).	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Local indication	•
• Additional features if any:	•

➤ **PRESSURE RELIEF VALVES:**

• Type / Class	•
• Make / Model	•
• Material of all body parts: (Enclose details)	•
Body / Bonnet	
Flange specifications	
Seat / Disc / Diaphragm:	
Stem / Plug / Trim	
Bearing/ sleeve	
Gland	
Seals	
Fasteners:	
• Operating range & limits: Pressure (Bar) / Temp. (°C).	•
• Cv value	•
• Max. Shut of pressure	•
• Test Pressure (Hydro – air) Shell / seat	•
• Leakage	•
• Additional features if any:	•

Description	Confirmation	Deviation
<ul style="list-style-type: none"> <li>• The valves should be of SS 316 construction, class 150 as per the details in SOQ.</li> <li>• The valves should be of spring operated, metal seated type.</li> <li>• The spring / pallet / piston / trim should be of SS.</li> <li>• The valves should be fire safe.</li> <li>• The valves should be of flange ended.</li> </ul>		

➤ **PIPING FOR DM WATER APPLICATION:**

▪ Material:	▪
▪ Make:	▪
▪ Schedule:	▪

➤ **INSULATION FOR CHILLED WATER LINES:**

• Type	•
• Make	•
• Density	•
• Thermal conductivity.	•

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

**TEMPERATURE SENSOR CUM TRANSMITTER:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Type of Indication – No. Of digits	•
• Working limits	•
• Type of enclosures	•
• Mounting detail	•
• Signal out put (Preferably 4 -20 mA)	•
• Calibration requirement	•
• Connection type and size.	•
• Power supply required	•
• Accessories Included (like terminal box, flanges etc)	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

**PRESSURE SENSOR CUM TRANSMITTER:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Type of Indication – No. of digits	•
• Working limits	•
• Type of enclosures	•
• Mounting detail	•
• Signal out put (Preferably 4 -20 mA)	•
• Calibration requirement	•
• Connection type and size.	•
• Power supply required	•
• Accessories Included (like terminal box, flanges etc)	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

**PRESSURE GAUGES:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Working limits	•
• Dial size	•
• Type of enclosures	•
• Mounting detail	•
• Calibration requirement	•
• Connection type and size.	•
• Accessories Included	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

**TEMPERATURE GAUGES:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Working limits	•
• Type of enclosures	•
• Dial size	•
• Mounting detail	•
• Calibration requirement	•
• Connection type and size.	•
• Accessories Included	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

**FLOW METER CUM TRANSMITTERS:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Type of Indication – No. of digits	•
• Working limits	•
• Type of enclosures	•
• Mounting detail	•
• Signal out put (Preferably 0 / 4 -20 mA)	•
• Calibration requirement	•
• Connection type and size.	•
• Power supply required	•
• Accessories Included (like terminal box, flanges etc)	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

**CONDUCTIVITY METER:**

• Type	•
• Make / Model / Size	•
• Material of construction of all parts	•
• Type of sensor & Transmitters.	•
• Measuring & Operating Range	•
• Accuracy	•
• Repeatability	•
• Response time	•
• Type of Indication – No. of digits	•
• Working limits	•
• Type of enclosures	•
• Mounting detail	•
• Signal out put (Preferably 4 -20 mA)	•
• Calibration requirement	•
• Connection type and size.	•
• Power supply required	•
• Accessories Included (like terminal box, flanges etc)	•
• Optional accessories Etc.	•
• Dimension (mm)	•
• Weight (kg)	•

## 5. 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
<b>1. Piping</b>	
<ul style="list-style-type: none"> <li>▪ SS pipe (Seamless / ERW)</li> <li>▪ Braided PVC pipe / Rubber hose pipe / flexible metal hose / fittings</li> </ul>	Chokshi tube/ Ratnamani/ Remi/SAIL/Jindal/Indian seamless Semsonex/ Samson /Abcoflex / Libra Flex / Micron (Legris) /Dunlop / Duplon / *
<b>2. Valves (DM water applications)</b>	
<ul style="list-style-type: none"> <li>▪ Butterfly (manual)</li> <li>▪ Globe (manual)</li> <li>▪ Ball Valves (manual)</li> <li>▪ Pressure reducing valves</li> <li>▪ Needle valves</li> <li>▪ Pressure relief valves</li> </ul>	Virgo/ Fisher control / AMRI / Technova / Intervolve / Advance / Saunders / Audco / CRI/ BDK Audco / Advance / Saunders / CRI / BDK Virgo/ Velan / Saunders / Audco / BDK Nirmal / Darling Muesco / Crescent / Forbes Marshall/ Brightech Valves Altop instruments / Laptop instruments / * Nirmal / Darling Muesco / Forbes Marshall/ Brightech Valves / BDK
<b>3. Insulation materials</b>	
<ul style="list-style-type: none"> <li>▪ Expanded polystyrene</li> <li>▪ Elastomeric EPDM foam</li> </ul>	Beardsell / Cooline / * Superlon / Armaflex / Arcoflex/ Aeroflex/ *
<b>4. Instruments &amp; Controls (Only DM water applications)</b>	
<ul style="list-style-type: none"> <li>▪ Temperature / Pressure gauges</li> <li>▪ RTD Temperature Transmitter / Pressure Transmitter</li> <li>▪ Conductivity meter</li> <li>▪ Flow meter (Turbine type)</li> </ul>	H-Guru / Bell Controls / Waree / WIKA/ IRA / Forbes Marshall Siemens / ABB / WIKA / Yokogawa / Rosemount /IRA / Honeywell Indion / Cole-Parmer / Forbes Marshall / Weller / Siemens / ABB Forbes Marshall / Rockwin / Sanvij / RR / *

\* Subject to IPR approval

## **6. STANDARDS/ CODES**

The following latest IS specifications / equivalent applicable codes are applicable for the proposed work.

IS: 2379 - 1963	▪ Colour code for identification of pipelines.
IS : 3656	▪ Welds testing by DP
IS : 6392 - 1971	▪ Steel pipe flanges.
IS : 628	▪ Rubber gasket, Teflon gasket for SS piping.
IS : 554 – 1975	▪ Dimensions for pipe threads for pressure tight joints
IS : 7240 - 1981 7413 - 1981	▪ Code for practice for application and finishing of thermal insulation material at temp. From -80°C to 40°C. & 40°C to 700°C.
IS : 1367	▪ Bolts, nuts, and studs./ threaded fasteners.
ANSI - B36.19	▪ Stainless Steel pipes.
IS : 444/87	▪ Insulated rubber hose manufactured in woven textile / braided yarn reinforcement.
IS: 1475 / 78, 1391/ 71	▪ Fan, heat exchanger, sheet metal works, tank insulation (For water cooler)

## **7. 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 SS Ball valves
- 3) QAP for SS Globe valves
- 4) QAP for SS Needle valves
- 5) QAP for SS Pressure reducing valves
- 6) QAP for SS Pressure relief valves
- 7) QAP for Instruments & controls
- 8) QAP for SS pipes

# SAMPLE COPY

CONTRACTOR		MANUFACTURING QUALITY PLAN ITEM: <b>SS BUTTERFLY VALVES</b>						Job.: <b>N-NBI Water distribution system</b>				
SUB-CONTRACTOR :								Contract No:				
								Contractor:				
No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	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			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	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

<b>IPR</b>		CONTRACTOR		MANUFACTURING QUALITY PLAN ITEM: <b>SS BALL VALVES</b>				Job.: <b>N-NBI Water distribution system</b>				
		SUB-CONTRACTOR :						Contract No:		Contractor:		
No.	COMPONENT & OPERATION	CHARACTERISTIC S	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT :	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			R
1	2	3	4	5	6	7	8	9	M	C	I	11
									10			
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**  
IPR

		CONTRACTOR		MANUFACTURING QUALITY PLAN				Job.: N-NBI Water distribution system				
		SUB-CONTRACTOR :		ITEM: SS GLOBE VALVES				Contract No:				
								Contractor:				
No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	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			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 DRQ. TECHNICAL SPEC	APPROVED DRQ. 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**  
IPR

CONTRACTOR		MANUFACTURING QUALITY PLAN						Job.: N-NBI Water distribution system				
SUB-CONTRACTOR :		ITEM: NEEDLE VALVES						Contract No:				
CONTRACTOR		ITEM: NEEDLE VALVES						Contractor:				
No.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	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			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 DRQ. TECHNICAL SPEC	APPROVED DRQ. 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 )

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

# SAMPLE COPY

		CONTRACTOR:		MANUFACTURING QUALITY PLAN				Job.: N-NBI Water distribution system				
		SUB CONTRACTOR:		<b>ITEM: SS PRESSURE REDUCING VALVES</b>				Contract No: Contractor:				
No. 1	COMPONENT & OPERATION 2	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
									M	C	N	
									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			
SIGNATURE						REVIEWED BY		NAME AND SIGN OF APPROVING AUTHORITY				

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

**SAMPLE COPY**  
IPR

		CONTRACTOR:		MANUFACTURING QUALITY PLAN				Job.: N-NBI Water distribution system				
		SUB CONTRACTOR:		ITEM: PRESSURE REFIEF VALVE				Contract No: Contractor:				
No. 1	COMPONENT & OPERATION 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY			R
									M	C	N	
									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 SET POINT TEST	CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	NO LEAKAGE	INSPECTION REPORT	P	V	W2	
3.2	FUNCTIONAL TEST		CRITICAL	VISUAL	100 %	APPROVED G.A DRG.	APPROVED G.A DRG.	INSPECTION REPORT	P	V	W2	
3.3	DOCUMENTATION		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					
SIGNATURE						REVIEWED BY			NAME AND SIGN OF APPROVING AUTHORITY			

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

**SAMPLE COPY**  
**IPR**

CONTRACTOR		MANUFACTURING QUALITY PLAN ITEM: INSTRUMENTS & CONTROLS					Job.: N-NBI Water distribution system				
							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	DOCUMENT NO.				
MANUFACTURER			CONTRACTOR		REVIEWED BY	M-MANUFACTURER C-CONTRACTOR I-IPR	REV – 0				
SIGNATURE							NAME AND SIGN OF APPROVING AUTHORITY				

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

**SAMPLE COPY**

<b>IPR</b>		CONTRACTOR SUB CONTRACTOR / SUPPLIER		MANUFACTURING QUALITY PLAN ITEM: <b>SS 304 / SS 316 PIPES</b>			Job.: <b>N-NBI Water distribution system</b> 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		DOCUMENT NO.		
MANUFACTURER		CONTRACTOR		REVIWED BY		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)

## **8. DRAWINGS**

The following drawings are enclosed in **Annexure-II** with this tender document.

### **A. P&I DIAGRAMS:**

Dwg. No. SST1/WDS/N-NBI/01/R0

### **B. SYSTEMS LAYOUTS & LOCATIONAL DRAWINGS:**

Dwg. No. SST1/WDS/N-NBI-LAYOUT/01/R0

## **PART – B (PRICE BID)**

### **SCHEDULE OF QUANTITIES (QUOTATION FORMAT)**

(To be filled in completely by bidder and returned to IPR)

#### **NOTES:**

All the items are broadly specified in SOQ, however for detail specifications refer to tender Section **3 &4**.

No alteration what so ever is to be made to the text or quantities of this schedule unless such alteration is authorized in writing by IPR. Any such alterations, notes or additions shall, unless authorized in writing, be disregarded when tender documents are considered.

All the system parts, equipments shall be offered strictly as per the approved make only, deviation may be liable for rejection. The Bidder may additionally submit quotations for any alternative equipment proposed by them, however, prices for each items listed in this schedule must be clearly and completely filled in.

In the event of error occurring in the amount column of the schedule, as a result or wrong extension of the unit rate and quantity, the unit rate quoted by the Bidder shall be regarded as firm and the extensions shall be amended on the basis of the same rates.

**The rate of each item of work included in the Schedule of quantities shall, unless expressly stated otherwise, includes cost of :**

All materials, fixing materials, accessories, operation, appliances, tools, plant, equipments, transport, labour and incidentals required in preparation for and in the full and entire execution, testing balancing, commissioning and completion of the work called for in the item and as per specifications and drawings.

Wastage on materials and labour.

Loading, transporting, unloading, handling/double handling, hoisting to all levels, setting, fitting and fixing in position, protecting, disposal of debris and all other labour, necessary for the full and entire execution and to fully complete the job in accordance with contract documents, good practice and recognized principles.

Liabilities, obligations and risks arising out of conditions of contract.

The specifications and drawings wherever available, are to be read as complimentary to and part of the Schedule of quantities and any work called for in shall be taken as required.

In the event of conflict between Schedule of quantities and other documents including the specifications, the most stringent shall apply and the interpretation of the Engineer In charge shall be final and binding.

All equipments, quantities and technical data indicated in this Schedule (SOQ) are based on the engineering by IPR. These quantities shall be adjusted / amended after detail engineering and in accordance with the actual requirement after the approval of drawings and specifications. Contractor shall be paid for the actual quantity of work executed by him in accordance with the approved drawings at the contract rates.

**The systems are placed at various locations within the utility building, negative ion NBI Lab at IPR as shown in layout drawings. The main water-cooling supply & return headers are also located outside the Tokamak hall. The pipelines will need to follow complicated paths. The contractor has to prepare piping layout to suit the site conditions / system layout. The Bidder has to take into account the necessary bends, fittings like elbow, tees, reducers, etc while submitting price bid. The SS mountings like nipple / coupling for thermowell / pressure sensor and other instruments should also to be considered while quoting for instruments.**

The Bidder may visit the site to have an idea of the complexity involved in the system, prior to quote if they desire. However, all the systems may not be physically available to see.

The Bidder shall Provide rates for all the items / sizes.

**We agree to the above terms and conditions.**

**Place:**

**Signature of Vendor**

**Date:**

**(Office Seal)**

**SCHEDULE OF QUANTITY**  
(To be filled in by bidder and returned to IPR)

Sr. No	Item Description	Qty	Unit	Unit rate (in Rs.)	Total rate (in Rs.)
A	<p><b><u>NEGATIVE ION NBI COOLING SYSTEM</u></b></p> <p>For details refer: Dwg. No. SST1/WDS/N-NBI/01/R0 Dwg. No. SST1/WDS/N-NBI-LAYOUT/01/R0</p>	-	-	-	-
A.1	<p><b><u>SS PIPING:</u></b></p> <p>Providing and fixing in position the following SS 316 pipes cut to required lengths and installed with all welded joints, necessary fittings, like elbows, tees, bends (Long/short radius), reducers, fasteners, PTFE / eq. gaskets (Sch-40 @ 5 mm) etc.</p> <p><b><u>Schedule 40 pipe, fittings and flanges.</u></b></p> <p>80 NB (ERW pipe) 65 NB (ERW pipe) 50 NB (Seamless pipe) 25NB (Seamless pipe) 20 NB (Seamless pipe) 15NB (Seamless pipe)</p>	80 20 20 30 10 30	RMT RMT RMT RMT RMT RMT		
A.2	<p><b><u>BRAIDED PVC HOSE PIPING:</u></b></p> <p>Providing and fixing in position the following FR-PVC flexible hose pipes of 20 bar working pressure, cut to required lengths and installed with all fittings including necessary size and quantity of flanges, elbows, tees, reducers, nipples, couplings, gaskets, hard wares etc.</p> <p>32 mm 25 mm 19 mm</p>	120 90 150	RMT RMT RMT		
A.3	<p><b><u>INSULATION :</u></b></p> <p>Supply, installation and testing of pre-moulded pipe section of TF quality (<b>flame retardant grade</b>) expanded polystyrene (EPS) insulation on DM water pipe, fittings like valves, flanges, unions etc (with aluminum cladding-24 SWG) EPS foam should be fix to pipe with charcoal and should have one layer of PE (Polyethylene) sheet at outer diameter</p> <p>80 NB (50 mm thk. Insulation)</p> <p><b><u>INSULATION:</u></b> Supply, installation and testing of flexible and lightweight elastomeric EPDM material on water pipes, fittings like valves, flanges, unions etc.</p> <p>80 NB (9 mm thk. Insulation) 65 NB (9 mm thk. Insulation) 50 NB (9 mm thk. Insulation) 25 NB (9 mm thk. Insulation) 20 NB (9 mm thk. Insulation) 15 NB (9 mm thk. Insulation)</p>	60       20 20 20 30 10 30	RMT       RMT RMT RMT RMT RMT RMT		

A.4	<p><b><u>BUTTERFLY VALVES:</u></b></p> <p>Providing and fixing in position of following wafer type Butterfly valves with total SS 316 construction, Class 300 including body with bubble tight shut off, replaceable Teflon / EPDM seat.</p> <p>80 NB 65 NB 50 NB</p>	6 1 1	Nos. Nos. Nos.		
A.5	<p><b><u>BALL VALVES:</u></b></p> <p>Providing and fixing in position of following three piece Ball valves with total SS 316, Class 300 construction.</p> <p>25 NB 20 NB 15 NB</p>	11 7 13	Nos. Nos. Nos.		
A.6	<p><b><u>GLOBE VALVES:</u></b></p> <p>Providing and fixing in position of following Globe valves with total SS 316, Class 300 construction</p> <p>65 NB 25 NB</p>	1 1	Nos. Nos.		
A.7	<p><b><u>Y-Strainer:</u></b></p> <p>Providing and fixing in position of following class 150 - Y strainers, with SS 316 body and SS 316 filter including matching flanges and fasteners.</p> <p>80 NB</p>	1	No.		
A.8	<p><b><u>PRESSURE REDUCING VALVES:</u></b></p> <p>Providing and fixing in position of following Self acting Pressure reducing valves with total SS 316, Class 300 construction, range (8 – 1) bar. The PRV should comprise ¼” pressure gauge connection, with one set of pressure gauge connected for downstream pressure measurement.</p> <p><u>Technical data:</u> Inlet pressure: 12 bar Outlet pressure: 0 –8 bar adjustable</p> <p>80 NB (Set Pressure- 4 bar) 50 NB (Set Pressure- 5 bar) 25 NB (Set Pressure- 5 bar)</p>	1 1 1	Nos. Nos. Nos.		
A.9	<p><b><u>PRESSURE RELIEF VALVE</u></b></p> <p>Providing and fixing in position of SS 316 Relief valve (RV) (Set. pr. less than 7 bar)</p> <p>50 NB</p>	2	Nos.		

A.10	<b>INSTRUMENTS:</b>				
	<b>(a) Pressure gauges:</b> Providing and fixing in position, water pressure gauges with all SS accessories like shutoff valve siphon pipe, etc. with 1% accuracy.	7	Nos.		
	<b>(b) Temperature gauges:</b> Providing and fixing in position the dial type industrial thermometers with all SS accessories.. Range - 0 - 100°C, Accuracy 1%.	1	Nos.		
	<b>(c) RTD Temp Transmitter:</b> Providing and fixing in position the PT-100 RTD sensor with head mounted temperature transmitter giving output of 4 – 20 mA to DACS with all SS mounting accessories. Range 0 - 100°C. Accuracy ± 0.5%. Cable length up to 5 m length to be included in the cost of each instrument / sensor.	13	Nos.		
	<b>(d) Pressure Sensor Cum Transmitters:</b> Providing and fixing in position, water pressure sensor cum transmitters with all SS mounting accessories and 4 – 20 mA / suitable output to DACS. Range 0-20 bar. Accuracy ± 0.5%. Cable length up to 5 m is to be included in the cost of each instrument / sensor.	1	Nos.		
	<b>(e) Conductivity meter:</b>  Providing, fixing in position and interlocking of electronic/ digital conductivity meters with ± 0.5% accuracy with all accessories including continuous reading and annunciation facility, flow type sensor for monitoring of water conductivity. Range 0 – 10 µS. with temperature compensation. Suitable V/I output to Data acquisition and control system (DACS).	2	Nos.		
	<b>(f) Flow meters:</b>  Providing, fixing in position the turbine type water flow meter with ± 0.5% accuracy, SS 316 construction, max. working pressure / temp. is 15 bar / 80 °C, with 4 digit LCD display, backlit type and suitable for 4 – 20 mA current output to Data Acquisition and Control System (DACS) for following sizes & flow range. Cable length up to 5 m length to be included in the cost of each instrument / sensor.  <b><u>Line Size (NB) : Flow Range (LPM)</u></b> 80: 300 – 1000 65: 200 – 570 50: 60 –200 25: 30 – 100  <b>Note: The digital LCD display unit for above flow meter to be mounted on custom built single panel board at one place, as per IPR requirement.</b>	1 1 1 1	Nos. Nos. Nos. Nos.		

A.11	<p><b><u>MS STRUCTURE WORK:</u></b></p> <p>Design, supply, fabrication, installation of minor MS structure work for supporting piping at the site to suit the system requirements, including operating platform (If at all needed) within the building with anti corrosion painting. Minor MS support structure work including plates / channels / pipes.</p>	1500	Kgs		
A.12	<p><b><u>MINOR CIVIL WORKS:</u></b></p> <p>For all the applicable equipments covered under Schedule of quantity – in the above sections of this tender. Grouting of supports and finishing good of them, making holes in the walls, finishing of holes and any other type of minor civil works to finished the works as per tender document conditions shall be included.</p>	1	Lot		

**TOTAL :** \_\_\_\_\_

**In words:** \_\_\_\_\_

**Applicable Taxes:** \_\_\_\_\_

**COMPLETION PERIOD:** \_\_\_\_\_ MONTHS FROM DATE OF LOI

**Note:**

- *Deviations if any shall be clearly specified on separate sheet with all details.*
- **Clearly mentioned the applicable taxes including service taxes, if any. If quotation is inclusive of all taxes, then also clearly mentioned “Applicable Taxes: Nil”. Quotations received without ‘applicable taxes information’ will be rejected.**

**Place:**

**Signature of Vendor**

**Date:**

**(Office Seal)**

**ANNEXURE – II**

**A. P&I DIAGRAMS:**

**Dwg. No. SST1/WDS/N-NBI/01/R0**

**B. SYSTEMS LAYOUTS & LOCATIONAL DRAWINGS:**

**Dwg. No. SST1/WDS/N-NBI-LAYOUT/01/R0**

**(ATTACHED SEPARATELY)**