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2.2.2	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes	
2.3	Minimum access opening required (with rolling shutter) transportation,	3.5 M wide x 4 M high or wherever entry of truck, for material depending upon the envisaged equipment size to be handled.	
2.4	Plinth level of all buildings, above the local developed for power house building.	300 mm	
3.0	<u>OTHER MAINTENANCE REQUIREMENT</u>		
3.1	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking / lowering assembly, dismantling of building end walls / structures etc. shall be kept.	Yes	

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3.2	Maintenance of the internals / impellers of all important equipment, like Boiler Feed Pumps, Feed Water Heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, Cooling Water Pumps, Coal Mills, Air Compressors, Blowers, Heat Exchangers, Fuel Oil Pumps, Filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3.3	Overhauling and handling of the casings for the above items	Shall be possible without disturbing / dismantling any piping / ducting not directly connected to them.
3.4	Crane Approach Wherever required, the unobstructed approach of the crane hook / other hoisting equipment hook to various plant & equipment shall be possible.	Yes
4.0	<u>CENTRAL CONTROL ROOM</u> All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes

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5.0	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.		
5.1	However, as a guide line, following features are given:		
5.1.1	False ceiling and false flooring shall be provided.		
5.1.2	Uniform height, colouring schemes for cabinets etc. shall be available.		
5.1.3	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.		
5.1.4	No opening shall be provided from Boiler side.		
5.1.5	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.		
5.1.6	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.		

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5.1.7	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.		
5.1.8	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.		
5.1.9	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.		
6.0	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.	

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SPECIFIC LAYOUT CONSIDERATIONS

ANNEXURE-D

While developing the layouts, the following major layout parameters shall be ensured, as a minimum:

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1.0	AB bay, BC & CD bay widths	36.0 M, 12.0 M & 12.0M
2.0	Arrangement of TG set	Longitudinal
3.0	Floor levels in AB bay	0.0 M, 9.0 M, 17.0 M
4.0	Floor levels in B-C bay	0.0 M, 9.0 M, 17.0 M 24.0M, 28.0 M 32.8 M, 38.0 M
5.0	Level of operating floor	17.0 M
6.0	Level of mezzanine floor	9.0 M
7.0	HT/LT Switchgear and MCC location	HT Switchgear at 3.5 M and LT Switchgear & MCC at 12.0 M in AB bay
8.0	Area of unloading bays	750 sq. M
9.0	Lay down Area (Minimum on operating floor) with EOT Crane approach	750 sq. M.
10.0	Minimum clear working space around the equipment	1200 mm
11.0	Location of Deaerator	In BC bay at EL. 38.0 M

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12.0	Location of Heaters	HP Heaters/LP Heaters at Operating Floor/ Mezzanine Floor respectively in B-C Bay.
13.0	Location of BFP	TDBFP at Operating Floor and MDBFP at Ground Floor in AB Bay.
14.0	Location of Boiler MCC	At 28.0 M in BC bay
15.0	Clear Head room within Main plant Building for pipes, structures & cable trays, ducts etc.	2.5 M
16.0	Number of Fire Escape staircases in the main plant with fire doors at each landing	Minimum Four (4)
17.0	Minimum width of all staircases landings	1500 mm
18.0	Passenger Elevators	One (min)
19.0	Clear approach width in front and rear of ESP	10 M (Height = 8 M)
20.0	Head Room for pipe/cables trestles at rail, road crossing	8.0 M
21.0	Minimum straight length in Flue gas duct at ESP outlet for Opacity meters.	As required for accurate dust measurement within the battery limits.
22.0	Elevation of ID Ducts entering Chimney	12.75 M (Min.) (Bottom of steel)

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1.0 <u>GENERAL INFORMATION</u> This section covers all the low-pressure piping up to 400 NB size, associated valves and specialties that include as a minimum: 1.1 The Raw Water Piping supplying raw water to raw water reservoir (from proposed raw water gravity line from Ozerkheda reservoir to existing 2 x 500 MW units.) 1.2 Raw water piping from discharge of raw water pumps up to Cascade Aerator in Pre treatment plant. 1.3 Service Air System 1.4 Instrument Air System 1.5 Demineralised Water Supply system 1.6 Plant Potable Water System - (filtered & Ozonised water) 1.7 Service Water System 1.8 Air heater washing system 1.9 Clear water supply line for Coal handling plant dust suppression/dust extraction from discharge of CHP DS/DE supply pumps located at Clear water pump house in ETP area. 1.10 Fuel oil system piping supply and Fuel Oil return from boiler and Steam tracing to HFO tank. 1.11 Any other low pressure piping as found necessary during detail engineering shall also be included. 2.0 <u>CODES AND STANDARDS</u> 2.1 In addition to the requirements spelt out in Volume II, the design, manufacture, inspection and testing of the piping, fittings, valves and		

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specialties covered under this specification shall conform, in general, to the standards and codes mentioned below:			
2.1.1	IS-1239 [Part-I & II]	: Mild steel tubes, tubular and other wrought steel fittings.	
2.1.2	IS-3589	: Electrically welded steel pipes for water, gas and sewage (200 to 2000 NB)	
2.1.3	IS-554	: Dimensions for pipe threads where pressure tight joints are required on the threads.	
2.1.4	IS-1363 [Part-I & II]	: Hexagonal head bolts, screws and nuts (size range M5 to M36)	
2.1.5	IS-1364	: Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)	
2.1.6	IS-3138	: Hexagon bolts & nuts (M42 to M150)	
2.1.7	IS-4736	: Hot dip zinc coating on mild steel tubes.	
2.1.8	IS 14846	: Sluice Valves for water works purposes.	
2.1.9	IS-2685	: Code of practice for selection, installation and maintenance of sluice valve.	
2.1.10	IS-5312	: Swing check type reflux (non-return) valves.	
2.1.11	IS-2379	: Colour code for the identification of pipelines.	
2.1.12	IS-2016	: Plain washers	
2.1.13	IS-2712	: Compressed asbestos fibre jointing	
2.1.14	ANSI B-16.5	: Steel pipe flanges and flanged fittings	
2.1.15	ANSI B-16.9	: Wrought steel Butt welding flanged	
2.1.16	ANSI B-16.11	: Forged steel fittings, Socket-welding and Threaded.	

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2.1.17 ANSI B-36.10 : Steel pipes thickness 2.1.18 API-600 : Steel gate valves 2.1.19 BS-2633 : Class I Arc welding of ferrite steel pipe work for carrying fluids. 2.1.20 BS-534 : Specification for steel pipes and specials for water and sewage. 2.1.21 BS-5351 : Specification for Ball valves. 2.1.22 BS EN ISO : Specification for Ball valves. 17292 : 2004 2.1.23 AWWA-C-504 : Specification for Butterfly valves. 2.1.24 AWWA-C-208 : Dimension for fabricated steel water pipe fittings. 2.2 Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Owner. 3.0 <u>SCOPE OF WORK</u> 3.1 The equipment and materials to be supplied shall include as a minimum, the following : (a) Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc as required for the piping system. (b) Matching pipes, matching pieces like reducers/expanders etc, counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc. (c) Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.		

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(d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc complete with the counter flanges and matching connecting pieces as required for entire low pressure piping system. (e) Anchors, hangers and supports etc as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc. (f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping shall be avoided to the extent possible. (g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches of the Power Station. (h) Pipe rack required between WTP, Oil storage area to TG Hall and boiler area is under bidders cost of design and construction including the civil foundation for pipe rack and any other piping support foundations wherever required. (i) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc as required for interconnecting piping, valves & fittings. (j) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop. 3.2 Following general requirements shall however be provided (a) Instrument connections including instruments, root valves, sensing lines etc. (b) Pipe stubs and blanking plates etc required for chemical cleaning and hydro testing.		

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For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.3 The Flow Diagrams forming a part of the specification are mainly intended to give general guidelines to the Bidder regarding extent of piping, valves, and specialties to be supplied under this section.

4.0 GENERAL DESIGN AND CONSTRUCTION

4.1 GENERAL CONSIDERATIONS

4.1.1 Line Sizing

Sizes of piping shall be selected such that the velocity of fluid in pipes does not exceed the following limits under conditions of maximum possible volumetric flow.

(a)	Water				
	(i)	Condenser CW	Below 1000 NB	1000-2000 NB	Above 2000 NB
		a. Pump suction	1.0	1.3	1.5
		b. Pump discharge / distribution	2.4	2.8	3.0
	(ii)	Water- General	Below 200 NB	200-400 NB	400-700 NB
		a. Pump suction	1.0		
		b. Pump discharge / distribution	1.8	2.2	2.5
(b)	Fuel oil				
		Heavy oil (Heated)			
		a. Pump suction	1.0		

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<table><tr><td></td><td></td><td>b. Pump discharge / distribution</td><td>1.5-2.0</td></tr><tr><td>(c)</td><td colspan="3">Gases</td></tr><tr><td></td><td></td><td>a. Compressed air</td><td>15-25</td></tr></table>						b. Pump discharge / distribution	1.5-2.0	(c)	Gases					a. Compressed air	15-25
		b. Pump discharge / distribution	1.5-2.0												
(c)	Gases														
		a. Compressed air	15-25												
4.1.2	The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.														
4.1.3	The piping system shall be complete in every detail and in accordance with the highest standard of workmanship. Against any doubt, Owner shall be referred for clarification.														
4.1.4	All design and fabrication shall be in accordance with codes/standards specified.														
4.1.5	No pipe work shall run in trenches carrying electrical cables.														
4.1.6	Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.														
4.1.7	All piping shall be identified by means of colour strips, by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.														
4.1.8	Air release and drain branches shall be provided, wherever necessary, depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.														
4.1.9	Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/cm ² (g) at 80°C or as required by the design of the different piping system, if higher.														
4.1.10	Drain Pipe work														
	(a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.														

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(b) Unless otherwise stated, all drain piping shall be of 25 NB minimum and all vent piping shall be of 15 NB minimum. For pipes up to 40 NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.

(c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.

4.1.11 Specification of pipes used in different services included in the L.P. piping section has been detailed in Annexure-I.

4.1.12 Following types of valves shall be used for the system/ service marked as y

	Types of Valves				
	Butterfly	Gate	Globe	Check	Ball
(a) Water	y	y	y	y	y
(b) Drains & Vent		y	y	y	
(c) Fuel oil		y	y	y	y
(d) Air		y	y	y	y

4.1.13 HFO oil line shall be traced by steam tracers.

4.2 MATERIAL SPECIFICATION

4.2.1 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Owner depending on the merits of alternative material.

4.2.2 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.

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4.3 <u>FABRICATION</u> For Detailed Fabrication requirement of LP piping, Refer clause no- 6.5 of Section –I of this specification. 4.4 <u>HANGERS, SUPPORTS, ANCHORS</u> Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item, shall be supported in such a way that the plant item does not take the weight of the piping. 4.4.1 Support spacing shall be as per good engineering practice. However, in no case it shall be less than support spacing stipulated in ANSI B31.1. 4.4.2 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection. 4.4.3 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required. 4.4.4 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by welding, by bolting or by beam clamps. Boltholes shall be drilled, not burned. Support components may be bolted to concrete using approved concrete anchors. 4.5 <u>VALVES AND ACCESSORIES</u> 4.5.1 Valves (a) All valves shall be of approved make and type and shall have cast/ forged bodies with covers and glands of approved construction and materials as specified in Annexure-II & III.		

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(b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/ outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs shall be avoided as far as possible. (c) All valves shall, unless otherwise stated, have the internal diameter same as the internal diameter of the pipes to be joined. (d) All valves shall receive tests at manufacturer's or contractor's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Owner. (e) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate. (f) Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Owner's approval. (g) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items: (i) Hand wheel with embossed open and shut directions. (ii) Local position indicator. (iii) Motorised operation as specified by Engineer. (h) Gate valves, in addition shall be provided with following extra features (i) Bypass valve for larger valves (ii) Draining arrangement		

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(iii) Enclosed Gear operators for valves 300 NB and above for ease in operation. (iv) Motorised operation as specified by Engineer. (i) All gate and globe valves shall be rising stem type. (j) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also. (k) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties. (l) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position. (m) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided. (n) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction. (o) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.		

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(p) Plastic or bakelite valve hand wheels will not be accepted. (q) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers. (r) Wherever practicable, heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500kg shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable. (s) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum. (t) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves. (u) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction. (v) All sampling and root valves shall be of integral body bonnet type. (w) Gate and globe valves used for fuel oil system shall be of such design as to permit re-packing while in service. For Design Requirements for different valves, refer Annexure-II & III. 4.5.2 Strainer for fuel oil system (a) There shall be Duplex strainers on the Fuel Oil Line.		

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(b) The strainer shall have basket type straining elements permitting easy removal and replacement. (c) The open area ratio (i.e. straining area to the inlet area ratio) shall be at least 6:1. (d) The strainer shall have screen of stainless steel (AISI-316) construction with wire diameter of about 0.01 inch and open area of about 50%. (e) Strainer body shall be made of Mild steel. No Cast Iron component shall be used in F.O. system. (f) All strainers shall also be provided with oil drip plates beneath them for collection of oil. (g) Bolts and nuts shall be as per IS-1363. Gaskets shall be minimum 3 mm thick and made of compressed asbestos fibre as per IS-2712. 4.5.3 Steam Traps (a) The steam traps shall be inverted bucket or thermodynamic type complete with integral or separate strainers. (b) Traps shall have carbon steel body with stainless steel internals to AISI 316. (c) Y-type strainers whether integral with steam traps or otherwise shall have body of Cast Steel Class 150 material and perforated metal screen of type AISI-316 stainless steel with about 0.8 mm perforation. The strainer shall have screwed blow off connections fitted with removable plug. The free hole area shall be at least three (3) times the internal pipe area. (d) Numbers and location of steam traps shall be selected by the Bidder. 4.6 <u>SAFETY/RELIEF VALVES</u> 4.6.1 Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.		

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4.6.2 All safety valves shall be provided with manual lifting lever. 4.6.3 Valves used for air and any other compressive fluid shall be of pop type. 4.6.4 Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure. 4.6.5 Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer. 4.6.6 The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting. 4.7 <u>HOSE PIPE AND ACCESSORIES</u> 4.7.1 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves. 4.7.2 Hose pipes with fittings for Service Water System: (a) The water hose shall be as per IS-444 (Type-3). (b) Length of each hose shall be 15 metres. (c) For each hose, one end shall be fitted with M.S. female coupling with swivelling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swivelling nut of a second hose whereby two hose lengths may be joined. 4.7.3 Hose pipes with fittings for Compressed air System (a) The compressed air hose shall be as per IS-911 (Type 2). (b) The length and type of each end shall be similar to as specified in above clause no. 4.7.2 (b) (c) above.		

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5.0	<u>BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING</u>	
5.1	All fittings like "T" pieces, flanges, reducers etc shall be suitably matched with pipes for welding. The valves shall be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.	
5.2	Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered part of work and such work shall be carried out as per instructions, which shall include specified heat-treatment procedures etc also, wherever required.	
5.3	Certain adjustments in length may be necessary while erecting low pressure pipelines and the extra lengths shall be removed to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.	
5.4	Suspension for piping, pressure parts etc shall be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.	
5.5	All the valves, lifting equipments, actuators, power cylinders etc shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, shall be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.	
5.6	All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes.	
5.7	Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even	

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after completion of erection, which shall be carried out by the Bidder without any extra cost to the Owner. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions. 5.8 No temporary supports shall be welded on the pressure parts. Welding of temporary supports, cleats etc on the building columns shall also be avoided. In case of absolute necessity, prior approval from Engineer shall be taken. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Engineer. 5.9 Wherever piping is connected to other piping or equipment, the joint at the connecting point shall be considered under this specification. (a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance. (b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance. (c) Piping shall be routed above ground unless otherwise specifically indicated/approved by the Engineer. In such special case, the piping may be arranged in trenches or buried and properly protected as per AWWA Standards. (d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 6 meters above roadways unless otherwise approved by the Engineer. Inside TG hall, headroom clearance for piping should be minimum 2 metres. (e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective drawings or not. The pipelines shall be sloped towards the drain points.		

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(f) All drips and drains for piping and equipment whether shown in the drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. 5.10 Painting (a) All uninsulated piping systems, hangers and supports shall have two coats of red oxide Zinc Chromate primer (conforming to IS 2074) with minimum dry film thickness (DFT) of 25 microns per coat and two coats of finish paints using enamel paint to give a minimum total DFT of 100 microns (after two coats of primer and two coats of finish paint). Shades shall be as per IS 5 or as indicated by Owner/ Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations. (b) Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot, grease, rust etc. (c) All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint. 6.0 <u>DRAWINGS, DATA, INFORMATION & MANUALS</u> 6.1 For Drawing, Data and Information required along with BID refer, Volume VIII.		

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ANNEXURE – I

(SPECIFICATION OF PIPES FOR DIFFERENT SERVICES)

	A	B	C	D
1.0 Services	(a) Raw Water Piping (b) Clarified Water piping, (c) Filtered Water to DM Plant	Drinking (Potable) Water Supply piping (filtered water, ozonised)	Demineralised Water, Service and Instrument air piping less than and equal to 40 NB	Demineralised Water, Service and Instrument air piping for sizes equal to or greater than 50 NB
2.0 Material of Pipe	Carbon Steel IS-1239 Part I Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm.	Carbon Steel as per IS-1239 Part I Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB. The pipes shall be galvanized as per IS-4736.	Stainless Steel as per ASTM A-312 Gr 304. Thickness schedule 40S as per ANSI-B 36.19	Stainless steel as per ASTM A-312 Gr 304. Size up to 250 NB as per schedule 10S, ANSI B 36.19
3.0 Construction	ERW/Seamless	ERW/Seamless	Seamless	ERW/Seamless
4.0 End connections	Flange and butt weld for size 50 NB and above and Socket weld joint for size 40 NB and below.	Screwed flange for sizes 50 NB and above and screwed socket for size 40 NB and below.	Socket welded for DM water lines. Screwed end connection for airlines.	SORF and butt weld joint for DM application. Screwed end connection for air

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	A		B		C	D
						lines upto 80 NB. Beyond 80 NB, it shall be butt-welded.
5.0 Fittings	Pipe size ≥ 50 NB	Pipe Size ≤ 40 NB	Pipe size ≥ 50 NB	Pipe Size ≤ 40 NB		
5.1 Materials	A 234 Gr WPB/ IS 3589	A105 or compatible with IS-1239	A 234 Gr WPB /IS 3589	A105 or compatible with IS -1239	A 182 F304	A 351 CF8
5.2 Construction	Welded / Seamless	Forged	Welded / Seamless	Forged	Forged	Welded/Seamless
5.3 Standard	ANSI-B16.9 / fabricated fitting as per AWWA-C-208 is also acceptable	ANSI-B 16.11/ IS-1239 (Part-II) cold Bends from pipes having bend radius R=3D is also acceptable	ANSI B16.9	ANSI B16.11/IS- 1239 (Part- II)	ANSI-B16.11	ANSI B16.9
5.4 End Details	Butt welded As per ANSI B16.25	Socket welded as per ANSI-B-16.11	Screwed/ Flanged	Screwed/ Socket as per ANSI B16.11/or IS-1239	Socket Welded	Butt welded for pipe & fittings and flanged for

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	A		B		C	D
				(Part-II)		valves/equipment
			All fittings shall be galvanized			
6.0 Flanges	150 class as per ANSI B16.5 complete with nuts, bolts and gaskets. FF flanges for CI valves.		As per ANSI B16.5 pressure class 150 - galvanised- complete with nuts, bolts and gaskets. FF flanges for CI valves.		As per ANSI B16.5 pressure class 150 complete with nuts, bolts and gaskets. Use slip on flanges here.	150 class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets. Use Lap Joint flanges here.
1.0	Services	Fuel Oil System				
2.0	Material of Pipe	API 5L Gr B or ASTM 106 Gr B				
3.0	Construction	Seamless				
4.0	End connections	≤ 40NB SW, ≥ 50NB – BW				
4.1	Fittings	ASTM A234 Gr WPB/A 105				
5.0	Valve end	Flanged end is preferred				
6.0	connection					
NOTE:						
1. Refer Annexure –III for Valve material specification.						
2. Pipes which fall under IS: 1239 shall be hydrostatically tested according to the said code, for others refer Section-V, Volume II.						

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<u>ANNEXURE – II</u> <u>SERVICES OF VARIOUS CATEGORIES OF VALVES</u>				
SR. NO.	VALVE CLASSIFICATION	SERVICE		
1.0	Cast iron body Gate/ Globe/Check Valve	(a)	Service Water (Clarified)	For sizes 50 NB and above
		(b)	Filtered Water	
		(c)	Drinking Water	
		(d)	Inhibited Demineralised Water	
2.0	Stainless steel & Bronze body Gate / Globe / Check / Ball Valve	(a)	For Demineralised water	For all sizes
		(b)	Drinking Water	For sizes less than and equal to 40 NB
		(c)	Service and Instrument Air	For all sizes. Ball valves to be used in air line.
3.0	Steel Body valves	(a)	Clarified Water	For sizes less than and equal to 40 NB
		(b)	Inhibited Demineralised Water for DMCW system	
		(c)	Fuel oil system	For all sizes
4.0	Cast Iron body butterfly valve & Check valve	(a)	For Demineralised Water	For sizes 50 NB and above. Rubber lining shall be provided for DM water application.
		(b)	Raw water	
		(c)	Clarified Water	
		(d)	Filtered Water	
		(e)	Inhibited Demineralised Water for DMCW system	

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ANNEXURE-III

SPECIFICATION OF VALVES

	(A) Cast Iron Body Gate/ Globe/Check Valve	(B) Stainless Steel Body Gate/ Globe /Check/Ball Valve	(C) Steel Body Gate / Globe / Check Valves
1.0 <u>BASIC DESIGN CODE</u>			
(a) Gate	(a)	(a)	(a)
	(i) IS-780 for 50 – 300 NB	(i) API 600 for 50 NB and above /ANSI-B-16.34	(i) API 600 for 50 NB and above/ ANSI-B-16.34
	(ii) IS-2906 for 350 NB & above or as per MSS- SP-70	(ii) API 602 for size below 50 NB / ANSI-B-16.34	(ii) API 602 for size below 50 NB/ANSI-B-16.34
(b) Globe	(b) MSS-SP-85	(b) BS 1873/ANSI-B-16.34	(b) BS 1873/ANSI-B-16.34
(c) Check	(c) IS-5312/MSS-SP-71	(c) BS 1868/ANSI-B-16.34	(c) BS 1868/ANSI-B-16.34
(d) Ball		(d) BS 5351	(d) BS 5351
2.0 <u>PRESSURE CLASS</u>	To be suitably chosen considering the pressure requirement.		
3.0 <u>CONSTRUCTION</u>	Cast body and bonnet/ cover	Forged body up to 50 NB and Cast body above that size	Same as Group B
4.0 <u>MATERIAL</u>			

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		(A)	(B)	(C)
		Cast Iron Body Gate/ Globe/Check Valve	Stainless Steel Body Gate/ Globe /Check/Ball Valve	Steel Body Gate / Globe / Check Valves
4.1	Body & Bonnet Cover	IS 210 Gr. FG 260	A 351 CF8 for cast Body and A 182 F304 for forged Body	A 216 Gr. WCB for Cast Body and A 105 for Forged body
4.2	Trim/Disc	IS 210 Gr. FG 260	A 182 F304 for 13% Cr. Steel as per Gate, Globe, Check valves and A 351 CF8 for Ball Valves	A 182 Gr.F6 heat treated and hardened (min. 250 BHN) for cast body and A 105 Hard faced with Stellited (min. 350 HB) for forged body.
4.3	Seating surface	13% Cr. Steel as per IS-1570	For Ball valves PTFE seats and seals	13% Cr. Steel as per A 182 Gr. F6.
5.0	<u>END PREPARATION</u>	Socket welded for size equal to and below 40 NB and flanged with counter flanges for 50 NB and above.		
6.0	<u>TESTING</u>			
(a)	Gate	(i) IS-780 for 50 – 300 NB	ANSI B-16.34 / API-598 / MSS-SP-61 / EN 12266-1	
		(ii) IS-2906 for sizes equal to and above 350 NB		
(b)	Globe	MSS-SP-85		
(c)	Check	IS 5312/MSS-SP-71		
(d)	Ball			

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<u>CONTENT</u> <table><tr><td><u>CLAUSE NO</u></td><td><u>DESCRIPTION</u></td></tr><tr><td>1.0</td><td>QUALITY ASSURANCE PROGRAMME</td></tr><tr><td>2.0</td><td>GENERAL REQUIREMENTS-QUALITY ASSURANCE</td></tr><tr><td>3.0</td><td>QUALITY ASSURANCE DOCUMENTS</td></tr><tr><td>4.0</td><td>INSPECTION, TESTING & INSPECTION CERTIFICATES</td></tr><tr><td colspan="2"><u>ENCLOSURES</u></td></tr><tr><td>ANNEXURE–A</td><td>FORMAT OF QUALITY ASSURANCE PROGRAMME</td></tr><tr><td>ANNEXURE–B</td><td>FIELD WELDING SCHEDULE</td></tr></table>			<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	1.0	QUALITY ASSURANCE PROGRAMME	2.0	GENERAL REQUIREMENTS-QUALITY ASSURANCE	3.0	QUALITY ASSURANCE DOCUMENTS	4.0	INSPECTION, TESTING & INSPECTION CERTIFICATES	<u>ENCLOSURES</u>		ANNEXURE–A	FORMAT OF QUALITY ASSURANCE PROGRAMME	ANNEXURE–B	FIELD WELDING SCHEDULE
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