MAHARASHTRA STATE POWER GENERATION CO. LTD.

PROJECTS & PLANNING DEPARTMENT

BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1

ADDENDUM -III

TECHNICAL SPECIFICATION
FOR
ADDITIONAL SOURCING OF RAW WATER

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1.0 INTRODUCTION

1.1 This section presents the system description, scope of work, basic design criteria and performance requirements of the sourcing of Raw Water for existing units as well as for 1 x 660 MW Bhusawal expansion project.

2.0 SYSTEM DESCRIPTION

2.1 The source of Raw Water for plant make up is from two sources i.e. Ozerkheda reservoir belonging to Irrigation Department located about 20 km from plant site and from Sudgaon Bandhara on river Tapi .

2.2 MAHAGENCO intends to provide two raw water sources as below:

(a) From Ozerkheda (pipe line terminal) to One Day Reservoir as indicated in the plot plan and in line with the other details like terminal points etc. indicated in the Original Tender specification.

(b) From existing river water pump house to One Day Reservoir via aqueduct & existing (abandoned) pump house, as per the details and specifications covered through this Addendum.

2.3 MAHAGENCO also have their own existing river water pump house on Tapi River which is used to serve through a canal, the existing 2x210MW units as well as the 2x500 MW units currently under commissioning. For the proposed 1x660MW unit also MAHAGENCO intends to use the Tapi River water from Sudgaon Bandhara.

MAHAGENCO intends to propose a comprehensive scheme to cater the water requirement for existing 2x210 MW, 2x500 MW (under commissioning) and for proposed 1x660 MW, consisting of providing and laying MS gravity pipeline of requisite diameter in the existing inlet canal from Tapi river pump house to aqueduct along with tapping arrangement for 2x500 MW project and also requisite diameter MS pipeline from existing (abandoned) pump house to one day reservoir of proposed 1x660 MW expansion project.

2.4 The distance for pipeline through inlet canal from the existing river water pump house to the aqueduct is about 2.5 Km and proposed pipeline from existing (abandoned) pump house to one day reservoir of proposed 1x 660 MW unit (Unit # 6) is approximately 1.9 km. The scope under this addendum covers providing and laying MS gravity pipeline of requisite diameter in the existing inlet canal from Tapi river pump house to aqueduct along with tapping and isolation arrangement for 2x500 MW project and MS pipeline of requisite diameters from existing (abandoned) pump house to one day reservoir of proposed 1x660 MW with 3 nos. of pumps (2 W + 1 SB).

2.5 Five (5) pumps are presently installed in existing River Water Pump House.

2.6 This river water will be transported to the power plant site by laying adequate diameter M.S. gravity pipe line through inlet canal and by providing and laying cross country M.S. pipe line from existing (abandoned) pump house up-to one day reservoir of proposed 1x660 MW expansion project.

3.0 SCOPE OF WORK

3.1 The scope of work shall include design, manufacture/fabrication, inspection, testing, packing & forwarding, transportation, delivery, erection, commissioning & performance test at site of raw water system (including carrying out soil investigation, excavation and backfilling of the soil, providing requisite thrust blocks for bends, valve chambers, etc.) for:

(a) Providing and laying M.S. gravity pipe line in the inlet canal, from the existing river water pump house of MAHAGENCO located on Tapi river to aqueduct including all necessary connections for conveyance of water to the existing Raw water system with adequate slope.

(b) Providing necessary connection and isolation arrangement to the existing pipeline for water supply to 2x500 MW Units.

(c) Providing and laying M.S. pipe line from existing (abandoned) Pump House to one day reservoir of 1x660 MW unit including necessary isolation wherever required renovation of Pump House and sump along with provision of required electrical and mechanical works, including providing Three pumps (2W+1S/B), valves, electrical,

control and instrumentation and appurtenances. The scope shall also include cleaning and desilting of approach canal to pump house and sump pump house, repairing/replacing of screens, inlet gate, inlet canal including new utilities for electrical, mechanical and ICA works for smooth operation. Further, the scope shall also include dismantling civil structures, electrical/mechanical fittings, wherever required and restoration of the existing utilities and depositing the Company's machinery/ equipments, serviceable material, in MSPGCL's Store and disposing the unserviceable material as per the direction of Engineer-in-charge.

(d) The details required for designing of pipe line shall be as per Data Sheet-A on page 43 & 44.

3.2 The indicative routing of the cross-country piping is shown in the attached sketches. However, the bidder shall independently carryout the site survey and determine the detailed scope.

3.3 The pumps and piping specification is as per Datasheet-A enclosed. However, any item not specifically mentioned but deemed necessary for making the system completely reliable and efficient shall also be included.

3.4 Supply, Providing, laying and testing of M.S. pipelines of required diameter of commercial quality Fe-410 grade conforming to IS 3589 including bends, aligning proper line and level as per site requirement.

3.5 Supply, providing, erection and testing of Mild Steel specials such as tees, laterals, reducers, drain pieces, etc. suitable for above pipeline generally as per specifications/drawings or as directed by the Engineer-in-charge. The gasket, ring flanges, blank flanges, slip on flange, nut and bolts etc. are included in the scope of this specification. All necessary clamps, hangers, sleeves, anchor bolts, inserts, thrust blocks etc. as required or pipe supports clamping and all other items necessary for the proper completion, testing and maintenance of the work to the complete satisfaction of the OWNER.

3.6 PIPING VALVES AND SPECIALS

(a) Manually operated butterfly valve at the interconnection point for 2x500 MW Unit. Isolation valves shall be provided at following locations:

(i) Outlet of individual pumps.

(ii) At the header.

(iii) Inlet to the aqueduct.

(iv) At the delivery ends i.e. at the both inlet of One Day Reservoir.

(b) Rubber expansion joints at pump discharge.

(c) Double kinetic air valves and accessories for pipelines at raw water pump house.

(d) Drain arrangement with isolation gate valve at suitable location as required.

(e) Pressure gauge and pressure switch with isolation globe valves at pump discharge and pressure gauge at common header.

(f) Pipe supports and associated civil/structural works as required including all temporary frames for transport.

(g) Electro -Magnetic Flow meter with integrator on pipe line

(h) Expansion joints to be provided at an interval of 300 m for above ground portion of pipe line.

3.7 Existing (abandoned) pump house shall be provided with level indicators and level switches with protection interlocks for associated pumps. Annunciation for abnormal conditions levels (low and high) in the pumps shall be annunciated in the control panel. The MCC for pumps providing

power supply to the pumps shall be provided in the existing (abandoned) pump house.

3.8 The pump set shall be supplied with the following accessories, as applicable.

(a) Heavy duty couplings of approved design to connect the pump shaft directly with the motor shaft.

(b) Sets of base plates, support plates, grounding pads, thrust blocks, lifting lugs, eye bolts, nuts etc. for each pump and motor set.

(c) Slip on type drilled steel counter flanges of proper rating to suit the discharge flange of each pump set. All the counter flanges shall be complete with requisite number of bolts, nuts and gaskets etc.

(d) Thrust pads, if required, for pump discharge head complete with all necessary fixing and bolting arrangement, fasteners etc.

(e) One (1) pressure indicator with isolating cocks at the discharge side of each pump, two (2) additional stubs with isolating root valves for pressure tapings and two (2) thermowells for temperature tappings at the discharge side of each pump for performance testing. Thrust bearing shall be furnished with thermometer, temperature switch for high temperature annunciation and oil level gauge. Thrust bearing temperature indicator shall be hooked-up to the Control panel.

(f) All internal/integral piping with valves, fittings and instruments for lubrication, cooling and sealing, if applicable, shall preferably be tapped off from respective pump discharge.

3.9 Two (1W+1S) Sump pumps of adequate capacity.

3.10 Two (1W+1S) Exhaust fans of adequate capacity in existing (abandoned) pump house.

4.0 <u>PREREQUISITE FOR FABRICATIONS OF BENDS & SPECIALS</u>

The contractor will have to procure the pipes only from SAIL or any other manufacturer/s approved by the MAHAGENCO. No pipes / appurtenances

shall be procured without approval of the OWNER/MAHAGENCO from the manufacturer/s and without pre-dispatch inspection by the OWNER's Engineer.

However, if approved by the OWNER, the contractor may fabricate / manufacture bends and other M.S. specials at site or at contractor's workshop by procuring suitable size / thickness plates from the manufacturer approved by the MAHAGENCO. For this, the contractor shall furnish the following information to the MAHAGENCO for getting approval for fabrication of bends and other M.S. specials.

(a) The details of equipments. & other resources including existing work shop facilities available with the contractor for fabrication of pipes for this work.

(b) The details of equipments for fabrication of bends & specials that will be used for this work by the contractor.

(c) The details of similar/comparable quantum of works carried out by the contractor during the last 5 years.

(d) The details of technical personnel with their qualifications who have carried out large jobs of pipe fabrication work and who will be made available for this work.

(e) The details of stacking and handling facilities available with the contractor.

(f) Facilities available with the contractor for testing of raw materials and fabricated pipes.

The contractor shall have to make their own arrangements for procuring all the materials required for fabrication of bends and specials from the market. The materials required for preparing jigs, testing arrangements, platforms etc. in this connection shall be provided by the contractor at his cost.

No fabrication work shall be started without written approval of the OWNER. Before starting the fabrication work, the contractor shall furnish the fabrication programme to meet the work completion schedule. The

progress of fabrication of bends & specials shall have to be as per fabrication programme approved by the MAHAGENCO. In case of slow progress, the contractor would be called upon to achieve the target by procuring the pipes from the approved manufacturer.

5.0 FABRICATION / MANUFACTURING OF PIPE/S

The pipes, bends and specials should be manufactured from hot rolled coil of M.S. Sheets of required thickness. The plates shall conform to IS. The bending shall be to the exact circle of diameter required. The edges should be beveled edge for receiving welding. The length of each pipe should be between 6 to 12 mtrs.

5.1 CUTTING OF PLATES

The plates shall be cut on all four sides to exact dimensions and shape required by means of suitable plate cutting machine such as Oxy-acetylene cutting machine/guillotine. Flanged cut edges will be finished by suitable automatic machine grinder for removing molten metal and such other flaws in order to prepare the edges for welding. The jig to be provided for this purpose shall depend upon the type of cutting machine used. The plates cut to the required shape shall be checked for correctness before they are rolled in to pipe drums, the corrections if any are required at this stage, they will be done by re-cutting if necessary.

5.2 PREPARATION OF EDGES

After the plates are cut, the edges shall be made smooth and even by electrical or pneumatic grinder to remove all inequalities. The care shall be taken to see that the cut edges of the plates are perfectly straight. The plates shall be given a bevel shape at the edges wherever necessary, depending upon the type of welding machine used by the contractor. Both the ends of finished pipe in the factory shall necessarily have bevel edges in order to facilitate welding in the field. As field welding is to be carried out from outside and/or inside of the pipes, the different type of bevels may be required. The pipe shall be manufactured accordingly if so ordered by the Engineer. Where Automatic Welding Machine in the factory have sufficient penetration, the edges of the plates may have square cut. The type of joints to be adopted in the factory shall depend upon the type of welding machine

used. As regards, the current, voltage, flux, type of electrodes etc. the details shall be decided after carrying out experimental welding and testing at site.

5.3 ROLLING OF PLATES

The plate's cuts to the exact size as described will be put in a rolling machine to form a pipe; it shall be of the required diameter. The rolling machine shall be adjusted to obtain uniform curvature of the pipe. The curvature shall be checked by the contractor's foreman during rolling operation. If proper curvature is not obtained, at any place the rolling operation shall be repeated. Heating of the plates to obtain the desired curvature shall not be permitted under any circumstances.

5.4 TACKING OF DRUMS

The rolled drums shall be kept on assembly platform for tacking. The care shall be taken to ensure that the tacked drums have their end faces at right angles to the longitudinal axis of the pipe. While tacking the drums a welding gap of about 2 to 4 mm shall be maintained for proper welding of the longitudinal joints. To achieve these clamp spiders, tightening rigs and or any other gadgets shall be used. Each such drum shall be numbered on the inside with oil paint, stating plate thickness before being transported to assembly platform.

5.5 ELECTRODES

The contractor shall use electrodes of approved make and quality depending upon thickness of the plates and type of joints. All electrodes used whether for hand welding or for the automatic machine shall conform to I.S. specification or its equivalent. In the case of automatic welding, if suitable Indian made electrodes may not be available, the contractor shall make his own arrangement to import the same. In the case of electrodes for hand welding. Indian made electrodes of the required quality and approved by the Engineer-in-charge shall be used, if available.

5.6 WELDING

All the welding shall be done as per specification laid down in "Welding Manual" of United States Bureau of Recommendation or its equivalent

Indian Standard. Welding/tack welding of piping shall be done only by certified welders, welding under this specification shall be done by manual shielded metal arc process. He shall use standard current and voltage required for the machine in use. Before the work is actually started the welded joints shall be prepared and tested in presence of Engineer-in-charge or his representative to determine the exact values of the current and voltage and the size of electrode for each type of work. The values once determined shall be maintained throughout the work. These values may only be changed only after obtaining necessary written permission of the Engineer.

5.7 TESTING OF WELDED JOINTS

The welded joints shall be tested in accordance with I.S. The test pieces shall be taken out from the positions pointed out by the Engineer-in-charge without any delay. They shall be immediately machined and tested in a week's time. The shape of the test pieces removed from the pipes shall be such that it will give specimen of the required dimensions, and at the same time leave a hole in the pipe with rounded corners. The hole shall be patched up by inserting and welding suitable sized plates. Great care shall be taken in preparing these plates, so as to get a good butt weld.

5.8 TESTS TO BE CONDUCTED ON WELDING JOINTS

The following tests shall be made on the test pieces:

(a) Tensile Test:

The test specimen taken perpendicular across the weld shall be stepped in accordance with the Indian Standard Specification. The specimen shall be taken at any point in the pipe as directed by the Engineer-in-charge and shall be out with the weld approximately in the middle of the specimen. The tension test specimen shall be flattened and the sides shall be machined. The protruding welding portion from both inside and outside shall be removed by machining or grinding before the specimen is tested.

If a test specimen shows defective machining or develops flows not associated with welding, it may be discarded and another specimen

submitted. The welded joint shall show strength of not less than the minimum tensile strength specified in the relevant.

(b) Bend Test:

The Bent test specimen shall be prepared in the same way as for tensile test and tested in the factory in the presence of the Engineer-in-charge or his representative. The specimen shall be taken from the same pipe selected for tensile test. The specimen shall stand being bent cold through 180 around a pin, the diameter of which is equal to 4,1/2 times the thickness of the plate, without developing cracks. In making the bend test, the side of the specimen representing the inside of the pipe shall be placed next to the pin.

(c) Tre-panned plugs:

In addition to the above-mentioned tests, tree-panned plugs shall be taken out from any welded portion as pointed out by the Engineer-in-charge. The plug taken out shall not show on examination any defects in welding such as inclusion of slag, blowholes, cavities etc. The plug should be 12 mm. to 20 mm. in diameter and shall be taken out by means of a suitable hole saw operated electrically. For the Tree-panned plugs, the holes will be either filled back by inserting a steel stud and welding G.I. plug.

The Tree-panned plugs shall be taken out only if considered necessary by the Engineer-in-charge and in any case not exceeding 5 in a length of 300 meters.

(d) Non-destructive and special testing:

In addition to the contractor's normal supervision and testing procedures, radiographic/ultrasonic or other non-destructive examination shall be carried out as and when required by the Engineer-in-charge on butt or fillet welded joints/and/or on test specimens. Dye penetration test of welds by using standard solution shall be carried out at the cost of the contractor. Wherever and whenever required by the Engineer-in-charge prepared etched section of the welds may be required for examination. The contractor shall at

his own cost provide these prepared sections. The test shall, however be carried out by the Mahagenco at contractor's cost through some other independent agency. In case of failure of any of the tests, the cost of that portion of the test shall be recovered from the contractor. Rectification of such component shall be carried out by the contractor at his own cost.

5.9 ALL EXPENSES FOR TESTING TO BE BORNE BY CONTRACTOR

All charges in connection with taking out test samples, machining and testing them in a laboratory shall be borne by the contractor. The tensile test will have to be carried out in Government or Semi Government institute by paying the necessary fees. This will be arranged by the Company at the contractor's cost.

5.10 PROCEDURE TO BE ADOPTED IN CASE OF FAILURE OF THE ABOVE TESTS

In the case of hand welding, the work should preferably be carried out by a pair of welders so that by observing proper sequence, distortion can be avoided. A joint entrusted to as particular individual or a pair shall be as far as possible, completed by them in all respects including sealing run. No helper or other unauthorized person shall be permitted to do any welding work whatsoever. In case of infringement of above, the person concerned shall be punished to directed by the Engineer-in-charge.

5.11 RE-TEST

If the results of tensile or bend tests of any lot do not confirm to the requirements specified, retest of two additional lengths from the same lot shall be made, each of which shall confirm to the required specification.

5.12 REJECTION

If the second test after the first test also proves the welding to be defective, the contractor will be asked to put forth his proposal for remaking the welds. These shall be to the approval of the Engineer-in-charge. The Engineer, in such cases, will be free to reject the defective welded pipes.

5.13 WORKMANSHIP

All pipes shall be correctly finished free of cracks, surface flaws, laminations and all other defects. They shall be cylindrical, concentric and straight in axis. The external circumference of the pipe particularly at the end shall not deviate from the theoretical circumference of specials.

6.0 PIPES

The M.S. pipes to be procure/manufacture/fabricated shall be of continuous uniform internal diameter and thickness of SW/ERW/SAW construction, commercial quality Fe-410 grade and conforming to IS: 3589. M.S. pipes of SW/ERW/ SAW construction, commercial quality Fe-410 grade and conforming to IS: 3589

(a) Test Pressure:

The pipes shall be tested for hydraulic test pressure as per IS: 3589.
Hydraulic Test at Manufacturer's Work/Fabrication Work Shop:
Before procurement and/or after fabrication, each pipe shall be tested hydraulically under cover at the Manufacturer's works/Fabrication workshop. This test for every 15th pipe shall be carried out in the presence of and to the satisfaction of the Engineer-in-charge or his representative. The pipe shall be tested in the shop of manufacturer/contractor at minimum test pressure of pipes indicated above without showing any signs of weakness, leakage, oozing or sweating. The pressure shall be steadily applied by an approved pump and maintained as per I.S. The pipe conveying the pressure shall be fitted with an accurate pressure gauge, approved by the Engineer-in-charge. Each pipe shall be hammered with sharp blows through its length with a hand hammer weighing about 1 Kg. when it is under hydraulic test. The contractor should submit the manufacturer's test certificate for the same.
Defects in welds such as sweats or leaks shall be repaired after obtaining the permission of the Engineer-in-charge in writing or otherwise, the pipe shall be rejected. The repaired pipe shall be re-tested to conform, to the specified pressure. Plastic caps required for covering the pipe ends during transportation shall be provided by the contractor at no extra cost

(b) Tolerances:

(i) Pipe body - The tolerance on the pipe body shall be as shown below:

Sr.No.	Nominal size	Tolerances
1	up to 500 mm.	± 0.75 percent
2	Over 500 mm.	± 1.00 percent

Note - Measurements may be made by any suitable instruments, such as outside calipers, diameter tapes, micrometers etc.

(ii) Pipe ends - If so specified by the purchaser, the tolerance on outside diameter for distance of 100 mm. from the end of the pipe shall be as follows.

Up to and including 250 mm.	+ 1.60 mm. - 0.40 mm.
Over 250 mm.	+ 2.40 mm. - 0.80 mm.

(iii) Thickness - The tolerance on specified wall thickness shall not be more than as specified in the relevant I.S. Specifications. However, no negative tolerance in wall thickness of the pipes is permissible and acceptable.

(iv) Straightness - Finished pipe shall not deviate from straightness by more than 0.2 percent of the total length. Checking shall be carried out using a foot string or wire from end to end, along the side of the pipe to measure the greatest deviation.

(v) Joints And Ends - The type of joints and ends of pipes shall be as specified by the ENGINEER. The types of joints and ends recognized under this standard are Plain ends or beveled ends for butt welding unless otherwise agreed, beveled ends shall be beveled to angle of 30° ($+5^{o}$ -0°) measured from a line drawn

perpendicular to the axis of pipe. The root face shall have 1.6 + 0.8 mm.

(vi) Random Length: - The pipes shall be supplied in single or double random lengths only.

(vii) M.S. Spiders for Protection of pipe during handling and transportation:

M.S. spiders as directed at the ends and at intervals if necessary shall be provided to all pipes & specials. No extra payment shall be made for providing, fabricating and welding such spiders to the pipes etc. Before spiders are welded to the pipes, the contractor will ensure that the pipes etc. are truly in final required shape. No distortion in shape on account of welding spiders will be accepted.

Plastic caps if any required for protecting the pipe ends during transportation and laying in position shall be provided by the contractor at no extra cost

7.0 PRECAUTIONS AGAINST FLOATATION

When pipeline laid underground or above ground in a long narrow cutting gets submerged in water collected in the trench or cutting, it is subjected to an uplift pressure due to buoyancy and is likely to float, if completely or partly empty. In the design of pipelines, provision is made to safeguard against floatation by providing sufficient overburden or by providing sufficient dead weights by means of blocks etc. the overburden on pipe line shall be at least 1.2 meter or as per IS. In the case of works extending over one or more monsoon seasons, however, special care and precautions are necessary during the progress of work on this account. The contractor shall close pipeline, if required, by blank flanges well in time for the monsoon. The work of providing blocks, refilling the earth to the required level and compacting the same etc. shall always be done as soon as the pipe line in the cutting has been laid. The contractor shall see that water shall not be allowed to accumulate in open trenches. Where work is in an incomplete stage, precautionary works such as blank flanging the open ends of the pipeline and filling the pipeline with water etc. shall be taken as directed by the

Engineer. No separate payment shall be made for such works and shall be to the contractor's account.
Protection of pipeline against flotation during the contract period shall be the responsibility of the contractors. Should any section of the pipeline float due to their negligence etc. the entire cost of laying it again to the correct line and level shall be to the contractor's account

8.0 HYDRAULIC TESTING OF PIPE LINE

After the work of laying of pipeline is completed and before putting in into commission, the pipeline including all the pressure retaining parts such as specials, appurtenances, valves etc. shall be tested in the field, as and when directed by the Engineer, both for its strength and leakage. The procedure for the test shall be as follows.

The pipeline shall be subjected to a hydraulic test in full length or in part as may be found necessary. For this test, the pipe shall be slowly filled with clean water by opening cross connections with existing mains or otherwise as directed and all air shall be expelled from the pipeline through air valves etc. fixed on the pipeline. Once the pipe is full, the cross connections shall be closed. The pressure in the line should then be raised and built up and maintained by means of suitable approved pumps, to the specified test pressure based on the line or section under test. The pipeline should be tested to a minimum pressure of 2.0 times of the working/delivery pressure.

No section shall be tested unless anchor blocks have been provided at either ends and for all appurtenances etc. have been fixed in position, arrangements for cross connection have been made with existing streams. Before starting the pressure test, the flanged joint, if any, shall be tightened. The test pressure shall be maintained as per latest I.S. The drop in pressure shall not exceed 0.2 kg/cm2. (10 lbs. per sq. inch) within a period of 2 hours after the full test pressure is built up. Under the pressure no leak or sweating shall be visible at the welded/flanged joints.

During the test, the pipe shall be struck sharp blows with a 4 lbs. hammer. Water shall not spout ooze or sweat through any part. In case of a leak anywhere in the field joints, whether welded or bolted the same shall be repaired entirely at the contractor's cost, which shall include repairs to welding, and coating, repainting chain age of pipe / specials etc. The re-

paired joint shall be subjected to a re-test. No section shall be accepted unless it is put in a perfectly water tight condition and retested satisfactorily. The entire cost of testing and retesting shall be borne by the contractors who shall make all arrangements for all labour, pumps, pressure gauges, equipment etc. No main valves or cross connection either on the new or the existing main shall operated by the contractors and only the Engineer-in-charge or his authorised representative shall operate the same. The contractors shall arrange for labour required for operating the air valves, drain valves etc. No separate payment shall be made for this item but the rate for field welding of circumferential joints after laying the pipes shall include the costs thereof.
The contractor shall arrange the potable water required for Hydro testing at his own cost. Temporary closer on piping required for hydraulic testing shall be arranged by the contractor at his cost. The same shall be taken away by him after completion of testing and with prior permission of the ENGINEER.

9.0 SPECIFIC DESIGN CRITERIA

9.1 In case the pumps/ motors need external cooling, the bidder shall consider the same and include in the proposal.

9.2 The design shall take into account the effect of internal/external pressure, thermal expansion, self weight of piping, support reactions, surge and water hammer, earthquake and wind effects at site, corrosion and erosion etc. and any other effects dictated by good engineering practices.

9.3 The M.S. gravity pipe line from existing river water pump house to aqueduct through inlet canal shall be designed for discharge of 9000 cum/hour (considering 24 hours operation per day). While designing the above pipe line, the agency shall ensure the same discharge after existing siphon arrangement. The raw water pipe line from existing (abandoned) pump house to one day reservoir of 1x660 MW Unit and pumping system sizing shall be based on Sixteen (16) hours operation per day for a quantity equivalent to 110 % of the plant make up water requirement arrived at by considering a cycle of concentration of five (5). The capacity of the each pump shall be equivalent to 110% of quantity requirement for plant makeup considering Cycle of concentration (C.O.C) of five (5). The number of pumps shall be Three (3) (2W+1S/B).

9.4 Pipelines shall be laid underground or in canal as far as possible. Wherever it is not possible, pipelines shall be laid over ground on the R.C.C. saddle supports with M.S. clamping.

9.5 Bidder shall carry out surge analysis for determining the thickness of the cross country piping with provision of additional 1.5mm thickness for corrosion allowance. No negative tolerance shall be accepted for thickness of pipe line.

9.6 Sizes of pumping pipe line shall be selected such that the velocity of fluid in pipes does not exceed the range of 1.5 – 1.7 m/s.

9.7 The pipe network shall be provided with air release valves at high points and drain valves at the lower points. Air valve should be placed at least every 500meters.

9.8 Pipeline passing under or through equipment foundations or walls of buildings or any other inaccessible structure shall be provided with steel encasing pipes for easy insertion and removal.

9.9 The over ground piping, wherever required, shall have a minimum vertical clearance of 0.9 metres above finished ground level and 8.5 meters above rail/road level in plant working area.

9.10 Valves provided on the over-ground pipe network shall be provided with steel structural platforms and access ladders.

9.11 C/C distance between two supports shall not be more than 6.0m.

9.12 All the buried pipelines shall be laid with a nominal slope towards the drain point.

9.13 In case of the buried pipe lines, the top of the pipeline shall be minimum 1200mm below the finished ground level.

9.14 Isolation /control valves, drain valves, air release valve provided on the buried pipe network shall be housed in suitably sized covered valve pit and the valve pits shall be of self-draining type. Air release valves shall be

provided at the highest points of each sector of the pipeline and drainage valves shall be provided at the lowest points of each sector of the pipeline.

9.15 Wherever the buried pipelines are crossing the roads and tracks, they shall be suitably encased with mild steel pipes or reinforced concrete casing pipes of NP3 class or as required as per statutory norms, whichever stringent. Permissions for crossing (Road/Railway track etc.) shall be obtained by the bidder from the concerned department.

9.16 Mechanical cleaning and anticorrosive protection of underground MS pipelines shall conform to IS: 10221 - 1982. The anticorrosive protection of pipelines shall consist of the following activities in sequence:

(a) Application of one coat of coal tar primer

(b) Application of one coat of coal tar enamel

(c) One wrap of fibre glass tissue

(d) Application of one coat of coal tar enamel

(e) One layer of fibreglass tissue impregnated in coal tar enamel.

(f) Application of the final coat of a water-resistant white wash

9.17 Alternatively, Coal tar based anticorrosion tape as per IS :15337 - 2003 shall be provided for protection of underground mild steel pipelines. The thickness of tapes shall be 3 mm up to pipe diameter DN 300 mm and 4 mm above pipe diameter DN300 mm.

9.18 <u>INTERNAL PAINTING TO PIPELINE</u>

Food-grade epoxy coating, minimum 250micron thick, shall be imparted to the internal surface of M.S. pipeline. Surface preparation of internal surface shall be made as per clause no. 9.21.

Resin and hardener shall be mixed in standard proportions and the mix shall be applied as primer to the internal surface within 'open time' of the

resin hardener mix. When the primer is "touch dry", two (2) top coats shall be applied to a total thickness of 250micron.

9.19 LAYING BURIED PIPELINES

9.19.1 All buried pipelines shall be laid with earth cover sufficient to avoid damage from pressure of vibration caused by the surface traffic. Minimum earth covering over the pipe shall be 1200 mm from the finished ground levels. For laying of buried pipelines earth work in excavation, back filling and acceptance of trenches etc. shall be as per IS: 5822-1994, IS: 3114-1994 and IS: 12288-1987.

9.19.2 The trench shall be so dug that the pipe line can be laid to the required alignment and at the required depth, proper levelling of the excavated surfaces is an essential requirement.

9.19.3 The bottom of the trench shall be levelled by sand layer for a minimum thickness of 150 mm.

9.19.4 If the depth of excavation is more, proper protection for side walls shall be provided till the pipe levelling is completed.

9.19.5 The entire pipe trenches bottom shall be covered with local sand bed of 150mm thick layer.

9.19.6 After laying the pipelines, 150 mm thick layer of local sand shall be provided all around the pipe.

9.19.7 Precautions shall be taken at all the times to prevent damage to the coating and wrapping in the pipe lines and appurtenances as applicable by workmen or trespassers during laying or at any other time. Pipe handling slung and any blocking used in handling or storing the pipes must be well padded to avoid damage to pipe and its coating.

9.19.8 After laying a pipeline on skids it shall be thoroughly cleaned, inspected for any damage to the protective coating. Satisfactory repair work shall be performed while the pipe is suspended above the trench.

9.19.9 After the pipes are erected and tested, the back filling of the trenches shall be done with loose soil free from stones, bricks and metallic pieces in layers and shall be well rammed and compacted.

9.19.10 The underground pipelines shall be provided with pipe markers at regular interval for proper identification.

9.19.11 The coating system for underground piping based upon the soil resistivity may be selected on the following basis:

	SOIL RESISTIVITY	CORROSIVITY	COAL TAR COATINGS	WRAPPING TAPES
(a)	≤ 1000 ohm-cm	Extremely corrosive	3 coats and 3 wraps	3 layers of tape
(b)	> 1000 ohm-cm	Corrosive & non-corrosive	2 coats and 2 wraps	2 layers of tape

9.20 PROTECTION FOR ABOVE GROUND PIPING

9.20.1 The coating shall consist of two coats of synthetic enamel painting over a coat of primer, as per relevant standard and manufacturer's specification.

9.20.2 The two ends of each length of pipe shall be left bare of primer coating for a distance of 150 mm from the end to facilitate field welding and subsequent field coating.

9.20.3 The supply, application, characteristics of materials and testing requirements shall be strictly as per relevant IS.

9.21 SURFACE PREPARATION

9.21.1 Pipe surfaces to be provided with underground protection shall be cleaned by shot blasting. The cleaning shall be so carried out that the piping surface is free from mill scale, rust, oil, welding scale and other foreign materials. Primer shall be applied immediately after shot blasting to prevent rust forming. Superficial rust formed shall be removed by wire brushing or by the use of emery paper. If the rust formation is heavy, re-blasting may be

necessary. Around field joints, the pipe surfaces may be cleaned by wire brushing prior to the application of anti-corrosive protection

9.22 PRIMER COAT

9.22.1 The primer shall be compatible with the grade of enamel used. It shall be thoroughly mixed before using by stirring or by rocking the drum to provide uniformity of material. The primer coat shall be applied over a thoroughly clean and dry surface within three (3) hours of the cleaning operation, and shall be applied preferably immediately with a uniform thickness on the entire surface of the piping using appropriate quantity per unit area of surface as recommended by the manufacturer. The primer coating shall be free of bubbles, globules, drips and runs. Pipes having a longitudinal seam shall be carefully examined to determine that all excess primer has been brushed out of each side of the welding seam. The primer shall be thoroughly dry before the enamel is applied. If ready-made tapes are used, then primer, as suggested by the manufacturer, shall be used.

9.22.2 Freshly-primed pipe shall be handled carefully to prevent damage. The damaged area shall be re-primed before applying enamel/wrapping tapes.

10.0 PERFORMANCE REQUIREMENTS

10.1 Performance requirements for all the pump(s) shall be as specified in datasheet-A enclosed.

10.2 Pump(s) shall preferably be designed to have the best efficiency at the specified duty point. Further, the pump(s) shall be suitable for continuous operation at any point within its intended range of operation.

10.3 Pump(s) shall have continuously rising head-capacity characteristics, with maximum head at pump discharge shut-off, to enable parallel operation

10.4 Under all circumstances, the 'range of operation' of the pump(s) shall exclude any unstable operating zone of the head-capacity curve.

11.0 ELECTRICAL

11.1 The existing 415 V switch gear & Power and control cables in existing (ABANDONED) Pump house are 40 years old and they shall be replaced. The entire replacement of 415 V switch gear and cables and all associated work shall be done by the EPC contractor. The scope of above work is generally given below. The EPC contractor is expected to visit the site to make the assessment of the quantum of work as the entire activities are included in the scope of EPC contactor.

11.2 All electrical equipments and systems shall comply with the Volume II, Volume IV A, Volume IV B and relevant drawings forming the Bid specification.

11.3 BROAD SCOPE SHALL BE AS FOLLOWS:

11.3.1 Disconnection of existing power and control cables, 415 V switch gears, control panels etc.

11.3.2 Removal of these cables from Trays, trenches, underground locations & transport & storing them at suggested location.

11.3.3 Removal of existing switchgear panels bus section wise and transport & storing them at suggested location.

11.3.4 Civil modification such as modifications of frames, trenches etc. as required for installation of transformer, new switch gear, cables & control panel etc.

11.3.5 Design, engineering, manufacturing, testing at works, Insurance supply to site, unloading, checking, storage, erecting / installation at site testing & commissioning and putting into successful commercial operation of the following electrical equipments.

(a) Two (2) Nos. 750 kVA, 6.6/0.433 kV, ONAN cooled, Off Circuit Tap Changer with range +/- 5 % in steps of 2.5 %, Dyn11, percentage impedance 5% complete with all accessories. Burnt oil pit below each transformer to accommodate transformer oil.

(b) One common oil pit shall be provided in Transformer yard. Oily water from oil pit of individual transformer shall be drained to the common oil pit by gravity.

(c) 415 V, 50 Hz, 3 phase, 4 Wire, 1250A, 50KA ACB switch gear as per key single line diagram no PE-189-EL-SK-5007/P0 attached here with.

(d) Three (3) new pumps with squirrel cage motors

(e) One (1) control panel for Three (3) new pumps

(f) Two (2) Nos. 240V AC /24V DC rectifier circuit shall be mounted in control panel for interposing relays.

(g) 4 nos exhaust fans with miscellaneous power DB for power supply to exhaust fan & other small loads.

(h) Relay based control system shall be considered for monitoring and control of the proposed Raw water pumps

11.3.6 11/0.433 kV XLPE armoured power cables & control cables along with trays for:-

(a) Connection between 750 kVA transformer no. 1 to incomer of 6.6 kV switchgear OCA # 04 (approximate length 500mtr)

(b) Connection between 750 kVA transformer no. 2 to incomer of 6.6 kV switch gear OCB # 05 (approximate length 500mtr)

(c) Connection to three (3) new 415 V motors and lighting DB, exhaust fan DB etc.

(d) Connection to new control panel.

(e) 2 x 10C x 2.5 sq mm stranded cu armoured cables per transformer for connection to 6.6 KV breaker panels (OCA#4 & OCB#5).Each cable of minimum length 500 meters. These shall be used for annunciation & tripping of 6.6 KV breakers for transformer faults.

(f) Ladder type GI cable trays for laying power cables & perforated type GI trays for laying control cables as required.

(g) Cables coming from 6.6 KV feeders & from DG & compressor house shall have to cross railway line. Adequate duct bank shall be provided for crossing railway line.

(h) Any other cables & trays as required.

11.3.7 Non Segregated Phase Bus Duct

The secondary of the Service transformers shall be connected to the 415V MCC through 415 V Non-segregated phase bus duct, which shall be rated for secondary side current of LV auxiliary transformer at minimum tap plus 10% margin rounded off to the next higher rating.

11.3.8 At present spare 220V DC feeders are not available in DG & Compressor house. Two feeders which are feeding 220 V DC supply to DG board PCC & AMF panel shall be disconnected and the same shall feed 2 nos new 220V DC Sub DBs to be supplied by the bidder.

Required numbers of outgoing feeders are envisaged on these Sub DBs for owner's use. Required size & number of DC cables from new DC Sub DBs to DG board PCC & AMF panel shall also be supplied & laid by the bidder. Bidder shall also refer KEY single line diagram for water supply arrangement (Drg no . PE-189-EC-SK-5008).

11.3.9 220 V DC armoured cables for:-

(a) Connection between main DCDB#1 to incomer of sub DB#1 (approximate length 200mtr)

(b) Connection between main DCDB#2 to incomer of sub DB#2 (approximate length 200mtr)

11.3.10 Indoor & Outdoor illumination system

Minimum 25kVA Lighting transformer, MLDBs, Lighting DBs/ Lighting Panels, light fittings, etc for the entire Pump house area including the Transformer yard

11.3.11 Grounding for the entire system

Grounding system for the entire area grounding connection to all equipment including Main underground Grounding Grid and connection to existing 500MW power plant main earthing grid at nearest location

11.3.12 Lightning Protection system for entire Pump house area including the Transformer yard

11.3.13 All electrical system studies such as short circuit levels, voltage drops, grounding, relay setting & relay coordination, all sizing calculations etc & preparation & submission of all necessary document and drawings for approvals & then with approved AS BUILT STATUS.

11.3.14 Any other activity required for completion of the project on EPC Basis.

11.4 LOCAL CONTROL PANEL

11.4.1 Local control panel shall comply with the Volume II, Volume IV A, Volume IV B and relevant drawings of Bid specification.

11.4.2 All electrical equipments and systems shall comply with the Volume II, Volume IV A, Volume IV B and relevant drawings of Bid specification.

11.5 TRANSFORMER

11.5.1 General Instructions

The Manufacturer shall include for the supply of the whole of the new materials in accordance with the Particular Specifications and the whole of the work of fixing accessories for the complete installation. This shall also includes any materials, appliances, equipment not specifically mentioned here in or noted on the drawings as being furnished or installed but which are necessary and customary to make the installation complete in all respects.

11.5.2 Quality of Work

The supply, testing and commissioning shall comply with the latest requirements of Bureau of Indian Standard and code of practice as amended up to date. All equipment and material being supplied shall meet the requirements of IS, TAC's regulations, Chief Inspector of Explosives, Local Electrical Inspectorate, Pollution Control Board, Local Fire department, Insurance Company insuring the building, Indian Electricity Rules and other latest Codes and Publications.

11.5.3 Drawings & Specifications

11.5.3.1 The Manufacturer shall develop the General arrangement drawing indicating the arrangements of all the equipments of transformer like conservator, cable terminal box etc. and obtain approval from the Project In charge / Client before manufacturing.

11.5.3.2 The successful bidder shall submit 6 sets of General arrangement drawings to the Project In charge / client for approval.

11.5.4 Materials and Equipment

All materials and equipment shall conform to relevant IS as listed.

11.5.5 Safety Procedures

The policy is to clearly define responsibilities and then to obtain the commitment of Manufacturers to maintain a high safety standard compatible with the policy. Safe methods of working shall be the main consideration in all operations. Manufacturers shall provide the Project In charge/Client with catalogue, Operation manual highlighting the safety aspects along with the relevant test certificates. The manufacturer shall be governed by the Latest National Safety Rules and Regulations as stipulated from time to time.

11.5.6 The Following Are The Applicable Codes & Standards:

11.5.6.1 Power Transformers IS-2026-1977(Part I-IV)

11.5.6.2 Danger notice plate IS-2551-1982.

11.5.6.3 Guide for safety procedures and practices in electrical work IS-5216-1982 (Part - I & II).

11.5.6.4 Electrical installation fire safety of Buildings (general) code of Practice IS-1646-1982

11.5.6.5 Guide for loading of oil immersed transformers IS 6600-1972.

11.5.6.6 Code of Practice for selection, installation and maintenance of Transformers IS 10028-

11.5.6.7 Insulating Oils IS 335-1980.

11.5.7 Technical:

The transformers shall conform to IS 2026 amended to date and IEC 76 and shall be as approved by the local Power Distribution Authorities. The rating shall be suitable to operate at continuous maximum rating (CMR). The impedance ratio and other characteristics of all the transformers shall be same for parallel operation.. The transformer shall be copper wound. CPRI type test certificate is to be submitted along with bid. The transformer losses should be within limits specified by latest IS/local EB norms.

11.5.8 Connection, Vector Group and Core Winding

The connections and vector group shall be Delta on High Voltage side and star on low voltage side with neutral terminal brought out for solid earthing corresponding to the Vector Symbol Dyn-11 of relevant Indian Standard specification. The system of supply shall be 3 phase, 50 cycles, and HV side is earthed through high impedance earthed system at supply end.

(a) The over load capacity of the transformer shall be 110 % continuous at an ambient temperature of 50ºC without exceeding permissible limit of winding temperature.

(b) The magnetic core shall be made up of Cold rolled grain oriented electrical grade sheet steel laminations coated with inorganic

insulating layers. The winding on the HV side shall be with sufficient end turn re-enforcement for extra strength.

(c) Sufficient radial and axial clearances shall be provided for safety and uniform cooling of the windings and limbs. The winding shall be so designed that they shall withstand thermal, dynamic and electrical stress during operation and short circuit conditions.

(d) The transformer shall be continuously rated for full load and indoor type. Temperature rise in Oil / Windings over an ambient temperature of 50deg.C is 50/55 deg

11.5.9 Tap Changing Gear

The bidder shall haver Off Load tap changing gear.

11.5.10 Off Load Tap Changing Gear

The off load tap changer shall be operable by means of an operating handle brought outside the tank and operable from ground level. It shall be equipped with an indicating device to show the tap in use and shall be provided with a locking arrangement to lock the switch in position. The tap changers contacts and connections shall be accessible through an access hole having a bolted gasketed cover.

11.5.11 Detachable Terminal Boxes

11.5.11.1 The terminals of HV and LV windings shall be connected through porcelain bushings suitable for the rated voltage and current. HV cable box shall be suitable for terminating 1R X 3C X 240 mm2, XLPE, AL, armoured cable. Suitable cable boxes shall be provided on HV sides as per the local regulations and as per Indian Electricity rules.

11.5.11.2 On the LV side, the end box shall be suitable for receiving Non segregated phase bus duct of 1250A rating.

11.5.12 Cooling System

The cooling system shall be natural air-cooling by means of pressed/round tubes and fins (radiators) around transformer tank. Each radiator shall have separate inlet and outlet valves. Insulation shall be achieved with oil, complying with IS 335/1980. Two separate earthing terminals shall be provided at the bottom of the tank on both sides.

11.5.13 Fittings and Accessories

The following accessories and fittings shall be provided:

11.5.13.1 Lifting Lugs: - The arrangement for lifting the active part out of the transformer tank along with the cover by means of lifting lugs without disturbing the connection.

11.5.13.2 Bi directional type Rollers: - The transformer shall be provided with 4 Nos. bi-directional rollers fitted on cross channel to facilitate the movement of transformer in both directions.

11.5.13.3 Oil Conservator: - The transformer shall be provided with an oil conservator with welded end plates. It shall be bolted to the cover and can be dismounted for purpose of transport. It has to be provided with oil level gauge with marking for minimum level and oil filling hole 1.25" BSF size with a cap. A draining plug shall be provide to drain the oil if, required. A connection pipe between the conservator and the main tank is to be provided with projections inside the conservator.

11.5.13.4 Air Release Valve: - An air release valve is to be provided on top of the tank to facilitate the release of the entrapped air.

11.5.13.5 Breather: - The transformer to be provided with indicating dehydrating silica - gel breather of sufficient capacity.

11.5.13.6 Drain valves & Filter valve: - The transformer shall be provided with a drain-cum- oil filter valve of 1.25" BSF size at the bottom of the tank.

11.5.13.7 Oil sampling valve at Bottom

11.5.13.8 Diagram and rating plate: - Diagram and rating plate shall be provided, indicating the details of transformer, connection diagram, vector group, tap changing diagram etc.

11.5.13.9 Buchholz Relay: - Double- float Buchholz relay where specified shall have two separate sets of contacts on for alarm and other for circuit-breaker trip. The relay shall have a test-cock and valve on the upstream and downstream side. A small window in the wall of the relay shall be provided to show the amount of the trapped gas, if any. The construction of the transformers shall be such that all rising gas will readily reach the Buchholz relay (wherever specified in Data sheet A).

11.5.13.10 Dial type thermometer (150 mm Dial) with maximum set pointer and electrical contacts for an alarm at high temperature.

11.5.13.11 Out put from Buchholz Relay of Double Float type with electrical contacts for low oil level alarm and high gas pressure trip shall be terminated on the connector block to feed to protection relay.

11.5.13.12 Filter valve of 1.25" BSF at top.

11.5.13.13 Oil Temperature indicator with Alarm and Trip contacts (wherever specified in Data sheet A).

11.5.13.14 Winding Temperature Indicator with Alarm and Trip contacts (wherever specified in Data sheet A)

11.5.13.15 Explosion vent with diagram

11.5.13.16 First filling of oil

11.5.14 Testing and Commissioning.

During manufacturing and on completion, all transformers shall be subjected to the routine tests in accordance with latest IS 2026 / IEC 60076 and its different parts.

The type test certificates shall be supplied along with the delivery of the equipment. (Type test certificate carried out for on identical transformer

within last 5 years will be accepted)

11.5.15 Guarantee:

11.5.15.1 On delivery of the equipment a thorough checking shall be conducted by the Project Manager/Engineer Incharge and snags if any, shall be recorded handed over to the Manufacturer for the attendance. On completion of the rectification work a provisional virtual completion certificate shall be issued by the Project Manager/ Engineer Incharge. However workmanship and the functionality of the whole of work shall be the responsibility of the Manufacturer for a period of 18 months from the delivery of the equipment or 12 months from commissioning of the equipment whichever is later. The Manufacturer shall be holding himself fully responsible for reinstallation or replacement at free of cost to Owner the following:

11.5.15.2 Any defective work or material supplied by the Manufacturer

11.5.15.3 Any material or equipment damaged or destroyed as a result of defective workmanship by the Manufacturer.

11.5.16 Labeling and Safety:

11.5.16.1 Each major component of the unit shall have the manufacturer's name, address, style, and type or catalog number on a place securely attached to the component of the units.

11.5.16.2 The function or duty of each meter, instrument, indicator, switch, or any other device for external control, shall be clearly defined with labels in accordance with the specifications.

11.5.16.3 Painting shall be in accordance with the appropriate specification requirements.

11.5.17 Deviations

Deviation if any shall be clearly submitted in a separate deviation sheet with proper justification by the vendor. Otherwise it shall be assumed that there is no deviation.

12.0 CONTROL AND INSTRUMENTATION

12.1 Two (2) nos. of level switches for sump levels (low & high) shall be provided. These levels must be considered for start/ stop interlock of individual pump.

12.2 4 nos. of flow meter with totalizer having wireless transmitters are required to measure water intake by each plant (210MW units, 500MW units & 660MW unit) and total water intake at MS gravity pipeline. These signals from all 4 nos. of transmitters should be received at Pre Treatment plant PLC of 1x660MW unit. Wireless repeaters should be provided. (Positions for 4 nos. of flow meters will be finalized during detailed engineering.)

12.3 Individual pump shall have pressure Indicator & pressure switch at the discharge. For common discharge header also, there will be pressure switch and wireless pressure transmitter.

12.4 Pump ON, OFF status for 3 nos. of pumps at 660MW pump house, common header discharge pressure reading and sump levels (high, low) shall be transmitted wirelessly to PT plant PLC of 660MW unit.

12.5 Intercom terminal with necessary cabling shall be provided for communication with main plant.

For detailed requirement of Control and Instrumentation system, Volume – V shall be referred to.

13.0 CIVIL

13.1 The bidder shall visit the site to acquaint himself regarding all site features and scope & extent of Civil/Structural works to be carried out for this purpose to amalgamate with the new facilities in consultation with Owner/owner's consultant.

13.2 Scope includes site survey, soil investigation, site development works, complete design engineering and construction of Civil, Structural works and to obtain necessary various approvals from concern Departments/agencies well in advance including necessary charges.

13.3 For crossing of the ash disposal pipe lines with nallahs, rivers, canals etc, pipe shall be laid over RCC /structural supports and bottom of pipe shall be kept at 0.5m above H.F.L.

13.4 Providing and laying pipe line including their supports and foundations, thrust blocks, valve chambers, etc. wherever required including earth mat/lightening protection.

13.5 Thrust blocks shall be provided to resist the thrust load from pipelines considering the test pressure in the pipelines at bends/tees etc.

13.6 Backfilling, around foundations and bottom of pipes, thrust blocks etc shall be carried out with approved material in layers not exceeding 30 cm thickness and each layer shall be compacted to 90% standard proctor density for cohesive soil and to 75% of relative density for non- cohesive soils.

13.7 Diversion of existing flow of water for connection of pipe line from existing tank.

13.8 Laying of pipe line in canal and filling around with sand upto canal top.

13.9 Inter connection of the existing pipe lines leading to 2x500 MW Units with the proposed pipe line through inlet canal before aqueduct.

13.10 Renovation of existing (abandoned) pump house and sump with installation of 3 pumps including all required civil works (2 W + 1 S/B).

13.11 End connection to the two compartments of One day reservoir for 1x660 MW Unit with necessary isolation arrangement.

13.12 Restoration of existing Utilities after completion of the work.

13.13 For detailed civil specification, refer volume VI-B.

14.0 <u>TESTING</u>

14.1 Thickness

14.1.1 The thickness of the pipe coating shall be measured either by elcometer or by coating thickness gauge.

14.2 BOND

14.2.1 Bond test shall be carried out by cutting 25 mm square at three locations of the coating on a sample test specimen to qualify the procedure. Coating shall be pulled out by lifting one corner of the square. For a good coating, the section shall not peel off easily.

14.2.2 The coating on the pipe shall be carried out only after satisfactory completion of the qualifying test.

14.2.3 In case of doubt regarding the quality of coating, bond test shall be carried out on any location of the pipe to the satisfaction of the Owner.

14.3 FIELD ADHESION TEST FOR WRAPPING TAPES

14.3.1 Adhesion test shall be made to determine the proper bond between the tape and primed pipe. The temperature of the tape and pipe to be tested shall be between 10 and 27 °C. If the temperature is outside this range, hot or cold water shall be poured over the test area until this temperature range is attained. A test area shall be selected by the inspector where the tape is smooth for 15 cm in the longitudinal direction of the tape. Two knife cuts that are 15 cm long and 5 cm apart shall be made through the tape. A flat blade shall be used to pry up 5 cm of the fabric. This 5 cm flap of fabric shall be grasped firmly in one hand and shall be pulled with a quick motion in the direction of the remaining 10 cm of the 15 cm knife cut.

14.3.2 The adhesion is satisfactory if the tape tears at the point of stripping or the fabric strips from the underlying coal tar component, leaving exposed not more than 10% of the primer or metal.

14.4 HOLIDAY TEST

14.4.1 On completion of coating/wrapping, the quality of the coating shall be tested using efficient high voltage holiday detectors, operating at a voltage high enough to jump an air gap, the length of which is equal to the

thickness of the coating/wrapping. All holidays found shall be repaired and the repairs shall be retested with the holiday detector to ensure that adequate repairs have been made.

14.4.2 The suggested test voltage shall be as follows:

V = 1250 (t) ½ where
V = voltage in volts,
t = coating thickness in mils (1 mil = 0.001 in.)

14.5 CERTIFICATES

The CONTRACTOR shall furnish certificates of all the materials purchased by him and also complete instructions from the manufacturer regarding the storage, preparation and application of the coating materials.

15.0 SPARES AND CONSUMABLES AND LUBRICANTS

Bidder shall consider identical mandatory spares for all mechanical, electrical and instrumentation items in line with Volume- II, Section-9 and include in the scope.

Similarly, all consumables and lubricants till COD of the unit shall be included in the scope.

Further, bidder shall offer recommended spares for Three (3) year operation as specified under Volume- I .

DATASHEET-A

VERTICAL PUMPS

SR.NO.	DESCRIPTION	
1.0	Service	From existing pump house (abandoned) to one (1) day reservoir.
2.0	Orientation	vertical
3.0	Duty	Continuous
4.0	Location	Indoor
5.0	Number of Pumps required	Three (3)
6.0	Number of Pumps working	Two (2)
7.0	Number of Pumps Standby	One (1)
8.0	Liquid handled	Raw Water
9.0	Motor pedestal floor elevation	Bidder to indicate based on specification guidelines
10.0	Level of bottom of sump	
11.0	Normal water level (M)	
12.0	Minimum water level (M)	
13.0	Maximum water level (M)	
14.0	**PUMP PERFORMANCE REQUIREMENTS**	
(a)	Performance Standard	IS-1710/equivalent
(b)	Rated capacity, (m^3/Hr)	By bidder
(c)	Speed (RPM)	By Bidder to be determined keeping in view the number of stages, acceptable head-capacity, power and NPSH values. (subject to Owner's review)

SR.NO.	DESCRIPTION	
(d)	Estimated Total dynamic head at rated capacity (MLC)	By Bidder to be determined as follows: Static head: Elevation difference between minimum water level in the existing (abandoned) pump house plus 3 mWC residual pressure at the destination. Frictional head: 20 % margin on the calculated drop in the line based on Hazen Williams formula with a C factor of 120.
(e)	Permissible tolerance in rated capacity (%)	± 2.5 percent at the rated head
(f)	Permissible tolerance in efficiency at rated capacity	No negative tolerance
15.0	**DESIGN AND CONSTRUCTIONAL FEATURES**	Please refer to Volume III-E2
16.0	**MATERIAL OF CONSTRUCTION**	
17.0	**SUPPLY OF ACCESSORIES AND SERVICES**	
(a)	Sole plate	Yes
(b)	Foundation bolts, nuts, sleeves etc	Yes
(c)	Discharge flanges with nuts, bolts and gaskets	Yes
(d)	Gland Sealing / cooling and bearing cooling / lubrication system complete with pipes, valves, fittings and instruments as required	Yes

SR.NO.	DESCRIPTION	
(e)	Thrust Block	Yes, if applicable
(f)	Pump motor Coupling and guard	Yes
(g)	Eye bolts, lifting tackle etc	Yes
(h)	Discharge pressure gauges with isolating cocks isolating cocks	Yes
(i)	Instrument connections	Yes
(j)	Vent with isolating cock	Yes
(k)	All other accessories and services	Yes
18.0	**INSPECTION AND TESTING**	
(a)	Material testing of casing, impeller and shafts	Yes
(b)	Hydrostatic testing	Yes
(c)	Dynamic balancing test	Yes
(d)	Sump model tests	Yes
(e)	NDT Tests on casing/ shaft	Yes
(f)	NDT Test on impeller	Yes
(g)	Vibration and noise measurement	Yes
(h)	Performance Tests	Yes
(i)	Performance test to be done on	Proto type at rated speed
(j)	Performance test required for determining	H Vs. Q curve P Vs. Q curve N Vs. Q curve NPSH Vs. Q curve
(k)	Field performance test required	Yes
(l)	Other tests as per applicable clauses of this specification	Yes

DATA SHEET A

1.0 PIPING AND SPECIALITIES

1.1 Please refer volume III - F

DATA SHEET A

1.0 BUTTERFLY VALVES

1.1 Please refer volume III - F

DATA SHEET A

1.0 M.S. GRAVITY PIPE LINE THROUGH INLET CANAL FROM RAW WATER PUMP HOUSE TO AQUEDUCT

SR. NO.		DESCRIPTION	DETAILS
1.0	M.S. Pipes		
	(a)	Length of Pipeline	About 2.50 km. (bidder to ascertain)
	(b)	Materials of Construction	M.S. Pipes of SW/ ERW/ SAW Construction, Commercial Quality, Fe-410 Grade conforming to IS: 3589 and IS 5504
	(c)	Nominal Diameter	As per design requirement (Minimum 1700 mm dia.)
	(d)	Thickness (without negative tolerance)	As per design requirement (Minimum 14.00 mm thick)
	(e)	Discharge required	9000 cum/hr.(Minimum) beyond existing siphon.

2.0 M.S.PIPE LINE FOR INTERCONNECTION OF 2X500 MW UNITS TO THE PROPOSED PIPE LINE THROUGH INLET CANAL BEFORE AQUEDUCT WITH ISOLATION ARRANGEMENT

SR. NO.		DESCRIPTION	DETAILS
1.0	M.S. Pipes		
	(a)	Length of Pipeline	About 50.00 Mtrs. Including 'T' , Bends & other specials
	(b)	Materials of Construction	M.S. Pipes of SW/ ERW/ SAW Construction, Commercial Quality, Fe-410 Grade conforming to IS: 3589 and IS 5504

SR. NO.		DESCRIPTION	DETAILS
	(c)	Nominal Diameter	1400 mm dia.
	(d)	Thickness (without negative tolerance)	12.0 m thick

3.0 **M.S.PIPE LINE FROM EXISTING (ABANDONED)PUMP HOUSE TO ONE DAY RESERVOIR FOR 1X660 MW UNIT**

SR. NO.		DESCRIPTION	DETAILS
1.0	M.S. Pipes		
	(a)	Length of Pipeline	About 1.9 km.(bidder to ascertain)
	(b)	Materials of Construction	M.S. Pipes of SW/ ERW/ SAW Construction, Commercial Quality, Fe-410 Grade conforming to IS: 3589 and IS 5504
	(c)	Nominal Diameter	As per design requirement (Minimum 800 mm dia.)
	(d)	Thickness (without negative tolerance)	As per design requirement (Minimum 10.00 mm thick)
	(e)	Discharge required	As per design requirement ((Minimum 3000 cum/hr.)

DATASHEET A

AIR RELEASE VALVES

SR. NO.	DESCRIPTION	UNIT	VALUES / REQUIREMENTS
1.0	Quantity	No	BY BIDDER
2.0	Size	mm	BY BIDDER
3.0	Type		Double Kinetic, with double orifice
4.0	Liquid handled		Raw water
5.0	Function		To admit air to prevent vacuum formation in pipeline and release air during filling the pipeline.
6.0	Working pressure	Kg/cm^2 (g)	BY BIDDER
7.0	Design pressure	Kg/cm^2 (g)	BY BIDDER
8.0	Maximum flow in pipeline	m^3/hr	BY BIDDER
9.0	Size of main pipeline	mm	BY BIDDER
10.0	**MATERIALS OF CONSTRUCTION**		
(a)	Body		IS210 GR. 260
(b)	Top cover		---------- DO----------
(c)	Splash cover		---------- DO----------
(d)	Floats		HARD RUBBER
(e)	Bolts and nuts		ASTM A193 Gr.B7 and ASTM A194 Gr.2H

SR. NO.	DESCRIPTION	UNIT	VALUES / REQUIREMENTS
(f)	Flange		Flat face per ASME B 16.1
(g)	Seats		IS 318 Gr LTB2 / ASTM B62
11.0	Flange drilling standard		Flat face per ASME B 16.1
12.0	Accessories		---

DATA SHEET - A

LT OIL TYPE TRANSFORMER

SR.NO	DESCRIPTION	UNITS	VALUE
1.0	General condition		
2.0	Design Ambient temperature for Electrical Equipment	Deg C	50
3.0	Altitude	M	As per project information sheet
4.0	Relative humidity	% RH	Max:-85
5.0	Rating	KVA	750
6.0	Quantity	Nos.	2
7.0	Service type		Indoor
8.0	Primary Voltage	KV	6.6 KV
9.0	Secondary voltage	KV	0.433
10.0	Winding material		Copper
11.0	No. of Phases		3
12.0	Frequency	Hz	50
13.0	Type of cooling		ONAN
14.0	Type of connection		Delta/Star
15.0	Connection Symbol		Dyn11
16.0	Voltage variation (on HV side)		+5% to -5%
17.0	Steps		2.5%
18.0	Class of Insulation		as per I.S.
19.0	Type of Tap Changer		OFF CIRCUIT TAP CHANGER
20.0	**TEMPERATURE RISE**		

SR.NO	DESCRIPTION	UNITS	VALUE
20.1	Ambient	Deg C	50
20.2	Oil by thermometer	Deg C	40
20.3	Windingby resistance	Deg C	45
21.0	**TERMINAL ARRANGEMENTS**		
21.1	HV side		Cable Box (1 X 3C X 240 mm2, XLPE, AL, Armored)
21.2	LV side		Non Segregated Phase Bus Duct, 1250A
22.0	No Load Losses	kW	Vendor to specify (should meet local EB requirement)
23.0	Load Losses	kW	Vendor to specify (should meet local EB requirement)
24.0	% impedance	%	5%
25.0	**STANDARD FITTINGS**		Specify items required
25.1	Rating and Diagram plate	1 no	YES
25.2	Silica Gel Breather	1 no	YES
25.3	Lifting lugs for tank and assembly	2 nos	YES
25.4	Lifting lugs for tank cover	2 nos	YES
25.5	Oil filling hole with cap	1 no	YES
25.6	Air release plug	1 no	YES
25.7	Conservator	1 no	YES
25.8	Base channel	1 no	YES
25.9	Thermometer pocket	1 no	YES
25.10	Oil level gauge (plain) & magnetic	1 no	YES
25.11	Earthing terminals	2 nos	YES

SR.NO	DESCRIPTION	UNITS	VALUE
25.12	Explosion Vent/PRV	1 no	YES
25.13	Bottom Filter cum drain Valve	1 no	YES
25.14	Conservator drain plug.	1 no	YES
25.15	Inspection cover	1 no	YES
25.16	Flat Uni / Bi-Directional Rollers	4 no's	YES
25.17	Double Float Buchholz Relay	1 no	YES
25.18	Top Filter Valve	1 no	YES
25.19	Radiator	1 set	YES (with separate valves & plugs)
25.20	Marshaling box with Oil & winding Temperature indicator (for Alarm & trip)	1no	YES
26.0	Routine test	As per IS 2026/ BS 171	YES. In presence of client representative / as per condition in P.O.

Note:

1. Separate neutral bushing to be brought out for earthing

2. The WTI & OTI shall be installed in IP55 marshalling box with proper terminal strip prewired to BZ, WTI, OTI, MOG & external purchasers cable.

DATA SHEET-B

VERTICAL PUMPS

SR. NO.	ITEM	UNIT	
1.0	**GENERAL**		
1.1	Designation of the pumps		
1.2	Manufacturer and Model No.		
1.3	Number of pumps offered		
2.0	**GUARANTEED PERFORMANCE PARAMETERS**		
2.1	Performance standard		
2.2	Rated capacity with tolerance	m^3/hr	
2.3	Total dynamic head at discharge elbow at rated capacity	mlc	
2.4	Shut-off head	mlc	
2.5	"Range of operation" within which the pump can operate continuously without any problem		...% to ...% of rated capacity
2.6	Pump rated speed	RPM	
2.7	Pump overall efficiency at rated capacity	%	
2.8	Maximum value of peak to peak amplitude of vibration on any pump/motor bearing	microns	
2.9	Maximum noise level	dB	
3.0	**DESIGN & CONSTRUCTIONAL FEATURES**		
3.1	Pump duty		Continuous / Intermittent

SR. NO.	ITEM	UNIT	
3.2	Pump Type		Centrifugal/Mixed flow/Axial flow
3.3	Pump design		Pull out/Non-Pull out/Above floor discharge/Below Floor Discharge
3.4	Impeller type		Closed/Semi-Open
3.5	Number of stages		
3.6	Running speed		
3.7	NPSHr		
3.8	Pump specific speed		
3.9	Pump suction specific speed		
3.10	Minimum submergence required at rated capacity	mlc	
3.11	REVERSE ROTATION		
3.11.1	Is the pump suitable for reverse flow condition?		Yes/No
3.11.2	Runaway speed of the pump due to reverse flow	rpm	
3.11.3	Head at Reverse Flow	m	
3.12	Pump Critical Speed	rpm	
3.13	MODE OF PUMP STARTING		
3.13.1	Whether the pumps offered can be started with discharge valve closed ?		Yes/No

SR. NO.	ITEM	UNIT		
3.13.2	(a) If the answer is "no" whether the discharge valve should be kept partially open and for what % flow?		Yes/No, …..% flow	
	(b) If the answer is "yes" allowable duration for such operation	minutes	……	
3.13.3	What precautionary measure is required to be taken to avoid hammering action on the valve disc if the pump is started with valve fully closed?			
3.14	Provision for impeller adjustment available.		Yes/No	
3.15	Type and make of coupling between pump and drive.			
3.16	Number of column pipes and maximum length of single piece.	mm		
3.17	Number of shaft pieces and maximum length of single piece.	mm		
3.18	Type of shaft coupling			
3.19	SHAFT BEARINGS		Impeller shaft bearings	Line and head shaft bearings
3.19.1	Type of bearings and Manufacturer			
3.19.2	Numbers provided			

SR. NO.	ITEM	UNIT		
3.19.3	Type of lubrication & cooling		Self/External	Self/External
3.19.4	Type of lubricant		Liquid handled / clear water/ oil	Liquid handled /clear water/ oil
3.20	THRUST BEARING (S)			
3.20.1	Location		On Pump / On Motor	
3.20.2	Numbers provided			
3.20.3	Type			
3.20.4	Manufacturer & Catalogue No			
3.20.5	Design life at pump duty point	Hrs.		
3.20.6	Description of lubrication arrangement and lubricant			
3.20.7	Coolant		Handling fluid/external water	
3.21	SHAFT SEALING ARRANGEMENT			
3.21.1	Type			
3.21.2	Sealing fluid		Handling fluid/External water	
4.0	**MATERIAL OF CONSTRUCTION (indicate applicable code/ standard)**			
4.1	Discharge head and discharge casing			
4.2	Column pipe			
4.3	Impeller bowl			
4.4	Suction bell			
4.5	Impeller			
4.6	Impeller shaft, head shaft and line shaft			

SR. NO.	ITEM	UNIT	
4.7	Impeller and casing wear rings		
4.8	Shaft sleeve		
4.9	Shaft coupling		
4.10	STUFFING BOX		
(a)	Submerged		
(b)	Above fluid level		
5.0	**CONNECTIONS AND OTHER DIMENSIONAL DETAILS**		
5.1	DISCHARGE NOZZLE		
5.1.1	Diameter	mm	
5.2	Column pipe O/D & thickness	mm	
5.3	Suction bell diameter	mm	
5.4	Impeller shaft diameter	mm	
5.5	Line and head shaft diameter	mm	
5.6	Shaft enclosing tube O/D and thickness	mm & mm	
5.7	Recommended Sump Dimensions (Bidder to furnish for each individual pump)		
5.7.1	Bottom clearance required from the edge of suction bell	mm	
5.7.2	Back wall clearance from pump centre line	mm	
5.7.3	Side wall clearance from pump centre line	mm	
5.7.4	Minimum water level	m	

SR. NO.	ITEM	UNIT	
5.7.5	Maximum water level	m	
5.7.6	Normal water level	m	
5.8	Approx. centre line elevation of discharge nozzle from floor level.	mm	
5.9	Minimum hook lift required from floor level to handle pump and drive.	mm	
6.0	**DRIVE DATA**		
6.1	Drive element output at ambient condition	kW	
6.2	Whether drive element rating takes care of the stipulations of the specification ?		Yes/No
6.3	Cooling arrangement for the drive		
7.0	**INSPECTION AND TESTING**		
7.1	Material test		Yes/No
7.2	Hydrostatic test pressure and duration	kg/ cm^2(g) and minutes	
7.3	PERFORMANCE TEST		
7.3.1	Testing standard		
7.3.2	Test to be conducted on		Proto- type
7.3.3	Test speed	rpm	
7.4	Cavitation test		Yes/No
7.5	Submergence test		Yes/No

SR. NO.	ITEM	UNIT	
7.6	Dynamic balancing test		Yes/No
8.0	**WEIGHT & LOADING DATA**		
8.1	Approximate weight of the pump and drive assembly	kg	
8.2	Weight of the largest single piece to be handled for	kg	
8.2.1	Erection		
8.2.2	Maintenance		

DATA SHEET - C

DRAWINGS, DATA, CURVES AND INFORMATION REQUIRED:

1.0 DRAWINGS/DATA

1.1 DRAWINGS/DATA

(a) Determination of pump head and capacity as per guidelines of this specification.

(b) General arrangement drawings showing the principal dimensions, weight and location of the suction and discharge connections of the pumps offered. Details of lubrication and sealing arrangement shall be included.

(c) Outline drawings of the pump showing the various dimensions, suction and discharge locations.

1.2 ANTICIPATED PERFORMANCE CURVES SHOWING THE FOLLOWING CHARACTERISTICS:

(a) Capacity Vs Head

(b) Capacity Vs Power & Efficiency

(c) Capacity Vs Submergence

(d) Capacity Vs NPSH requirement

1.3 A write-up describing clearly the procedure for installing the pump with its column pipe - piece by piece and also for overhauling the pump in a like manner. A diagram showing the required pump house crane hook lift above the pump operating floor has also to be furnished.

DATA SHEET – B

LOW PRESSURE PIPING, VALVES AND SPECIALTIES

SR. NO	ITEM	UNIT	
1.0	**LOW PRESSURE PIPING AND FITTINGS**		
1.1	PIPING CLASS OR GROUP (A/B/C)		
1.1.1	Codes and Standard for design fabrication and erection		
1.1.2	Codes and Standards for testing and inspection		
1.1.3	Applicable codes/standard for		
(a)	Qualification of welding procedure and welder/welding operators		
(b)	Shop and site welding		
(c)	Edge Preparation		
	(i) For butt weld end		
	(ii) For socket weld end		
	(iii) For screwed end		
1.1.4	Pipes		
(a)	Manufacturer		
(b)	Manufacturing Process		
(c)	Type of construction		

SR. NO	ITEM	UNIT	
(d)	Material of construction (indicate code/standard)		
(e)	Type of joints		
	(i) For size 65 NB & above		
	(ii) For size 50 NB & below		
1.1.5	Fittings		
(a)	Manufacturer		
(b)	Material		
(c)	Type of Construction		
(d)	Standard		
(e)	End details		
	(i) For size 65 NB & above		
	(ii) For size 50 NB & below		
1.1.6	Flanges		
(a)	Manufacturer		
(b)	Type		
(c)	Standard		
(d)	Material Standard		
(e)	Gasket		
1.1.7	(a) Welding Process		
	(b) Type and make of welding rods to be used		

SR. NO	ITEM	UNIT	
1.1.8	Hydrostatic Test Pressure	ata	
1.1.9	All equipment and temporary piping for hydro testing furnished?		Yes/No
1.1.10	Type of rust inhibitor given before shipment		
1.1.11	Procedure for galvanization of pipes and fittings (mention standard)		
1.1.12	Outside protection for Buried Pipes		
(a)	Type and make of primer		
(b)	Type and make of paint		
(c)	Number of coats of primer		
(d)	Number of coats of paints		
(e)	Total dry thickness of the paint applied		
(f)	Type of wrapping		
(g)	Number of layer of wrapping		
(h)	Surface preparation before painting		
1.1.13	Outside Painting for Overground/ Trench Pipes		
(a)	Type and make of primer		
(b)	Type and make of paint		

SR. NO	ITEM	UNIT	
(c)	Type of surface preparation before use of paint		
2.0	**The following data is to be furnished for each category (different materials, type and size of valves for different services)**		
2.1	TYPE AND CLASS OF VALVE		
2.1.1	Manufacturer		
2.1.2	Service/Location		
2.1.3	Design Standard/Code		
2.1.4	Pressure class		
2.1.5	Material of construction for valve components (Indicate also applicable codes/standards and grades)		
(a)	Body and Bonnet		
(b)	Trim/Wedge		
(c)	Seating surfaces/Seat rings		
(d)	Yoke		
(e)	Stem		
(f)	Flanges		
(g)	Bolts		
(h)	Nuts		
2.1.6	Gear operator provided		Yes/No
(a)	If so, for what size of valve		
(b)	Type		
(c)	Make		

SR. NO	ITEM	UNIT	
2.1.7	Integral bypass valve provided		Yes/No
(a)	If so, for what size of valve		
2.1.8	End preparation		
2.1.9	Valves are outside screw and rising spindle type?		Yes/No
2.1.10	Type of valve position indicator for the valves		
2.1.11	(a) Hand-wheel included with all valves?		Yes/No
	(b) Are the valves provided with service tag discs at the hand-wheel?		Yes/No
2.1.12	All the valves under this Group as desired for safe and reliable operation offered?		Yes/No
2.1.13	Flange standard		
2.1.14	Standard for Bolts and nuts for counter flanges		Yes/No
2.1.15	Enclosed with proposal, manufacturer's descriptive and illustrative literature/drawings on the valves		Yes/No
2.1.16	Testing Standard		
3.0	**BUTTERFLY VALVE**		

SR. NO	ITEM	UNIT	
3.1	GENERAL		
3.1.1	Manufacturer		
3.1.2	Whether double flanged		Yes / No
3.1.3	Size of the valve	mm	
3.1.4	Number offered		
3.1.5	Installation		Horizontal / Vertical Shaft
3.1.6	Type and Make		
3.2	EQUIPMENT PROCEDURE		
3.2.1	Maximum disc differential pressure	Kg/cm^2 (g)	
3.2.2	Maximum differential back pressure allowable for valve operation	Kg/cm^2(g)	
3.2.3	Maximum allowable flow	m^3/hr	
3.2.4	Maximum allowable fluid velocity through valve	m/sec	
3.2.5	Pressure drop across the valve at design flow when valve is fully open	Kg/cm^2 (g)	
3.2.6	Angle of travel from wide open to shut-off condition in degrees (applicable for Butterfly Valves only		
3.2.7	Design pressure	Kg/cm^2(g)	
3.2.8	Design temperature	^0C	

SR. NO	ITEM	UNIT	
3.3	DESIGN AND CONSTRUCTION		
3.3.1	Valve design standard		
3.3.2	Design pressure class		
3.3.3	Maximum torque required at the disc shaft for operation (Including seating and unseating)	Kg. m	
3.4	VALVE BODY & DISC		
3.4.1	Body construction		Cast /Fabricated
3.4.2	Pressure class		
3.4.3	Thickness of disc.		
3.4.4	Disc. Construction		Cast / Fabricated
3.4.5	Flange drilling standard for flanged valve		
3.5	VALVE SEAT		
3.5.1	Material		
3.5.2	Location		
3.5.3	Seat thickness (mm) and radial width	mm	On body/on disc
3.5.4	Whether of replaceable design		Yes/No
3.5.5	Whether reinforcement provided (applicable for resilient material)		Yes/No
3.5.6	Number of retaining ring segments		

SR. NO	ITEM	UNIT	
3.6	VALVE SHAFT		
3.6.1	Shaft attachment piece		Stubbed/Single
3.6.2	Shaft diameter	mm	
3.7	SHAFT BEARING		
3.7.1	Type and make		
3.7.2	Location		
3.7.3	Number's provided		
3.7.4	Catalogue No.		
3.7.5	Design life at normal operating conditions	Hrs	
3.7.6	Whether self lubricating		Yes / No
3.8	THRUST BEARING		
3.8.1	Type and make		
3.8.2	Catalogue No.		
3.8.3	Location		
3.8.4	Numbers provided		
3.8.5	Design axial thrust	Kgf	
3.8.6	Design life at normal operating conditions	Hrs	
3.9	SHAFT SEAL		
3.9.1	Type		
3.9.2	Location		

SR. NO	ITEM	UNIT	
3.9.3	Seal replacement possible without dismantling the valve		
3.10	MATERIAL OF CONSTRUCTION		
3.10.1	Valve body		
3.10.2	Valve disc		
3.10.3	Valve seat ring		
3.10.4	Valve shaft		
3.10.5	Shaft bearings		
3.10.6	Thrust bearings		
3.10.7	Shaft seals/stuffing box packing		
3.10.8	Gears		
3.10.9	Extension spindle, if any		
3.10.10	Clamping rings		
3.10.11	Hand wheel/Chain wheel		
3.10.12	Internal fasteners (pins, screws, etc.)		
3.10.13	External fasteners		
3.10.14	Floor stand, if any		
3.10.15	Seal		
3.10.16	Gear casing		
3.11	INSPECTION AND TESTING		
3.11.1	Material test		

SR. NO	ITEM	UNIT	
3.11.2	Hydrostatic Test		
3.11.2.1	Pressure	kg/cm^2(g)	
3.11.2.2	Duration	minutes	
3.11.3	Disc Strength Tests		
3.11.3.1	Disc strength test pressure	Kg/cm^2(g)	
3.11.3.2	Duration	minutes	
3.11.4	Air Leakage Test		
3.11.4.1	Pressure	kg/cm^2(g)	
3.11.4.2	Duration	minutes	
3.11.5	Seat Test		
3.11.5.1	Pressure	kg/cm^2(g)	
3.11.5.2	Duration	minutes	
3.12	VALVE SEAL		
3.12.1	Whether seal is mounted on disc or body?		
3.12.2	Thickness and radial width of seal	mm	
3.12.3	Type of reinforcement or inserts provided in rubber seal		
3.12.4	Replaceable design		
3.13	Class & Retaining Rings etc., for Rubber Seal		

SR. NO	ITEM	UNIT	
3.13.1	Type		
3.13.2	Type of construction		
3.13.3	Replaceable design		
3.14	WEIGHT DATA		
3.14.1	Weight of the valve assembly complete with gearing, motor etc.	kg	
3.14.2	Weight of the largest piece to be handled	kg	
4.0	**DOUBLE KINETIC AIR VALVE**		
4.1	GENERAL		
4.1.1	Manufacturer		
4.1.2	Size of the valve	mm	
4.1.3	Number offered		
4.1.4	Installation		Horizontal / Vertical Shaft
4.1.5	Type and Make		
4.1.6	Working pressure	Kg/cm^2 (g)	
4.1.7	Design pressure	Kg/cm^2(g)	
4.1.8	Maximum allowable flow	m^3/hr	
4.1.9	Pressure drop across the valve at design flow when valve is fully open	Kg/cm^2 (g)	

SR. NO	ITEM	UNIT	
4.1.10	Design pressure	$Kg/cm^2(g)$	
4.1.11	Design temperature	^0C	
4.2	DESIGN AND CONSTRUCTION		
4.2.1	Valve design standard		
4.2.2	Design pressure class		
4.2.3	Maximum torque required at the disc shaft for operation (Including seating and unseating)	Kg. m	
4.2.4	Body construction		
4.2.5	Top Cover		
4.2.6	Splash cover		
4.2.7	Floats		
4.2.8	Bolts and nuts		
4.2.9	Flange		
4.2.10	Seats		
4.2.11	Flange drilling standard	mm	
4.2.12	Accessories		

DATA SHEET – C

DRAWINGS, DATA, INFORMATION & MANUALS REQUIRED:

1.0 Final versions of all the documents, furnished during the bid.

2.0 A complete list of all piping systems and corresponding materials included in the scope of work.

3.0 A complete list of all valves with their quantities and ratings.

4.0 Detailed layout of the cross- country piping from Tapi river water pump house upto the interconnection point.

5.0 Manufacturer's catalogue indicating complete range of available size and rating of pipes, fittings, valves and specialties.

6.0 General Arrangement and Sectional drawings with data on weight and material of construction for each category of Expansion Joints with control rod assemblies.

7.0 Outline drawings and Cross Sectional drawings indicating principal dimensions and weights of equipment, size and location of various nozzles, connections, nozzle sizes and foundation arrangement.

8.0 Detail drawings including fabrication drawings of all shop fabricated piping system indicating design parameters and complete bill of material (Relevant Standards and grades to be indicated) and information/data pertaining to the hydrostatic and non-destructive test requirements to be submitted progressively.

9.0 Detail dimensioned drawing of each valve, specialties, indicating tag no., pressure rating, manufacturing standard, the bill of materials and hydrostatic test pressures. The drawing shall include the end preparation details and shall indicate the position of the hand wheel/operator. Technical particulars of motor operators wherever applicable shall also be indicated.

10.0 General arrangement drawing for each hanger/support/anchor etc. indicating identification number, auxiliary supporting structural details, other details & information as required in the specification.

11.0 Wiring diagram for all limit switches of motor operated valves.