SECTION V – TENDER SPECIFICATION FOR CONSTRUCTION OF 21 LAKH LITRE DOMESTIC WATER TANK AND ALLIED WATER DISTRIBUTION NETWORK AT ACTREC, KHARGHAR, NAVI MUMBAI - 410210

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

The Specifications, Tender Bill of Quantity, Drawings are all to be read in conjunction and the stringent requirements in all these documents apply.

ACTREC reserves the right to break the system in various phases as per the site fronts available.

ACTREC/ TMH vendor qualifications requirements, EMD/PBG legal, human resources, financial, commercial, technical requirements , general specifications/ terms & conditions as enclosed needs to be confirmed and complied by vendors without any deviations

1.02 SUMMARY

Furnish and install a factory packaged and tested, triplex variable-speed drive based hydro-pneumatic domestic water system along with tank filling system of underground tank system including pumps, motors, controls, drives, valves, pressure tanks, interconnecting piping of yard (external system to the complex buildings) system of SS 304 & UPVC (Unplastisized PVC) which is internal to the ACTREC complex, (with central monitoring by PLC/BMS based SCADA System with complete wiring and accessories for a complete, approved system as per the instruction of Engineer incharge). The system will be finally tested for performance as per design expectations. The System will have 4 major components:

1) Transfer Pump System Consisting of 1W + 1S Centrifugal Horizontal Split case Pumps with IE3 Motors of 100 Cu.M/Hr to transfer water from 21.0 Lacs Liters Above Ground RCC Fire & Potable Water Tank to New Proposed 20.5 Lacs Liter RCC Water Tank. There will be 2 filters ie active carbon & sediment filters in transfer circuit before water is transferred to Underground tanks. There is a new 6 Inch SS 304 line which will be used for this transfer. **(This part of tender will be done in future as required by ACTREC)**

2) Hydro pneumatic System Consisting for 1W + 1 S + 1 Jockey Centrifugal Inline Pumps with IE3 Motors.

3) Above Ground 150 dia. SS 304 Pipe Network in ACTREC Yard rested on RCC supports and the same supported by PCC & Soling. Internal pipe within factory building will be 50 dia. UPVC mounted on walls, columns & beams, shafts, inside Factory. SS pipe will be supported by support every 5 meter while UPVC will be supported every 1 meter, pipes will be suspended from ceiling with GI Clamps.

4) PLC & SCADA/BMS System for Monitoring of Entire System in the designated Control room as regards Flow, Level, Pressure, Electrical and Supervision of Pump/Motors/Power Supplies Systems **(this part of tender will be done in future as required by ACTREC)**

1.03 **ABBREVIATIONS :**

ACTREC	Advanced Center for Treatment, research & Education in Cancer at Kharghar Complex
AHJ	Authority Having Jurisdiction
AHU	Air Handling Unit
AC	Alternating Current
ASME	American Society for Mechanical Engineers
ASTM	American Standard for Testing & Materials
BMS	Building Management System
DC	Direct Current
EHS	Environment Health & Safety
FAT	Factory Acceptance Test
FPS	Foot Per Second
HOA	Hands Off Auto
HR	Human Resources
IP	Ingress Protection
IS	Indian Standard
ISA	Instrument Society of America
LED	Light Emitting Diode
LPM	Liters Per Minute
LOTO	Locked Out Tagged Out
PLC	Programmable Logic Controller
MIDC	Maharashtra Industrial Development Corporation
NBC	National Building Code of India

NEC	National Electric Code of USA
NEMA	National Electrical Manufacturers Association
NPSH	Net Positive Suction Head
NRV	Non Return Valve
OEM	Original Equipment Manufacturer
P & ID	Piping & Instrumentation Diagram
PCC	Plain Cement Concrete
PPE	Personnel Protective Equipment
QAP	Quality Assurance Plan
RCC	Reinforced Cement Concrete
SAT	Site Acceptance Test
SCADA	Supervisory Control & Data Acquisition
SMPS	Switch Mode Power Supply
SS	Stainless Steel
TEFC	Totally Enclosed Fan Cooled
TIG	Tungsten Inert Gas Welding
TMH	Tata Memorial Hospital & Research Center
UL	Underwriters Laboratory
UPVC	Unplasticized Poly Vinyl Chloride
VFD	Variable Frequency Drive

1.03 REFERENCE STANDARDS

The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. Material Codes for SS 304 Pipes is ASTM A 312
2. Material Code for UPVC Pipes is as per IS 4985 Codes
3. Design & Reference Code are IS 2065, IS 7834, IS 10500, IS 12183, IS SP-57, NBC – 2005 , Factory Inspector Norms & Factory Act of India, MIDC Norms of Maharashtra,
4. National Electrical Manufacturers Association (NEMA) & Ingress Protection (IP) Codes
5. PLC & SCADA/BMS System will be designed as per ISA Codes
6. ANSI Standard 61 - Drinking Water System Components - Health Effects
7. The design of reinforced concrete water tank is based on IS 3370: 2009 (Parts I – IV)
8. Method of Tests for Strength of Concrete as per IS 516
9. Steel for Concrete Reinforcements shall be as per IS 1786 latest revision
10. The electrical panel or pump distribution shall be as per IS/IEC standards 61439-1 (low voltage electrical panels), 61439 – 2 (power panels) & IEC 61439 – 6 (bus bar systems)

1.04 QUALITY ASSURANCE PLAN (QAP)

All equipment under this section shall be furnished by a single supplier and shall be products that the manufacturer regularly engages in. The supplier shall have sole responsibility for proper functioning of the system and equipment supplied.

The vendor doing installation, testing & commissioning of the domestic water system shall be responsible for compliance with all applicable codes and regulations, and be held accountable for the complete pump package, piping network & SCADA installation.

Manufacturer’s Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years experience in Plumbing, Fire Fighting System and shall possess a valid license from Maharashtra Government, a final Approved Plumbing Engineer certification is required. The packaged system manufacturer shall have 24 hour local service available provided by a trained representative of the contracting company for period of 3 months.

All disconnects, transformers, and control devices shall be installed to provide minimum wire bending clearances per Indian Electricity Code. All wiring shall be FRLS Armoured stranded copper tinned conductors with 75° C. insulation. Conductors shall be numbered and identified at all termination points. All wiring shall be installed in cable ways and laced with nylon tie straps. All disconnects, transformers, controllers, control devices, selector switches, and indicator lights shall be provided with nameplates indicating their respective function and/or identification. A factory wiring schematic shall be permanently affixed to the inside of cabinet door. The entire assembly shall be wired and tested in accordance with the Indian Codes (I.S.). All components shall be built to National Electrical Manufacturers Association (NEMA) & IP standards and be IS/UL approved. The entire control panel shall be from pump vendor for enclosed industrial control panels.

Certification shall obtained by the OEM indicating that the function and performance characteristics of all products and materials have been determined by testing and ongoing surveillance by an approved third-party certification agency. Assertion of certification shall be in the form of identification in accordance with the requirements of the third-party certification agency. ACTREC Kharghar & Consultants reserve right to test the system prior to dispatch or can perform FAT or SAT as deemed necessary by them.

As part of Quality Plan Vendor to offer a demonstration of a good weld job by welding two pipe samples of 3 inches prior to starting of main job. After ACTREC & Consultant approval the main welding jobs will commence. ACTREC reserves right to instruct welding, installing & commissioning team to do corrections if proper job output is not received at site, vendor will be solely responsible for the same and for the delay in the work.

1.05 SUBMITTALS

Product Data:

1. Provide manufacturers data sheets including general assembly, pump curves showing performance characteristics with pump and system with operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.
2. Code and Standards compliance.
3. Third-Party Certification of Work done for similar systems
4. Spare Parts List for Commissioning & O&M

Record Documents:

5. Provide full written description of manufacturer’s warranty.

6. Good for Construction Drawings: P & ID , Pipeline layouts, Pump House Layout, Filtration System,general assembly, GA drawings, components, dimensions, weights, clearances, foundation and stability certifications and methods of assembly will be provided before installation and for client/consultant approvals. All as built drawings shall be provided by vendor in A0 size colour 4 sets and 2 sets in Autocad format 2010 version in CDROM. All manuals of electrical/mechanical components shall be provided in 3 sets.

7. Manufacturer's Installation Instruction: Indicate support details, connection requirements, and include start-up instructions for pumps & motor or hydro pneumatic systems.

8. Manufacturer's Certificate: Certify that pumps meet or exceed specified requirements at specified operating conditions. Submit summary and results of factory tests performed.

9. Field Reports: Submit verification statement, signed by system manufacturer representative, of start-up, adjustment service and acceptance of installation. Indicate summary of hydrostatic test and field acceptance tests performed.

Operation and Maintenance Data:

10. Operation Data: Include manufacturer’s instructions, start-up data, trouble-shooting check lists for pumps, VFD drives, and controllers.

11. Maintenance Data: Include manufacturer’s literature, cleaning procedures, replacement parts lists, and repair data for pumps, VFD drives and controllers, preventive maintenance schedule, preventive maintenance recommendations and procedures. Identify place of purchase, location and contact numbers of service depot and technical support for each product installed.

1.06 DELIVERY, STORAGE AND HANDLING

Accept pumps and components on Site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.

Protect pumps and components from physical damage including effects of weather, water, and construction debris.

Provide temporary inlet and outlet caps, and maintain in place until installation.

Loading/Unloading of System will be done by vendor

Cost of pipes quoted per meter will include all fittings like elbow, tee, reducer, threaded adapters, flanges, screwed end, clamping, fixing, welding, testing, and finishing of pipe complete in all respect, ACTREC will not accept any cost for fittings or accessories separately and will not reimburse any charges for the same

Before charging the pipes all burrs/unevenness of pipes will be removed and will be finished properly. Proper flushing of pipes will be followed with high speed water/flushing pumps. No pipes will be left open so that any animal ingress does not happen in open pipes

All underground pipes will be provided with wrapping coating. Anti corrosive tape and will have hume pipe collar of either NP2 or NP3 based on traffic load passing through that road crossing

Hydro test will be performed while work progress and pipe network will be tested at least 1.5 times maximum operating pressure ie at 16 Bar.

1.07 SPARES

Vendor to offer 2% Commissioning Spares for the system as recommended by System OEMs, and 5% O & M spares as per OEMs recommendations

1.08 WARRANTY

All components furnished shall be warranted for a period of 12 months from documented date of startup after final commissioning and handover of the system.

PART 2 - PRODUCTS

2.01 GENERAL

All materials shall meet or exceed all applicable referenced standards, national, state and local MIDC requirements, and conform to codes and ordinances of authorities having jurisdiction.

All materials that may come in contact with the potable water delivered shall comply with ANSI Standard 61.

The system is largely SS 304 and UPVC based (internal to building) if any brass or bronze piping materials/fittings are used that may come in contact with the potable water delivered shall have not more than 10% zinc content.

Pressure ratings of pumps, pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed. Necessary safety devices shall be available to avoid any burst pressure conditions of equipment and pipes which can cause injury to plant personnel or asset.

The Contractor shall ascertain for himself the space and access available for the installation of a factory assembled packaged unit and as an option may assemble the various components in place at the Site in lieu of providing a factory assembled unit. However, all components of the system shall be compatible and be furnished by a single source manufacturer and all electrical services and interconnecting equipment wiring must be provided for within this Contractors bid.

The pumps, drives, panels and valves shall be factory assembled on a steel skid including Schedule 40 304 series stainless steel suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with logic and power controls. All SS 304 pipes of sizes 150, 80 will comply as per ASTM A 312, Schedule 10 while UPVC Pipes will be Schedule 40 for 50mm& lower dia. Pipes and will comply with IS 4895 codes. Vendor will completely provide water through new SS & UPVC network as inline with older system. All drinking water coolers, production machines wash basins, toilets will be revived if water is not reaching any particular outlet whether in plant or building. All O& M devices like pot strainer, flow meters, relief valves will be installed in such a way that they will not be in close proximity to electrical or electronic panel boards and will be easily accessible,

Over pressurization of the system while operating across-the-line shall be prevented by a pilot operated diaphragm type combination pressure regulating and non-slam check valve on each pump. Main valve and cover shall be with SS 304 with a fused epoxy coating and stainless steel stem and cover bolts. Construction shall be suitable for the maximum working pressure of the system.

All pilot lights and visual indicators shall be illuminated from the rear by long life LED lamps. Neon and incandescent lamps are not acceptable.

Provide isolation gate valves with LOTO arrangement on the suction and discharge of each pump. The isolation valves shall be sluice valves valves (2" and smaller) .

Provide two 4 1/2" ASME grade A, panel mounted glycerin filled gauges for indicating system suction and system discharge pressure.

All skid-mounted components shall be factory finished in high quality epoxy or enamel paint. The base shall be suitable for grouting or fixing. The material can be GI or MS powder coated with epoxy paint

The packaged pumping system shall include all electrical wiring between components and shall be completed and tested at the factory prior to shipment.

Unions or flanges shall be provided for easy removal of pumps. Pipe headers shall be sized for a velocity not exceeding 7-1/2 FPS and shall be terminated with a groove joint capable of accepting a groove coupling or groove flange furnished by Contractor.

System shall be arranged such that single point connections are required for piping and electrical power supply.

Individual pumps, motors and pressure regulating or check valves shall be serviceable with the pumping system in operation.

All similar components shall be of one manufacturer, (i.e., valves, gauges, etc.).

All Pumps will be SS 304 material and All Motors Shall be IE3 TEFC motors

TIG Welding with Inert Argon gas will be acceptable welding method for welding 6 meter long SS 304 pipes. Welder shall ensure that he uses ER 308L low carbon material (around 0.02%) as filler wire, acceptable size is minimum 2.5mm dia. or maximum 3.15mm dia. length of filler rod shall be 36 inches. Welder shall ensure that welds are performed after proper cleaning of surface as quality of weld will depend on clean surface area of pipes. Welding shall be done after properly preparing beveled ends, cleaning the weld area and then for a good finish welder shall employ either K2 paste or Grinding or Buffing wheels and smooth finished job shall be possible after the process is complete. Vendor to only employ trained, certified manpower during the TIG welding process. Vendor to prepare safe methodology work statement and shall carry out risk assessment of the welding process and shall get approvals/ work permit from ACTREC prior to carrying out hot work in particular areas. Safety supervisor to ensure that all safety precautions be followed for TIG Welding process with risks associated with electric & shock hazard, earthing & grounding of welding machines, circuit breaker protection, machine wiring, use of proper PPE by welding team, weld watch, material handling of heavy equipments, solvent safety, storage of welding & cleaning material at site, gaseous fume, special precautions for welding in confined spaces are adhered constantly.

Refer to schedules on Contract Drawings for required pump capacities and electrical characteristics.

All Valves, strainers, instruments and other pump house, network components shall be as per BOQ specifications or datasheets, drawings and most stringent of specifications is applicable

Cement A. i)The cement shall be sulphate-resisting cement of local manufacturer meeting requirements with minimum strength 400kg/cm2 after 28 days. ii) Aggregate Fine Aggregate A. Sand for concrete, mortar and grout shall be furnished by the Contractor from any approved source and shall be natural sand or a mixture of natural sand and fine crushed stone. The sand shall meet the requirements of ASTM C33, with the additional requirement that the specific gravity of the sand shall not be less than 2.50.

iii) Water A. Water used in concrete either for mixing or curing shall be fresh potable water derived from an approved source of supply and shall be free from silt, oil, organic matter, acid, alkali-slare and other dexterous substances. The temperature of the water shall not be less than 10°C. the water shall meet the requirement of ASTM C94 iv) Reinforcing Steel A. The steel bars to be used are of plain and deformed steel bars complying with ASTM standards before bending the steel is to be straightened to the Engineer’s satisfaction and cleaned of all rust loose mill scale, oil or any other dirt. B. Spacers shall be made of precast concrete cubes which shall match the concrete into which they are cast in every way (strength proportion, color) or as approved by the Engineer.

C. Jointing of reinforcement bars shall be done with overlap no less than 50 times the diameter of the respective bar. v) Additives A. Where required or approved by the Engineer, the Contractor shall use additives such as plasticizers or retarders in the concrete. Proportioning and mixing of additives thereof to be used in the concrete shall be in accordance with manufacturer's recommendations and subject to the Engineer's approval. Additives shall be added to the batch in solution in a proportion of the mixing water according to the manufacturer instructions. This solution shall be batched in such a manner as will ensure uniform distribution of the additive throughout the batch during the specified mixing period. B. Additives shall be suitable for use in contact with potable water after 30 days of concrete curing. C. The additives used shall be furnished by the Contractor, and the cost of the materials and all costs incidental to their use shall be included in the unit prices bid in the Bill of Quantities for concrete in which the materials are used. ACTREC Ground Water Tank project

. Concrete type as per BOQ shall be used as watertight for tank .The Contractor shall use the proportions as per BOQ of the mix provided that it could be demonstrated that the mixes used have the lowest possible water content consistent with proper grading and good workability for the sake of minimum drying shrinkage, and on condition that the Contractor can prove by advance testing carried out in approved laboratory, that they are suitable, comply with all the requirements of the specifications, and that they can be transported, placed and compacted by the methods and equipment used on site. Vendor to perform Cube tests (6 cubes of 150 X 150 X 150mm size shall be cast , 3 for 7 days testing and 3 for 28 days testing). The IS codes referred for test of Concrete Strength shall be as per IS – 456 latest edition , the machine used shall be in line with IS 14858 standards and vendor shall offer a test report from IIT Mumbai and variation of 3 set of cubes shall not be ore than +/- 15% of the average, if ore the test result will be declared as invalid.

Forms and Shuttering

A. All forms for casting of concrete shall be made of steel, plywood, mazonite or similar material providing a completely smooth surface of the face coming in contact with the concrete. Only new, strong and smooth timber shall be used for shuttering and scaffolding. B. The Contractor shall bear the sole responsibility for the safety and stability of the forms, scaffolds etc., and in the case of collapse, excessive deflections, buckling and /or any other changes in shape, the damage shall be repaired by the Contractor at his expense.

C. Form ties shall be internal where possible. The typing of forms in the walls shall be made with special accessories fitted with cones or accessories of approved type by the Engineer so as to ascertain complete sealing after stripping of forms, and avoid any seepage of water at the ties. After the tie fittings have been removed, the holes shall be filled with epoxy on the inside and cement grout of the approved type by the Engineer on the external face. D. Forms shall be stripped only with the Engineer's approval. The minimum period from completion of casting to commencement of stripping will be as follows : Walls - 48 hours Roof - 14 to 21 days

Mixing and Placing of Concrete

A. Contractor will have to submit for Engineer's approval a scheme of the proposed forms and shuttering as well as a detailed schedule for casting proceedings.

B. Contractor must inform the Engineer of any scheduled casting at least 48 hours prior to the casting and must obtain Engineer's approval to the proposed schedule.

C. When and if mixing on site is approved by the Engineer, concrete shall be machine mixed with approved machines.

D. The location of the mixing plants shall be agreed on with the Engineer and the Contractor must submit to the Engineer for approval before erection of any mixing plant his proposed arrangements for the storing of aggregates, batching and mixing of the concrete

E. The placing of concrete in any element is to be carried out continuously without pause, in a manner which will not produce construction joints or cold joints due to partial drying of compacted concrete.

F. The concrete transported by transit mixer or agitators, the time elapsing from the time water is added to the mix until the concrete is deposited in place shall not be greater than the time taken for 300 revolutions of the transit mixer or agitator or 20 minutes, whichever is the least.

G. Driver of delivery trucks shall be provided with trip tickets, which shall be signed by a responsible member of the central plant staff, for submission to the Engineer. The ticket shall contain name and address of the central plant, serial number of the ticket and date, truck number, class and/or strength of concrete, cement content of the mix, loading time, slump and any other type of relevant information. The Engineer may send his representative to the central plant to check the batching and mixing, verify loading time and take a copy of the trip ticket.

H. The placing of fresh concrete will be gently placed in position and will not be allowed if the free fall is more than 2.0m. Concrete shall not be placed in such a manner that it displaces reinforcing bars, ties, etc. The fresh concrete is to be placed in its final destination in accordance with the above mixing and batching procedures. Any concrete that has become so stiff that proper placing cannot be assured, shall be wasted

I. Concrete shall be consolidated to a maximum practicable density, by means of vibration, so that it is free from pockets of coarse aggregate and entrapped air, and closes snugly against all surfaces of forms, reinforcing steel bars and embedded materials. The slump for concrete thus consolidated must be fairly high and the cement quantity increased accordingly to achieve specified strength.

Joints

A. Working joints in the concrete will be permitted only in places marked on the Drawings or as approved by the Engineer.

B. Working joints will not be measured for payment and Contractor will incorporate their cost in the unit prices for concrete works.

C. Joints with P.V.C water stops will be constructed as marked on the Drawings or requested

D. The water stops will be of P.V.C strips 240 x 4 mm. supplied by an approved manufacturer and approved by the Engineer. Contractor must furnish samples of water stop to be used along with the manufacturer's certificate specifying the characteristics and quality of the material.

E. Engineer's approval of the sample does not release the Contractor from any responsibility to the quality of the material and the proper execution of the joint. F. Water stops will be furnished to the site as complete units having the shape and dimensions as indicated on the Drawings.

G. The edges of the water stop will be joined by welding since no overlap will be permitted.

H. The water stop will be inserted accurately in the elements of the structure cast first and will be properly protected from any damage, dirt or distortion of its shape and position. Prior to casting the adjoining part of the concrete element, face of the joint will be properly cleaned and a 3 mm. hot asphalt coat will be applied on the whole of the joint area. Sealing of joints shall be completed by filling the groove with an elastoseal pack as marked on the Drawings.

Concrete Repairs and Finish

A. All repair works that might be required on sections of the cast concrete shall be performed by the Contractor not later than 24 hours after removing of forms.

B. If not otherwise instructed, Contractor will cut all projecting tie wires to a depth of 15 mm, into concrete face and fill the recess with fresh concrete. Concrete projection caused by roughness of forms will be chiseled away or otherwise removed by a polishing carborundum stone. Gravel pockets, holes or faulty spots shall be chiseled out until clean and healthy concrete is exposed. All recesses shall be filled up with fresh concrete of approved cement grout and properly repaired. The repaired section will merge with the concrete of the structure and smoothened level with its surface.

C. All repair works will be performed only after damaged part has been checked by the Engineer.

D. All finish works shall be performed by the Contractor at his expense and he would not be entitled to any compensation for the same.

Construction of Manholes

i) General

A. The Contractor shall construct manholes in reinforced cast-in-place concrete or in precast concrete rings to the levels, dimensions and shapes shown on the Drawings, or as directed by the Engineer.

B. All manholes shall be constructed with incoming and outgoing pipes neatly and truly concreted in, complete with benching, cast iron steps and manhole cover and frame as here specified and shown on the Typical Drawings.

ii) Manholes

A. The Contractor shall construct a well compacted blinding layer of plain concrete to the required levels after the Engineer has inspected and approved bottoms of excavations. The surface of the blinding layer shall be regular and smooth.

B. The Contractor shall set tops of manhole frames and covers to the elevations as indicated on Drawings, unless otherwise directed.

C. All items built into walls of manholes and structures such as pipe ends shall be adequately sealed to obtain watertight construction to the satisfaction of the Engineer. Steps shall be installed in a staggered pattern to the extent indicated at not more than 300 mm centers and shall be well grouted.

D. Changes in direction of gravity sewers shall be made through the use of a manhole.

E. House connections shall be made to manholes using a piece of pipe called socket.

F. Drilling shall be used when connecting pipes into manholes.

G. Covers and frames shall be well centered and anchored all around to the approval of the Engineer.

H. After the installation of the cast iron frames, the Contractor shall provide plain concrete in surrounds. Surrounds shall be well hunched all round and toweled smooth.

I. **Drop fittings**: Drop manholes shall have drop pipes and fittings installed such that the crown of the incoming drop pipes shall be at the same elevation as that of the outgoing pipe. Drop pipes shall be of the same diameter as the incoming pipes. The drop pipes and fittings shall be encased in plain concrete.

J. Benching to manholes shall be constructed in plain concrete, well formed and streamlined and smooth trowelled in channels, bends and junctions.

K. All manholes steps, covers and it's frames shall be well cleaned and painted with black paint of bituminous base after complete installation and to the approval of the Engineer.. All manholes shall be properly ventilated.

Cleaning- All manholes shall be cleaned of any accumulation of silt, mortar, debris or other foreign matter and shall be free of any such accumulation at the time of final inspection.

Metal Components Embedded in Concrete

All metal components that have to be fixed in the concrete such as pipe sections, steel frames and covers, hooks, ladders etc., shall be tightly placed in their right position within the shuttering prior to casting of concrete. All faces of metal parts that will be embedded in the concrete shall be thoroughly cleaned removing all dirt like, oil, paint, scale etc., in order to secure thorough adhesion between concrete and metal. Where pipes have to be anchored in the concrete, anchoring rings shall be welded to the pipe. In case a free passage of the pipe is required through the concrete, pipe should be wrapped with a bitumen saturated felt or a similar elastic sealing material.

Concrete Tests

Concrete tests shall be carried out in accordance with IS 516 codes for samples. Preliminary tests shall be made by the Contractor to determine suitable mixes. Routine tests shall be taken for cube strength according to IS standards.

If the mean value of strength does not comply with the requirement of standards the particular structural element must be core tested, if the cores don't comply with the requirement , Engineer shall have the right to require strengthening or replacement of that element which fail to develop the required strength. All remedies associated costs shall be at the expense of the Contractor. C. All costs in connection with the tests shall be at the Contractors own expense.

Pump House

The Pump house as indicated in drawing to be provided by vendor , in design it shall be ensured that the suction is positive and no negative suction or bends will be allowed in suction pipes. All necessary puddle flanges shall be cast during pump house erection, vendor to take all the necessary consultation from project consultants to correctly place nozzle orientation and number , size and type of nozzle. A lightning arrestor will be provided on pump house building. There will be 10 High intensity LED lamps provided of minimum 24 watts rating on all sides of the pump house of at least 100 Lumen/Watt Luminous efficacy. The fixtures shall be IP 66 as inimum and the body of the exterior lights shall be corrosion resistant. Vendor will also provide 8 Nos of LED lights inside the Pump House and 2 Nos Exhaust fans of 16 Inch diameter and of air flow rate of 2400 CFM. The power to the lights, fans shall be routed through MCB and one common ELCB for the switchboard. All cables used for internal and external wiring shall be Copper cables of cross section 3C X 2.5 sq.mm and 3C X 4 sq mm for Exhaust fans. Earth pits for individual pumps and electrical panel shall be provided outside pump house as per IS 3043 standards. The pump house shall have internal drainage system connected to nearest storm water drains all necessary UPVC piping, SS nani traps as required to be provided by vendor. Pump house shall have the desired slope and water outlets to nearest storm water drain. Vendor to also provide down take pipes for rain water for both tank & pump house. Main LT panel and distribution board as per IS/IEC 61349. RCC construction, Brick Walls, Plaster Internal & External will be as per NBC 2016 civil codes. Pump House will be painted from inside & outside of 3 coats of Acrcylic Washable distemper .Water Tank will have 3 coats of same colour from outside only.

Pump House will have a rolling shutter with 3 coats of grey oil paint from front & back with shutter cover and hydraulic shutter adjustment and 3 feet X 6 feet water resistant wooden door with door stopper, door closure, SS finish tower bolt.

Pump house will have aluminum anodized glass heavy duty sliding windows with sun film on both sides of pump house of 2.5 feet height with locking arrangements

RCC Water Tank:

RCC water tank will be as per drawing enclosed with tender and will follow the IS 3370 latest revision standard. The Nozzle orientation will be provided by vendor as per P & ID drawings and the drawing will offer Nozzle sizes in mm, Elevation levels of Nozzles from FGL. Manholes of GI type of 6 mm thickness with internal jalli will e provided so that no one falls inside the tank. There will be a GI ladder provided for every alternate manhole entry and the same shall be marked from outside. Handles will be provided outside of manholes where ladder entry exists in the tank. Tank will have two compartments and will be connected with gate valves for easy isolation and cleaning. RCC tank will have tape and level gage apart from level transmitter instruments and the level shall be indicative from the distance and shall be road facing. Nozzles shall be casted during tank construction and all good for construction drawings shall submit nozzle orientation and submitted to consultants.RCC tank will also have lightning arrestor as per IS 2309 & guidelines of NBC 2016. Vendor to carry out Soil test for both tank & pump house as per IS 1888 and IS 6403, IS 12070 latest revision prior to starting of work, and submit a report from recognized laboratory with samples.RCC tank will have vents with insect cage at regular intervals. All nozzles with be GI type fabricated from Heavy Duty GI Class C ERW pipes. Capacity of RCC tank of 20.5 lakh liters shall be without 400mm free board.

2.02 ACCEPTABLE & APPROVED MANUFACTURERS

The following manufacturers are acceptable provided their products meet or exceed these Specifications and the Contract drawing schedules, ACTREC Kharghar reserves the right to suggest the preferred makes among the approved vendors:

1. Ebara, Grundfos, Kirloskar : for Main, Standby & Jockey Pumps with VFD wherever specified, Motors, Air Tank and Panel
2. SS 304 Pipes & Fittings : Any ASTM A 312 Compliant Pipes or Sumitomo/Jindal/Tata/Roopam Steel
3. U PVC Pipes & Fittings : Supreme/Astral/Finolex
4. SS Clamps : Hitech, United, ISI Mark
5. SS 304 Valves & Actuators (Gate, Sluice, Ball, Globe, Butterfly, NRV, Air Relief) : L & T, Rapid Valves, Rotork, Kirloskar Valves, Hawa, , Claval, Normex, Audco, Gecomini, Cair Euromatic,)
6. Pressure Switches – Danfoss/Indfoss/System Sensor(Honeywell)
7. Glycerin Filled Pressure Gauges – Warree, Baumer, Wika
8. Pot/Y Strainers – Armstrong, Bombay Chemical & Equipment Co., Acme, Wermer, Tecmara

9. Level, Pressure Transmitters – Siemens, Azbil, Honeywell, Wika
10. Flow Meter – Siemens, Azbil, Endress & Hauser
11. Filters (Sediment, Membrane, Carbon) – Thermax, Ion Exchange
12. PLC & SCADA Devices – Siemens, Azbil
13. LT Motors – Siemens, Ebara, Grundfos, Kirloskar, WEG
14. Electrical & Control Cables – Polycab, Lapp, Metaplast, Belden
15. Electrical Contactors, Switchgears MCB, MCCB,ELCB, RCCB, RCBO Load Manager – Siemens, L & T
16. PC & Monitor – Dell/HP
17. Printer – HP. Epson, Canon
18. Electrical Instrumentation Panels & Cabinets – Rittal, Arrow, L & T, Schneider, Siemens, Elecmec Controls
19. UPS – Emerson Power, Siemens, APC
20. Water Dispensing RO System – Kent, Eureka Forbes
21. Cement (Ordinary, Portland, Pozzalona – ACC, Ambuja, Lafarge, Ultratech Cements
22. White Cement – Birla White, JK, Kamdhenu,
23. Reinforcement, Structure Steel – Tata, SAIL, Jindal
24. Ceramic, Vitrified Tiles, - Kajaria, Somany, Johnson
25. Plumbing Fittings – Kohler, Jaguar, Grohe, Hindware
26. Aluminium Frame – Jindal, Hindalco
27. Glass – Modi, Saint Gobain, HNGIL
28. Stainless Steel – Jindal, SAIL, Indian Stainless Steel
29. SS Hardware – Godrej, Hettich, Droma
30. SS Bolts Washers Nuts – Kundan Puja, Atul
31. Pipe Supports, Anchor Fasteners – Hilti, Mupro Eqvt.

2.03 PUMPS AND MOTORS

System shall include three horizontal (1W+1S) mounted close-coupled end suction centrifugal pumps with ANSI flanged connections. Pump features to include foot supported casing, back pull out design, top centerline discharge and hydraulically balanced impeller. Pump shall be SS 304/AISI 304 fitted construction with a replaceable shaft sleeve and mechanical seal.

Motor shall be NEMA close-coupled type with a JM shaft. Motors shall be open drip proof and manufactured in accordance with NEMA standards IP 52 & above.

Motors shall be high efficiency and balanced to a maximum vibration amplitude of .001". Motors shall have ball bearings and operate at 40° ambient. Each motor shall be equipped with the manufacturer's nameplate and shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of 1.15 for variations in voltage and frequency.

Each pump shall be provided with an individual temperature probe and purge valve having adjustable high temperature set point and differential to sense heat buildup in the pump casing. On sensing high temperature the probe circuit shall open a solenoid valve that allows the heated water to flow out.

2.04 VARIABLE FREQUENCY DRIVES (FOR HYDRO PNEUMATIC PUMPS)

Provide and mount on the system skid three variable frequency drives of the PWM design suitable for variable torque applications using any standard NEMA Design B squirrel cage induction motor. Variable frequency drives shall sized for the maximum possible amp draw throughout the programmed sequence of pump operation. Required Harmonic Filter shall be provided.

The efficiency at full load and full speed shall be 97% with a fundamental power factor of .98.

Drives shall be pulse width modulated, start into a rotating load, follow signal from logic section of control panel when in auto mode and be provided with the following features:

1. Hand/off/auto switch and manual speed adjustment.
2. Auto Drive Shutdown for electrical fault.
3. Automatic restart after power fails shutdown.
4. Provide complete service diagnostics with fault history log.

Keypad Operator Device including the following:

5. 2 Line Backlit LCD Display.
6. Power On and Alarm/Fault Displays.

Operational data displays include:

7. Drive Speed (HZ)

8. Motor Power
9. Energy (kWh)
10. Current
11. Elapsed Time
12. RPM
13. Motor Voltage

No bypass shall be provided with any drive.

2.05 PRESSURE SENSOR/TRANSMITTER

Provide one pressure sensor/transmitter that provides a 4 to 20 mA, HART DC output, compatible with the system controls, temperature and pressure requirements. Pressure sensor/transmitter shall have zero, span and damping devices. The transmitter shall be installed on the system discharge header and factory wired to the control panel.

2.06 SEQUENCE OF OPERATION

The lead pump shall run only as necessary to maintain system pressure and will be controlled automatically by means of a pressure sensor/transmitter and programmable logic controller (PLC/BMS) programmed to prevent short cycling. If the lead pump is unable to maintain system pressure the lag pump(s) will be called on after a time delay and will operate in parallel with the lead pump in accordance with the PLC program. When one pump can handle the system demand the controls will shut down the lag pump. When a low or no flow condition is reached, the controls will accelerate the lead pump to charge the system and hydro-pneumatic tank then shut the lead pump down and alternate.

In the event of a storage tank low level alarm condition, all pumps shall be shut down and shall be automatically restarted upon restoration of the storage tank level. In the event of a low system pressure alarm, all pumps shall be started and the alarm must be manually reset. The system will have full automation as regards Level of Tanks and to auto start the transfer system there will be level float system and SOV for auto opening the filling lines of tanks.

2.07 CONTROL PANEL

Monitoring Section - Provide, mount and wire on the skid a programmable logic controller/BMS system in a IP 52 enclosure to interface the signal from the pressure sensor to the VFD's and provide a stabilized response to speed up or slow down or add pumps to meet system requirements. The controller shall provide setpoint adjustment, timer adjustment, PID functions and both system and controller self diagnostics via touch screen display. The touch screen display / human machine interface shall include a 5.7” STN display, resistive analog touch, numerical system keyboard. All user interface set points shall be easily accessible via a password protected display screen. Normal system operation shall be tuned to eliminate hunting. Controller shall have one RS 485 Communication port, real time calendar/clock and EEPROM memory transfer cartridge.

Power Section - Each system shall include a enclosed floor or wall mounted IP52 industrial control panel as per ACTREC/TMH Electrical standards, factory wired and mounted on the steel skid. The panel shall be furnished with individual pump disconnects with through the door handles, pump run lights, H-O-A selector switches and 230 volt fused control transformer and include the following features:

1. Control power (on-off) switch and light.
2. Low suction pressure shutdown circuit with auto reset, delay timer and light.
3. High system pressure shutdown circuit with auto reset and light.
4. Power failure monitoring.
5. Audible alarm with silence push button.
6. Auto alternate three equal pumps.
7. Auxiliary relay contacts for all alarm conditions.
8. PLC enable switch.
9. Individual pump temperature probe and purge valves.
10. Main Disconnect.
11. Audible and visual indication of low storage tank level (signal by others), with silence push button.
12. Elapsed time meters.
13. Flow meter with digital display in CU.M/hr or LPM and with 4- 20mA output
14. Real time clock for event stamping of alarm & trouble signal.

2.08 HYDRO-PNEUMATIC TANK

Provide a vertical hydro pneumatic tank with a carbon steel shell and a replaceable FDA approved heavy-duty bladder to separate the air and water. All plastic & rubber items shall be food grade. No water shall come in contact with the metal walls of the tank. Features shall include an nitrogen/ air fill valve, pressure gauge connection and top system connection suitable for 100 percent drawdown.

The tank shall be constructed in accordance with Section VIII of the ASME code and be stamped and shall be rated for minimum 125 psig operating pressure and maximum operating temperature of at least 75 degrees Celsius .

Tank shall be factory finished in high quality epoxy or enamel paint. Tank shall have its capacity and pressure defined on the outside.

The tank shall be mounted in a remote location at high-point of distribution piping system where shown on the Contract Drawings. Provide glycerin filled gauge to monitor bladder tank pressure.

Tank shall be of 500 liters with 16 bar capacity and nitrogen filled bladder.

PART 3 - EXECUTION

3.01 INSTALLATION

Installation shall meet or exceed all applicable national, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with manufacturer’s published recommendations.

Install the system level and in accordance with manufacturer’s published recommendations.

Locate equipment with allowance for manufacturer's recommended clearances around unit.

Set entire unit on 4" high reinforced concrete equipment pad. Provide vibration isolators and bolt skid to pad. Structurally connect equipment pad to building slab to prevent movement.

Pipe discharge from all relief valves, drains and individual pump thermal purge protection solenoid valves, indirectly to floor drain having adequate capacity to accept discharge.

Required SOP to be followed as per ACTEC /TMH EHS, HR, Legal requirements during work execution

As project has to be completed in working factory premises, advance planning, adhering to project schedules and manpower requirements is key to the project.

ACTREC will provide free electricity & power to vendor, items like Scissor/Boom Lifts, Scaffolding to be arranged by vendor on their own cost

ACTREC/TMH Norms to be followed by Vendor Staff while inside the premises for Supervision of Work, Work Permits, PPE and General Safety Behaviors

3.02 FACTORY TESTING

The transfer & hydro pneumatic system shall be hydrostatically tested and shall undergo a complete electric and hydraulic test from 0 to 100% design flow at the factory. All control devices including transmitters and all safety features shall be factory calibrated and tested.

3.03 VERIFICATION AND TESTING

Verify that the pumps and prime movers have been aligned according to manufacturers’ recommendations.

Test the system performance by verifying the operation of the pumps and system vs. the pump curves, alarms, controls, etc.

Contractor shall inform Owner 48 hours in advance of verification and testing so that Owner’s Construction and Physical Plant personnel may observe pump alignment, performance verifications, and testing of system performance, alarms and controls.

3.04 INSTRUCTIONS, START-UP, O&M, SPARES

Provide for the service of a competent factory-trained supervising agent from the pump package manufacturer to inspect the completed installation, start the system and acquaint the O & M operators of ACTREC/TMH with the proper operation and maintenance of the equipment.

Vendor to Quote for Required O & M Spares, Recommended Spare Parts List from OEM to be attached with bid

END OF SECTION