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**PROJECT: CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR  
HALL AT SRI HARMINDER SHAB, AMRITSAR**

**INDEX FOR, WATER SUPPLY PUMPS, DRAINAGE AND WATER TREATMENT  
SYSTEM**

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## **I) SPECIAL CONDITIONS OF CONTRACT**

### **1. PRECEDENCE**

These special conditions shall be read in conjunction with the General Conditions of Contract. In the event of conflict between them the more stringent of the conditions shall apply.

- a) The work shall conform to the Specifications unless otherwise specified in individual items.
- b) Where items are not covered under Technical Specifications, the work shall be performed as per the current I.S Code of Practice relevant to that work.
- c) Where items are not covered under paragraphs a. and b. then the work shall be performed as stipulated by the relevant Consultant, (Such instructions being arranged to be issued by the Client), whose decision shall be final and binding.

### **2. SCOPE OF WORK**

Without Restricting to the generality of the foregoing, the Water treatment & R. O. Plant installation shall include the following:-

- a) Supply, Installation, testing and commissioning of Hydropneumatic system and Water Supply Pumps
- b) Supply, Installation, testing and commissioning of Drainage and Sewage Pumps.
- c) Supply, Installation, testing and commissioning of Piping, Valves and Accessories. .
- d) Supply, Installation, testing and commissioning of Water Treatment Equipment..
- e) Supply, Installation, testing and commissioning of Complete R.O. system if provided.
- f) Electrical Work Related to Water Treatment Plant & R.O. System.
- g) Any other Items required completing the system installation & commissioning.

### **3. PROGRESS REPORTING**

The Contractor shall provide the Client with written reports on a weekly basis. Such reports shall include but not necessarily be limited to progress against the programme and any anticipated problems that may cause delays or disruption. A format for these reports shall be approved by the Client/Consultant prior to issue or reports.

### **4. TAXES - GENERAL**

The Contractor is deemed to have include for all Taxes associated with this work. This shall include but not necessarily be limited to works contract tax and any other duties, transport, octroi etc.

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## **5. INCOME TAX**

Owner shall deduct money as “Tax deducted at sources” (TDS) as per the current income tax laws and regulations from all payments to the Contractor.

## **6. INSURANCE**

The successful Contractor shall take out Contractors All Risk (CAR) insurance policy and other necessary policies in the name of the Contractor beneficiary M/s SHIROMANI GURDWARA PARBANDHAK COMMITTEE, AMRITSAR (SGPC) as per requirement. The original policies shall be deposited with the Owner.

PERIOD OF POLICIES: All Insurance mentioned above shall be kept alive during the contract period and upto the completion of defects liability period.

## **7. SUB CONTRACTS**

The Contractor shall not enter into any Sub-Contract without the knowledge & prior approval of the Client/Consultant representative. Such approval shall not be unreasonably withheld.

The Contractor shall require its Sub-Contractor where previously approved by the Client/Consultant representative – to agree in writing with the contractor to be bound to the contractor by the terms of the contract documents that apply to the Sub-Contractor's work, and to assume towards the contractor, all of the obligations and responsibilities that the contractor, by the contract documents assumes towards the Owner, Owner's representative and Services Consultants.

## **8. LIMITATIONS OF SPACE & FACILITIES TO BE PROVIDED**

Due to the constricted nature of the project, the following limitations are imposed :

- a. Prior to locating his Site Offices, Storage Facilities, Plant Locations, Bulk Materials Storage location on site, the contractor shall obtain approval of the Client for the location and extent of such facilities. Such approval shall not relieve contractor of any of his obligations under the contract. The contractor shall provide at his own cost, his site offices and maintain the offices on good condition and provide facilities and manpower for keeping the offices clean & hygienic.

Under no circumstances shall stacking/storage of construction materials, Plants, Equipment, surplus materials or rubbish be permitted within the immediate surroundings of the Owner's premises. If/when in violation, the contractor shall be held solely responsible for each and every cost associated with such violation and shall immediately upon the direction of the Client rectify the situation. Lack of any instruction by the Client shall not relieve contractor from entire responsibility for said remedial action.

- b. Contractor is advised that on site parking – other than legitimate construction traffic for loading/unloading purposes on the designated areas – shall be limited and must have the Client prior approval.

Contractor shall immediately remove any illegally parked on Site Company or private vehicles when required by Owner.

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**9. SECURITY**

Contractor shall be held entirely responsible for the security of the works and protection of the works at all times inclusive of non working hours. He shall be deemed to have included for all costs associated therewith.

**10. TEMPORARY POWER AND WATER**

One distribution point for temporary water at the tube well or the Municipal Supply tap-off location, and one point for electricity shall be provided by the Owner at ground level. However cost of electricity consumed shall be charged from individual contractor at actuals. Electricity will not be given free of cost by the Owner. Water, if supplied from the municipal connection shall be charged from individual contractors an actual basis. Necessary metering for power and water shall have to be arranged by the Contractor at his own cost.

Contractor, at his own cost, shall be responsible for all connections, pumps, pipes, storage facilities and all other things necessary to distribute and user services from these distribution points and as may be required for his work. Owner does not warrant sufficiency nor continuity of supply at these distribution points.

**11. TRESPASS**

Contractor shall ensure that none of the work force or their dependents trespass on surrounding areas owned by "others".

**12. SAFETY**

Contractor shall provide and maintain any and all temporary lighting, access-ways and/or safety precautions (such as guard rails, temporary coverings for holes in floors etc.) that are deemed necessary for the efficient and safe execution for the works. In the event of disagreement as to the type or extent of such temporary lighting, access way and/or safety precautions, the Client decision shall be final and binding. Lack of any direction or instruction by the Client shall not relieve/limit the Contractor's responsibilities and obligations under this clause. This clause shall enhance and compliment safety measures described under head safety measures of this document.

**13. HOISTING, TRANSPORTATION ETC.**

Contractor shall include for his own loading/unloading and hoisting of materials and equipment, own scaffolding, rigging and access equipment.

**14. MULTIPLE VISITS**

Contractor shall be deemed to have allowed for multiple visits to complete the work described.

**15. MAINTENANCE OF ROADS, ACCESS WAYS, TRAFFIC CONTROL**

Contractor shall be jointly responsible alongwith other contractors for maintaining public roads and private entrance roads presently under the control of the client, adjacent to the site, free from any materials of whatever nature being delivered to or removed from the site and in a generally clean and safe condition. With this in mind, Contractor shall ensure adequate traffic control at the entrance and agreed points of the site, both

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temporary and permanent and ensure no parking on public roads, pavements or lands adjacent.

**16. BOUNDARY WALL**

Contractor shall provide and maintain any and all temporary works he considers necessary to preserve the boundary of his stores at his own cost. Such cost should also include for shifting/re-fixing, as necessitated from time to time.

**17. GENERAL CLEANING & SECURITY**

General cleaning and security and also all specific requirements regarding cleaning and security shall be provided by the contractor. However, if the same is not carried out satisfactorily, the Owner shall arrange to carry out the same and charge the costs to various contractors at site on a prorata basis.

**18. ESCALATION**

No escalation shall be payable to contractor for fluctuation in market prices or any other reason whatsoever. The prices quoted by the contractor shall be deemed to be firm for this contract.

**19. PROTECTION OF OTHER CONTRACTOR'S WORKS AND SAFETY OF PERSONNEL AT SITE**

The contractor shall ensure at all times that during the execution of his work or during the operations and movements of equipment and supply equipment and machinery, no damage or injury is caused to the work or property or personnel or other system.

In case of any such loss or damage the contractor shall take full responsibility for same and shall bear all cost and expenses thereof. Also, the contractor shall be responsible and liable for all delays caused due to such damage and or injury and for the consequences which the other contractors and agencies may have to face or to which they may be subjected to or be accountable for as a result of such delays.

**20. SAFETY OF MATERIALS**

The contractor shall provide proper and adequate storage facilities to protect all the materials and equipment including those issued by the Owner against damage from any cause whatsoever.

**21. TOOLS, TACKLES, EQUIPMENT & SCAFFOLDING**

All tools, tackles & equipment necessary for the Water Treatment & R.O. installation and testing of works shall be provided by the contractor. The quoted rates shall take into account for providing any such equipment, which may not form part of the installation, but are necessary for the execution of the job. Contractor shall be responsible to make his own arrangement to provide scaffolding/supports etc. necessary for this work. However the contractor may use the civil contractor's scaffolding if available with prior understanding with the civil contractor.

**22. PLASTERING OF WALL CHASES/OPENING ETC.**

All chases and openings made by the contractor for his pipe lines shall be filled/covered over with cement plaster in reasonable manner.

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Before rough plastering on the pipe surface the concealed pipes shall be secured to the wall or using proper supports/clamps.

## **23. MANUFACTURERS**

Where manufacturers have furnished specific instruction relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

For items not covered under the 'List of Approved Makes' contractor shall offer items of first class make only and obtain the approval of Client/Services Consultant /PMC before procuring them.

Where interfacing occurs, equipment shall be mutually compatible in all respects.

## **24 RATING**

Rating of all items shall be appropriate for the conditions on the particular site on which the item will be used. All the equipment shall be fit for continuous work under the most severe ambient conditions at site.

## **25 INSPECTION AND TESTING**

The Client reserves the right to request inspection and testing at manufacturer's works at all reasonable times during installation for this contract. Tests on site of completed works shall demonstrate, among other things.

That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions and that all items operate efficiently and quietly to meet the specified requirements.

The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Client/Services Consultant /PMC and shall provide test certificates signed by a properly authorized person. Such test shall be conducted on all materials and equipment and on completed work as called for by the Client/Services Consultant.

If it is proved that the installation or part thereof is not satisfactorily carried out then the contractor shall be liable for the rectification and retesting of the same as called for by the Client/Services Consultant /PMC at the cost of the contractor. The Client/Services Consultant /PMC decision as to what constitutes a satisfactory test shall be final.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere. All tests shall be carried out by a test house approved by the Project Manager/Services Consultant.

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## **26. SAMPLES AND CATALOGUES**

Before ordering the material necessary for the installation, the contractor shall submit to the Client/Services Consultant /PMCfor approval, a sample of technical literature every kind of material.

Also contractor shall ensure that the dimensional details of the equipment fit into the allotted space provided in the building.

## **27. VENDOR AND SHOP DRAWINGS**

The contractor shall prepare and submit to the Client /Services Consultant for their approval four (4) sets of detailed layout drawings of Water Treatment & R.O. along with the design calculations.

Contractor shall prepare shop drawings incorporating the details given by manufacturers for the items included in his contract and also Owner supplied items and any other items which need to be coordinated with other contractors for interfacing.

Before starting the work, the contractor shall submit to the Client /Services Consultant for their approval in the prescribed manner, the shop/execution drawings for the entire installation.

The Client /Services Consultant, reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they do not offer the most satisfactory performance or accessibility for maintenance. Contractor shall supply in six (6) sets of all approved shop drawings for execution.

## **28. INSTRUCTION / MAINTENANCE MANUAL**

The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and the maintenance of the supplied equipment and installation, and submit to the Client /Services Consultant six (6) copies at the time of handing over. The manual shall generally consist of the following:

- a. Description of the Project.
- b. Operating instructions.
- c. Maintenance instructions including procedures for preventive maintenance.
- d. Manufacturers catalogues.
- e. Spare parts list.
- f. Trouble shooting charts.
- g. Drawings.
- h. Type and routine certificates of major items.
- i. One (1) set of reproducible "As Built Drawing".



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**29. GUARANTEE**

At the close of the work and before issuance of final certificate of virtual completion by the Client/Services Consultant, the contractor shall furnish written guarantee indemnifying the Owner against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to Owner, the following :

- a. Any defective work or material supplied by the contractor.
- b. Any material or equipment supplied by the Owner which is damaged or destroyed as a result of defective workmanship by the contractor.
- c. Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor.

**30. RATE ANALYSIS**

At anytime and at the request of the Client /Services Consultant, the contractors shall provide details or breakdown of costs and prices of any part or parts of the work.

**31. STAFF**

The contractor shall employ competent fully licensed qualified, full time engineers to direct the work of Water Treatment & R.O. installation in accordance with the drawings and specifications.

The engineers shall be available at all times at site to receive instructions from the Client, in the day to day activities throughout the duration of contract. The engineer shall correlate the progress of the work in conjunction with all the relevant requirement of the supply authority.

**32. DISPOSAL OF RUBBISH FROM THE WORKS AND THE SITE AND PROVISION OF SAFETY NETTINGS/SCREENS BY CONTRACTOR**

The contractor shall at all times keep the works and the site in clean, neat and tidy condition. All rubbish from the works and the site shall be collected and deposited in large bins provided on the site for such purpose by the contractor at his own cost. The rubbish from such bins shall be regularly carted away by the contractor to rubbish tips and dump yards beyond the site.

At no time or stage shall any rubbish be thrown over the edges of slabs or through any openings or shafts or ducts or stairwells.

**33. SPACE FOR CONTRACTOR'S CONSTRUCTION YARD, STORES ETC.**

The Owner shall provide adequate storage/office space to the contractor for his use. The space has to be maintained/constructed by the contractor as per his usage requirements.

All space allotted to the contractor, as described above shall be vacated and all structures removed from site at any time as and when required and directed by the relevant authorities or by the Owner, unconditionally and without any reservation. The authorities or the Owner will not be obliged to give any reason for such removal. Upon

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receiving instructions to vacate the space, the contractor shall immediately remove all his structures, materials etc., from the spaces and clear and clean-up the site to the satisfaction of the Client.

It shall be the specific responsibility of the contractor to safeguard the site and ensure that no illegal encroachments are made by outside elements within the area allocated to the contractor. Upon completion of the work or earlier as required by Owner/Authorities, the contractor shall vacate the land totally without any reservations. Necessary bond to this effect on a stamp paper shall be signed by the contractor in a prescribed form.

The performance bond and/or guarantees towards retention amount furnished by the contractor shall not be released until the spaces allotted to the contractor are fully vacated and handed over to the Owner as per the instructions of the Owner.

**34. PROFESSIONAL INTEGRITY AND TEAM SPIRIT**

It is the intent of the Owner, that this project shall be executed in a spirit of team and full professional integrity. Contractor is expected to co-operate with all the agencies involved in the project to fulfill this objective.

**35. MALPRACTICES**

The contractor shall not try to influence in any manner the employees, staff or anyone else of the Owner, and his Services Consultant by offering undue favours, monetary gains or any such illegal gratifications for any reason whatsoever. If it is established that the contractor has indulged in such activity, the Owner reserve the right to terminate the contract forthwith.

**36. LIST OF APPROVED MAKES.**

The contractor shall clearly indicate the list of makes proposed to be used by him & enclose the same with the tender.

**37. TRAINING TO OWNER'S STAFF**

Upon completion and commissioning of the works, the contractor shall make necessary arrangements to train the Owner's technical staff in operation, maintenance and trouble shooting of all the works installed by him. The training shall be for a period of atleast 2 weeks, 6 days a week, 8 hours per day or such period until the Client is fully satisfied that proper training has been provided. For this purpose the contractor shall engage specialist agency or agencies, if so desired by the Client.

All the costs for providing training to the Owner's staff shall be borne by the contractor without any extra cost implications to the Owner.

**38. AWARENESS OF SITE CONDITIONS AND CARRYING OUT OF SITE INSPECTION PRIOR TO TENDER SUBMISSION:**

Prior to the preparation and submission of his Tender, the Contractor shall make visits to the site and carry out all the necessary inspections and investigations in order to obtain all information and to make his own assessment of the conditions and constraints at site, including the means of access to it. The Contractor shall make himself aware of all the

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features of the site and the working conditions and space and shall, in general, be responsible for obtaining all the necessary and requisite information needed for him to prepare and submit his Tender.

Should the Contractor require any clarifications he shall seek these in writing from the Construction Manager before submitting his Tender. At no stage will any extra claims be entertained or allowed on any matter or for any reason arising from or as a consequence of the Contractor's failure to comply with all the requirements stipulated in this Clause

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**ANNEXURE-I TO SPECIAL CONDITIONS**  
**SUBMITTALS TO BE MADE BY THE CONTRACTOR**  
**DURING THE EXECUTION OF THE WORK**

1. Weekly progress report including number of men employed under each trade, equipment at site etc.
2. Fortnightly progress report showing progress against programme.
3. Programme of work for the forth coming week.
4. Labour and Equipment Deployed at site – Programmed requirement VS actual deployed – weekly.
5. Updated approved monthly PERT chart alongwith monthly progress chart – weekly.
6. Construction materials for the coming (next) month – monthly.
7. Owner supplied materials for the coming (next) month – monthly.
8. Reconciliation of Owner supplied materials – monthly.
9. Value of work anticipated to be done in the forth coming month including value of any materials/equipment of large value – monthly.

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## **II) TECHNICAL SPECIFICATIONS:**

### **A) WATER SUPPLY & DRAINAGE PUMPS:**

#### **1.0 SCOPE OF WORK:**

Work under this section shall consists of furnishing all labour, materials, equipment and appliances necessary and required to supply install and commission the water supply and drainage pumps as described hereinafter and given in the Bill of Quantities and/or shown on the drawings.

#### **2.0 GENERAL REQUIREMENTS:**

- 2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Project Manager.
- 2.2 All equipment shall be of the best available make manufactured by reputed firms.
- 2.3 All equipment shall be installed on suitable foundations, true to level and in a neat workmanlike manner.
- 2.4 Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.
- 2.5 Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.
- 2.6 Each pumping set shall be provided with a butterfly valve on the suction and delivery side and a slim type non return valve on the delivery side.
- 2.7 All delivery headers/hanging pipes within the pump house shall be floor supported.

#### **SPECIFICATION FOR PUMPS:**

#### **3.0 VARIABLE SPEED PUMPING SYSTEM FOR WATER SUPPLY SYSTEMS:**

- 3.1 Water supply pumping system for the building shall be fully automatic variable speed drive system, packaged skid mounted system with two vertical centrifugal pumping sets( All with VFD) and arranged in a manner to operate the entire system between pre-determined operating conditions specified. Pumps shall be protected against running dry by providing low level electronic cut off switch separately for system selected. The system will be provided with an integral programmable sequence controller so that each pumps operates sequentially and no single pump remains idle. The system will also be provided with stainless steel vessel of capacity as per manufacturer's recommendations with timing mechanism to ensure that each pump operates for a minimum period of one minute between two starts. Pumps shall have a pump head/efficiency curve to operate within the range given in the specifications. The pumps selected shall be suitable for continuous duty operating.
- 3.2 All systems offered will be complete packaged systems comprising of the pumps, stainless steel vessels, variable speed control systems, sensors, pressure gauges and switches.
- 3.3 Notwithstanding the descriptions, BOQ and drawings issued with the tender, offer for which system must be complete in all respects in ready to use condition. Contractor must include all items necessary and required, whether described in the specification, drawing and BOQ.

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#### **4.0 PUMPING SETS FOR RAW WATER TRANSFER PUMPS:**

- 4.1 Water supply pumps shall be suitable for clean filtered water. Pumps shall be single/multi stage, monobloc vertical/horizontal, centrifugal pumps with C.I body and bronze impeller, stainless steel shaft, mechanical seal and coupled to a TEFC electric motor. Each pump should be operate to a curve required by the operating conditions.
- 4.2 All parts in contact with water shall be corrosion resistant stainless steel DIN-Nr.1.4401.
- 4.3 Each pump shall be provided with a totally enclosed fan cooled induction motor of suitable H.P. The motors shall be suitable for 420 volts, 3 phase, 50 cycles A.C. power supply and shall conform to IS 325 operating at 1450 RPM nominal speed.
- 4.4 Each pumping set shall be provided with 100-mm dia gunmetal "Borden" type pressure gauge with gunmetal valve and connected piping.
- 4.5 Pump or the whole set shall be stable on rubber vibration eliminating pads appropriate for each pump as recommended by the manufacturer and accepted by the Project Managers.

#### **5.0 SUBMERSIBLE PUMPS:**

- 5.1 Submersible pumps for sewage/drainage shall be single stage, single entry pump. Pump shall be with dynamically balanced impeller connected to a common shaft to the motor. The vane for sewage pump will be open type, while for drainage pump, etc. It will be of semi open type.
- 5.2 Stuffing box shall be provided with mechanical seals.
- 5.3 Each pump shall be provided with water cooled squirrel cage induction motor suitable for 420 volts, 3 phase, 50 cycles A.C. power supply.
- 5.4 Each pump shall be provided with liquid level controller for operating the pump between predetermined levels. Operation of level controller shall be similar to as discussed in para 6.0 & 6.1 below.
- 5.5 The pumping set shall be for stationary application and shall be provided with pump connector in it. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation, without disturbing delivery pipe the pump unit shall have a back pull out design. A rust proof chain shall be provided for each pump.
- 5.6 Pump shall be provided with all accessories and devices necessary and required for the pump to make a complete working system.

#### **6.0 LEVEL CONTROLLERS:**

- 6.1 Level controllers shall be magnetic type using required number of stainless steel type probes, shrouded in PVC sheath or encapsulated in a stainless steel pipe.

#### **7.0 PIPE & FITTINGS (FOR HEADERS AND CONNECTIONS):**

- 7.1 Pump suction and delivery headers shall be galvanized iron pipes heavy class 'c' with matching fittings. The pipe joints shall be threaded as per manufacturer's instructions.

#### **7.2 Vibration Eliminators:**

Provide on all suction and delivery lines as shown on the drawings double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connectors shall be as per site requirements in accordance with manufacturer details.

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### 7.3 Valves :

#### 7.3.1 Butterfly Valves:

All valves 65 mm dia and above shall be C.I. slim seal butterfly valves or sluice valve. Butterfly valves shall be of best quality conforming to I.S. 13095 of class specified.

#### 7.4 Non-Return Valves (Check Valves) :

Non-return valves shall be cast iron dual plate type with cast iron body and gunmetal internal parts conforming to IS : 5312.

### 8.0 **PAINTING AND CLEANUP:**

- a) On completion of the installation contractor shall scrub clean all pumps, piping, filters and equipment and apply one coat of primer as required.
- b) Apply two or more coats of synthetic enamel paint of approved make and shade on steel pipes.
- c) Provide painted identification legend and direction arrows on all equipment and piping as directed by Project Manager.
- d) On final completion of the work, contractor shall cleanup the site Pump room of all surplus materials rubbish and leave the place in a broom-cleaned condition.

### 9.0 **MEASUREMENT:**

#### 9.1 General:

9.1.1 Unit rate for individual items, e.g. Pumps, MCC and level controller are for purposes of payments only. Piping, headers, valves, accessories, cabling and MCB to be measured separately in this contract only.

9.1.2 All items must include all accessories fittings as described in the specifications. BOQ and shown on the drawings.

#### 9.2 Water Supply Pumps:

Pumps shall be measured by sets and shall include all items as given in the specifications and Bill of Quantities to provide a complete working system.

#### 9.3 Drainage Pumps:

Drainage Pumps shall be measured by sets and shall include all items as given in the specifications and Bill of Quantities to provide a complete working system.

#### 9.4 Level Controllers and Alarms :

Level controllers for each set of pumps shall be measured by number and inclusive of probes, cabling unto surface box near the pump and shall include all items as given in the specifications and Bill of Quantities to provide a complete working system.

#### 9.5 Piping Work :

9.5.1 Suction and delivery headers for each pumping system shall be measured per linear meter of finished length and shall include all items as given in the Bill of Quantities. Painting shall be measured per linear meter.

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- 9.5.2 G.I. pipes between various equipment's shall be measured per linear meter of the finished length and shall include all fittings, flanges, jointing, clamps for fixing to walls or hangers and testing. Flanges shall include 3 mm thick insertion rubber gasket, nuts, bolts and testing.
- 9.5.3 Water tank, Vibration eliminators, "Y" strainers, butterfly valves, slim non return valves shall be measured by numbers and shall include all items as given in the Bill of Quantities and specifications.



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**B) WATER TREATMENT EQUIPMENT:**

**1.0 GENERAL REQUIREMENTS:**

- 1.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Project Manager.
- 1.2 All equipment shall be of the best available make manufactured by reputed firms.
- 1.3 All equipment shall be installed on suitable foundations, true to level and in a neat workman like manner.
- 1.4 Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.
- 1.5 Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.

**2.0 WATER FILTERS FOR DOMESTIC WATER SUPPLY:**

- 2.1 Water filter shall be designed in accordance with the code of unfired pressure vessel conforming to I.S. 2825.
- 2.2 Water filter shall be pressure dual media/activated carbon filter may be altered to suite contractor's own design of the most efficient performance.
- 2.3 Filters shall be vertical type of required diameter. The shell and dished ends shall be fabricated from M.S. sheet. Tank suitable to with stand a working pressure given in Bill of Quantities. The shell shall have a minimum thickness of 6 mm and dished ends 8 mm or as per manufactures recommendations.
- 2.4 Each filter shall have at least one pressure tight manhole cover for inspection and repairs.
- 2.5 Each filter shall be provided with screwed or flanged connections for inlet, outlet individual drain connections and all face piping, diaphragm valves and all other connections necessary and required.
- 2.6 Face piping shall be G.I. class 'C' as per IS : 1239.

**3.0 CHEMICAL DOSING PUMP:**

- 3.1 Chemical dosing system comprising of metering pump, 100 lts. Capacity HDPE solution tank with level gauge and lid on top.
- 3.2 Motor driven metering pump with mechanically activated diaphragm with oil lubricated gear mechanism. The output of the plug should be adjustable operation from 10-100%. Pump construction shall be corrosion resistant polypropylene or similar material dosing pump shall be used for :
- 3.3 Each pump shall be provided with an injector assembly with suction and delivery piping complete in all respects.

**4.0 WATER SOFTENER:**

- 4.1 Softeners shall be designed in accordance with the code of unfired pressure vessel conforming to I.S. 2825.

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- 4.2 Softeners shall be designed to give required hardness. Softener shall provided with suitable grade of Cation exchange resins in quantity to be indicated by the contractor at the time of tendering.
  - 4.3 Softener vessel shall be fabricated from MS sheet with dished ends and self supporting arrangement. Vessel shall be suitable for a working pressure given in bill of quantities. The shell shall have a minimum thickness of 6 mm and dished ends 8 mm or as per branded manufacturer.
  - 4.4 The vessel shall have an internal collecting and distribution system of manufacturer's design.
  - 4.5 Softener shall have a set of face piping for inlet, outlet brine injection with all valves. Suitable drain shall be provided. Pipes shall be GI class 'C'.
  - 4.6 One set of hydraulic injector with control valve, brine delivery pipes with adjustable indicating lamps.
  - 4.7 One cylindrical FRP saturator and mixing tank, provided with brine delivery piping with adjustable level indicating clamp and control valves complete. The tank shall be of capacity as given in the schedule of quantities.
  - 4.8 One orifice board for indicating wash and rinse rate to be filtered in drain sump.
  - 4.9 One charge of supporting gravel, sand and "Cation" resin in requisite quantity.
  - 4.10 One water testing kit with instructions for testing water samples.

#### **5.0 PIPE AND FITTINGS (FOR HEADERS AND CONNECTIONS):**

- 5.1 Pump suction and delivery headers shall be of approved corrosion resistant material with matching fittings. The pipe joints shall be threaded or as manufacturer's instructions.

#### **5.2 Valves :**

Valves 50 mm dia and above shall be rubber lined butterfly valves.

Non return valves shall be rubber lined cast iron slim type of approved make.

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**C) REVERSE OSMOSIS SYSTEM [R.O. SYSTEM]:**

**1.0 DESIGN PARAMETERS:**

The reverse osmosis plant shall be designed for a maximum of 20 hour operation cycle per day.

The water treatment system has been designed on the basis of raw water analysis report from the existing borewell. The raw water analysis of the borewell is enclosed in Appendix I.

Borewell water and municipal water shall be stored in the raw water storage tank. This raw water shall be supplied to the R.O. system. R.O. stream shall be installed output of capacity of 500 LPH treated water output as per detail given in BOQ. Treated water output shall be stored in potable water storage tanks (R.O. Water Storage Tank).

**2. AN ANALYSIS:**

Water Treatment System - Reverse Osmosis:

It is evident from the enclosed borewell water analysis report that raw water shall require Reverse Osmosis treatment for bringing the treated water to an acceptable Standard for various applications. Output water parameters desired after treatment from the plant are listed in Appendix-2.

Reverse Osmosis unit with battery of pretreatment & post treatment like ACF/Cartridge filters, dosing system etc have been designed, for 500 LPH.

**3. R.O. System Operation:**

i) Activated Carbon Filter :

Activated Carbon Filter is used to remove aromatic compounds (odour) dissolved organic compound (taste & colour) free chlorine etc. from the water. Activated Carbon Filter unit is provided for further filtration and removal of organics and residual chlorine which may be present in the filtered water. This is a MS vertical pressure vessel. Water from water transfer pump is passing through Activated Carbon Filter for removal of organic, colour, odor, free chlorine if any. Internally the unit is fitted with top distributor and header lateral type of bottom collecting system.

The unit is charged with granular Activated Carbon is supported on a layer of Silex and pebbles. The unit is isolated for back washing whenever pressure drop exceeds 0.8 Kg/cm<sup>2</sup>. General requirement of filtered water are:

Colour	<5NTU
Taste	Unobjectionable
Odour	Unobjectionable
Residual chlorine	≤ 0.2 PPM

iii) Anti-Scalent Dosing System :

The output water shall be dosed with sodium hexa meta phosphate solution in order to avoid any scale formation on the RO membrane. The hardness Salts are likely to be precipitated if concentration its solubility limit and it may foul the membranes resulting into sealing which ultimately leads to poor treated water quality from Reverse Osmosis system. To prevent this scale inhibitor dosing system shall be provided. A scale inhibitor is dosed in raw water. Dosage rate is usually 3-5 ppm. A HDPE chemical preparation tank with one No. of electronically operated diaphragm type of Dosing Pump is provided for this purpose.

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iv) Micron Filters :

Feed water passes through a cartridge filter where the fine suspended solids are removed in order to avoid R.O. membranes clogging.

To remove the fine particles up to 05 microns and reduce silt density index level to acceptable level.

v) High Pressure Pumps :

To feed the Reverse Osmosis Membrane at pressure more than the Osmotic Pressure taking into consideration flux rate, flow and recovery. Two No. (1 Works +1 Standby) of centrifugal vertical/multi stage type of pump in stainless steel construction is provided for feeding the water to R.O system at High Pressure of 8-10 Kg/cm<sup>2</sup>. Necessary instruments like High & Low pressure switch, pressure gauges & necessary valves are provided for this system.

Flow Rate	:	1500 LPH
Head	:	140 M

In order to safeguard the high pressure pump, a low pressure switch is provided at the suction of high pressure pump, which trips the high pressure pump in case of low feed pressure and also protect the high pressure pump from dry running. High pressure switch shall be provided to protect R.O. Pump from back pressure.

vi) R.O. Membrane :

The feed water after the high pressure pump passes through the reverse osmosis membranes. Reverse Osmosis membranes then removes most of the dissolved solids, bacteria, pyrogen, virus and organic substances. Two streams come out of the Reverse Osmosis System, one carrying the reject salts & other Impurities and the second one treated water free of dissolved salts and other Impurities.

The first stream is called reject stream, while the second stream is called the Permeate. In case of two stage system, the reject of stage one becomes the feed of the second stage. The final reject stream is throttled to increase the feed pressure of the membranes and is drained out on a continuous basis to a nearby drain. The Permeate from all membranes is collected in a common permeate header and is collected in a common permeate header and is collected in the permeate / treated water storage tank.

To remove the major part of TDS up to 99% by Reverse Osmosis Membrane's arranged and designed to give adequate flow and recovery. This system removes total dissolved solids by the principle of 'Reverse Osmosis Process' at the rejection rate of 97-98%. This system consists of a epoxy painted Structural Steel Skid for mounting of high pressure tubes with spiral wound membrane elements for each stream. Necessary control valves are provided with required instrumentation for operating & performing parameters.

Pressure gauges are provided for pressure indication and control of complete R.O system. An Online/Bypass type of Flow Indicator at product & brine pipe work are provided for controlling desired flow rate & recovery. For Monitoring product water quality an online Conductivity Indicator is provided.

vii) Ph Correction Dosing System:

The water from the outlet of R.O system has pH in the range of 6. It is necessary to raise pH & for this propose suitable pH correction dosing system (by dosing sodium hydroxide).

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One No. of HDPE chemical solution preparation tank and One no. of electronically operated diaphragm type dosing Pump is provided for this purpose.

viii) Chemical Cleaning System:

After prolong operation it is possible that reverse osmosis membranes may indicate certain fouling or scaling in terms of higher feed pressure required after the high pressure pump, or reduced permeate flow or higher TDS in the permeate water. In such eventuality it indicates that reverse osmosis membranes require chemical cleaning. A cleaning system consisting of a chemical tank and a pump is provided to clean the RO membranes. The cleaning chemicals and procedure is detailed in the operation and maintenance manual which will be provided along with the supply of the reverse osmosis plant.

This system is provided for the removal of any type of fouling occurring in R.O System. It consists of a HDPE chemical preparation tank, a Centrifugal Pump is SS construction & a separate Micron Cartridge Filter (5 Micron rating) with inter connecting pipe work & isolation valves. Necessary instruments like pressure gauge, flow indicator and a level indicator is provided.

Depending upon the chemical responsible for membrane fouling, the cleaning chemical solution is prepared.

This system consist of the following equipments:

4. **OUTPUT WATER QUANTITY:** - As per BOQ

5. **WATER TRANSFER PUMPS :**

- a) Water Supply Pumps shall be suitable for raw water (tube well water) as per site. Pumps shall be single or multistage, monobloc horizontal centrifugal pumps with S.S/cast iron body and S.S/bronze impeller, stainless steel shaft, mechanical seal and coupled to a TEFC electric motor.
- b) Pump and motor shall be mounted on a common M.S. structural base plate duly painted with antirust paint.
- c) Each pump shall be provided with a totally enclosed fan cooled induction motor of suitable H.P. The motors shall be suitable for  $415 \pm 10\%$  volts, 3 phase, 50 cycles A.C. power supply and shall conform to I.S. 325.
- d) Each pumping set shall be provided with a 150 mm dia gun metal "Bourdon" type pressure gauge with gunmetal isolation valve and connecting piping.
- e) Provide vibration eliminating pads appropriate for each pump.
- f) Flexible connection on the suction as well as the discharge side.

6. **GI PIPES, FITTINGS:**

- 6.1 All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to IS: 1239 of Class specified. When Class is not specified they shall be Heavy Class.
- 6.2.1 Fittings shall be of malleable cast iron galvanized of approved make. Each fitting shall have manufacturer's trade mark stamped on it. Fittings for G.I pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes etc. Fittings etc. shall conform to IS : 1879. (Part 1 to X) 1987.

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6.2.2 Pipes and fittings shall be jointed with screwed joints using Teflon tape suitable for water pipes. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. Necessary vents and drains shall be provided at all high and low points respectively.

6.2.3 Each pipe should pass through a M.S. sleeve/GI sleeve (hot dip galvanised) while crossing R.C.C.

6.3 CLAMPS :

G.I pipes in shafts and other locations shall be supported by G.I clamps of design approved by the Architect/Consultants. Pipes at ceiling level shall be supported on structural clamps fabricated from MS structurals. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

6.4 UNIONS :

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock or check valve and on straight runs as necessary at appropriate locations as required for easy dismantling and/ or as directed by Architect/Consultants.

6.5 FLANGES :

Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Architect/Consultants. Connections shall be made by the correct number and size of the GI nuts/ bolts as per relevant IS Standards and made with 3mm thick insertion rubber washer/ rubber gasket (Rubber gasket should be of Neoprene make with fibre reinforced). Bolt hole dia for flanges shall conform to match the specification for butterfly valve. Gaskets shall conform to IS:11149.

6.6 TRENCHES :

All G.I pipes below ground shall be laid in trenches with a minimum cover of 600mm. The width and depth of the trenches shall be as follows :-

<u>Dia of pipe</u>	<u>Width of trench</u>	<u>Depth of trench</u>
15mm to 50mm	300mm	750mm
65mm to 100mm	450mm	1000mm

6.7 SAND FILLING :

GI pipes in trenches shall be protected with fine sand 150mm all around before filling in the trenches.

6.8 PAINTING :

All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality to give an even shade. Pipes shall be painted to standard colour code specified by the Architect/Consultants.

6.9 PIPE PROTECTION :

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Where specified in the schedule of quantities all pipes in below ground shall be protected against corrosion covering with bitumen faced hesian for prevention of rust and to increase life.

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#### 6.12 PIPING INSTALLATION :

Tender drawings indicate schematically the size and location of pipes. The contractor on the award of the work, shall prepare detailed working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain valves and all pipe support, structural supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

- a. Piping shall be properly supported on or suspended from clamps, hangers as specified and as required. The contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency.
- b. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated back. Where pipe and clamps are of dissimilar materials a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

<u>Pipe Size</u>	<u>Spacing between Supports</u>
Upto 15 mm	1 500 mm
15 to 150 mm	2000 mm
150 mm & over	2500 mm

- c. All pipe work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work so that particular area work shall be carried out in one trench.
  - d. The contractor shall make sure that the clamps, steel structural supports, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes, and include expansion joints where required.
  - e. All pipes shall be accurately cut to the required sizes in accordance with relevant codes and burrs removed before laying. Open ends of the pipes shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.
- 6.13 All pipes, fittings and valves shall be tested in accordance with IS:2065 except as may be modified herein under. All pipes, fittings and valves, after fixing at site, shall be tested to a hydrostatic pressure of 1.5 times the working pressure for 8 hrs.
- 6.14 The test pressure shall be maintained for a period of at least 8 hrs. without any drop in pressure.
- 6.15 A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and the Architect/Consultants/Employer Representative.
- 6.16 After commissioning of the water supply system, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently and effectively. Valves which do not operate efficiently and effectively shall be replaced by new ones at no extra cost and the same shall be tested as above.



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- 6.17 All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

**7. BALL VALVES:**

All ball valves shall be heavy duty of approved make. Valves shall have suitable for test pressure of 25 Kg/Sqcm. Ball valves shall conform to the following specifications.

Size	Construction	Ends
15 to 50 mm	Bronze body S.S. Working Part	Screwed

**8. BUTTERFLY VALVE:**

All butterfly valves shall be heavy duty cast iron of approved make. The valves shall be suitable for 15 Kg/Sqcm test pressure & shall conform to the following specifications:

Size	Construction	Ends
65 mm and above	Cast iron	Flanged

**9. NON-RETURN VALVES:**

All non-return valves shall be provided as shown in the drawings conforming to relevant Indian Standards and in accordance with the following specifications.

Size	Construction	Ends
Upto 50 mm.	Gun metal	Screwed
65 mm and above	Gun metal/cast iron	Flanged

Non-return valves shall be of approved make.

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## **APPENDIX - 1**

### **WATER SOURCE :**

Ground water (Bore well water) is being considered as the source of water.

### **WATER ANALYSIS REPORT**

Water sample test report of the ground water source is tabulated below:-

<b><u>Parameter</u></b>		<b><u>Value</u></b>
1. pH	:	7.8
2. Total dissolved solids (TDS)	:	600 mg/l
3. Turbidity's	:	5.0 NTU
4. Chlorides (as Cl)	:	107.89 mg/l
5. Sulphates (as SO <sub>4</sub> )	:	5.76 mg/l
6. Iron (as FE)	:	0.03
7. Total hardness	:	300.0 mg/l
8. Fluorides (as F)	:	0.54 mg/l

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**APPENDIX - 2**

**EXPECTED OUTPUT WATER QUALITY :**

<b>S.NO</b>	<b>PARAMETER</b>	<b>VALUE</b>
1.	pH	6.5 - 8.5
2.	Total Hardness	<10 PPM
3.	Chlorides as Cl	< 10 PPM
4.	Total Dissolved Solids	< 30 PPM
5.	Fluorides	< 0.1 Mg/l
6.	Iron	< 0.1 Mg/l
7.	Turbidity	< 1 NTU

**Annexure –I**  
**INTERLOCKING SYSTEM**

	<b>INSTRUMENT</b>	<b>LOCATION</b>	<b>INTERLOCK WITH</b>	<b>CONDITION</b>
1	Level Switch – Low	Raw Water Tank	Feed Water Pump	Feed water pump should stop when level in tank is low.
2	Level Switch – High	Raw Water Tank	Raw Water Pump	Raw water pump should stop when level in tank is high.
3	ORP Meter	On RO Skid	Dump Valve	Valve should open when chlorine is detected in ORP Meter, till chlorine is available in water.
4	Low Pressure Switch	On RO Skid	High Pressure Pump	High Pressure Pump should stop when suction pressure is below recommended.
5	High Pressure Switch	On RO Skid	Feed Water Pump	Feed Water Pump should trip when feed pressure is more than recommended.
6	NaOCl Dosing Pump	Dosing Tanks	Feed Water Pump	Dosing pump should start/ stop with start/ stop of Feed Water Pump.
7	Antiscalant Dosing pump	Dosing Tanks	High Pressure Pump	Dosing pump should start/ stop with start/ stop of High Pressure Pump.
8	SMBS Dosing Pump	Dosing Tanks	Feed Water Pump	Dosing pump should start/ stop with start/ stop of Feed Water Pump.
9	pH Correction Pump	Dosing Tanks	High Pressure Pump	Dosing pump should start/ stop with start/ stop of High Pressure Pump.
10	Level Switch – High	Permeate Water Tank	Feed Water Pump	Feed Water Pump should stop when level in tank is high.
11	Level Switch – Low	Permeate Water Tank	Feed Water Pump	Feed Water Pump should stop when level in tank is low.

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## **D) ELECTRICAL INSTALLATIONS:**

### **1.0 GENERAL :**

This section covers the general requirements for electrical work to be installed under this specification.

The Contractor shall supply and install all electric wiring, switchgear etc., necessary for the complete, safe and satisfactory operation of the plant covered by the Specification. All electrical wiring and cables shall be properly tagged to the satisfaction of the Architect.

All equipment provided shall be 'tropicalized', i.e. designed for use in conditions up to 50°C ambient air temperature and 100% relative humidity.

All equipment, materials, workmanship and fittings shall comply with the appropriate Indian Standard or Code of Practice as listed in the relevant paragraphs of this Section, or any approved equivalent international standards.

### **2.0 ELECTRICAL SUPPLY :**

The electricity supply shall be 415/240 Volts, 50 Hz, 3 phase, 4 wire. All equipment shall be designed to operated with a  $\pm 10\%$  voltage tolerance without a loss of rated output.

All equipment shall be connected to ensure that the phases are balanced, to the requirements of the local supply authority.

### **3.0 SWITCHBOARDS AND SWITCHBOARD EQUIPMENT :**

#### **a) Motor Control Panel :**

Control panels shall be self-contained suitable for the location indicated and an operating environment of 50 degree C, built up of enclosed compartments conforming to form 3B as per BS 5486 Part-I : 1990 and IEC 439-1 to preclude fault transference between sections of the switchboard.

Control panels shall be arranged for the maximum safety of personnel. All power wiring and busbars shall be fully enclosed with isolating and insulating barriers and interlocks provided to ensure maximum safeguards. All switches shall be lockable in both of the 'OFF' or 'ON' positions.

Control panel shall be of the floor standing, type tested modular design, totally enclosed "dead front" type, consisting of dished front panels and doors built up on an approved substantial mild steel angle or channel frame with no cross-struts, and shall be fitted with removable rear and end panels held in position with six fixing points.

All panels and doors shall be constructed of best quality, dead-flat CRCA MS sheet not less than 2 mm thick. Neat cutouts shall be provided in dished panels to allow the exposure of circuit breaker escutcheons and toggles, and switch operating handles and indicators only. The edges of all outlets and drilled holes shall be burr free.

Doors shall be stiffened and provided with metal based neoprene gaskets and concealed non-ferrous door hinges. Door handles shall be chrome plated and incorporate a barrel type locking mechanism and shaft adjustment for increasing sealing pressure.

All switches/MCCB shall be provided with mechanical interlocks to prevent any positive access to any equipment inside the cubicle when the switch is in the 'ON' position.

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Dished panels shall be stiffened and held in place with chrome plated castle head nuts attached to fixed studs of not less than 10mm nominal diameter. All fixing hardware shall be cadmium plated.

The removable rear panels shall be provided with a pair of handles for easy fixing/removal of the panels.

Provision shall be made for lifting cubicle switchboards. Eye bolts shall not be used when subjected to shear stresses.

Adequate provision and space shall be provided for bending and connecting cables, which shall be separated from switchboard busbars.

All internal small wiring shall be PVC insulated, neatly, bunched and run on supporting cleats or in trunking, colour coded and labeled or sleeved for identification. All switchboard small wiring is to terminate on labeled terminal boards or strips to which external connections are made.

Insulators, including busbar supports, shall be non-hygroscopic and non-deteriorating. The use of fibrous materials, linseed oil, varnish, "Presspalin", etc is prohibited.

Low voltage switchboards shall be constructed to withstand a system fault level of 25 KA at 415 volts for 1 seconds. Low voltage switchboards shall be designed to comply IS : 13947-1993.

Type test certificates, issued by an reputable and independent testing authority such as CPRI certifying the circuit breaker, busbar and its enclosure shall be submitted for review.

Ventilating water-proof louvers are to be provided on the sides and back and are to be of approved design with internal dust baffles.

Where ventilating fans are installed, a low level, filtered air intake shall be provided. The filter shall be removable from outside the switchboard.

Current transformers shall be mounted without reduction of busbars or connections and arranged for ease of removal.

b) Wall Mounted Panel :

Wall mounted panels with an appropriate rating and number of circuits shall be provided to supply power to plant located throughout the building.

Panel enclosures are to be fabricated from CRCA sheet metal of minimum 2 mm thickness and finished in enamel of a colour to the approval of the Architect. Inside the enclosure door, a circuit chart indicating the number of ways, location of equipment, loading and protection rating shall be fixed.

All wiring terminations, busbars, and live parts within the panel board shall be adequately shrouded and an insulating front shield of minimum 1.6mm thickness shall be provided to completely screen the unit's interior. Only the operating dolly and insulated surround shall project through the shield.

The units are to be provided with sufficient wiring ways for outgoing circuits at both the top and bottom of the board. Space for future ways shall be provided.

c) Busbars :

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All busbars shall be made of hard drawn high conductivity aluminium. Conductor conforming to grade 91E of IS 5082-1981, making and arrangement of the busbars, connections and auxiliary wiring shall be to relevant Indian Standard. Bus bars shall be insulated with heat shrunk PVC sleaving of 1.1 KV grade and Bus bar joints shall be provided with clip on shrouds.

Busbars shall be adequately rated and supported by porcelain or moulded insulators spaced at suitable intervals, the complete assembly being capable of withstanding the maximum mechanical stress to which it may be subjected under fault conditions. Full size neutral bars shall be provided.

Busbars shall be so arranged that all conductors can be brought onto the bars without undue bending.

Conductors between the busbars and MCCBs or isolators are to be high conductivity aluminium bar having a current rating of not less than that of the switches to which they are connected. The conductors are to be insulated with PVC sheathing and colour coded for phase identification.

Removable bolted links shall be provided for the accommodation of current transformers for metering and protection facilities without affecting the mechanical and electrical properties of the busbars as a whole.

d) Moulded Case Circuit Breakers (MCCBs) :

All moulded case circuit breakers shall conform to IS : 13947-1993, and be of one approved manufacture throughout the project.

The body and base of the units are to be moulded and the units are to be sealed after assembly.

The load handling contacts are to be silver/tungsten and the contacts and operating mechanism so designed as to give a wiping action both at make and break.

The breaker operating mechanism is to be of the trip-free type so designed to prevent the load handling contacts from closing on a fault.

The toggle handle shall open and close all poles of a multipole circuit breaker simultaneously. A fault on one pole shall open all poles.

The MCCBs shall have the fault level rated as per schedule of quantities.

Circuit protection against overload and fault conditions is to be provided by means of a thermal-magnetic device designed to give thermal operation on overload and magnetic operation under fault conditions.

The position of the breaker operating dolly is to be clearly indicated for 'ON' and 'OFF'.

MCCBs shall be suitable for use at temperatures of 50°C Ambient.

e) Miniature Circuit Breaker :

Single pole or triple pole miniature circuit breakers (MCB) are to be used for sub-circuit protection.

All MCBs shall conform to IS : 8828-1996. The body and base of the units are to be moulded bakelite or similar material and the units are to be sealed after assembly.

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The load handling contacts are to be silver/tungsten, and the contacts and operating mechanism shall be so designed as to give a wiping action both at make and break.

The breaker operating mechanism is to be the trip free type. A thermal-magnetic time tripping mechanism is to be included for circuit protection against overload and short circuit. Short circuit level of MCBs shall not be less than 10 KA.

Tripping characteristics of MCBs shall be able to discriminate with up stream breakers.

f) Isolators :

All isolators whether mounted in a cubicle type switchboard or separately mounted shall be heavy duty type conforming to the requirements of IS : 13947-1993. All contacts are to be fully shrouded and are to have a breaking capacity on manual operation as required by British Standards.

Operation of switches shall be independent of the operator's control, with a quick make/quick break action.

The links for switch are to be high rupturing capacity.

The category of duty of the main switchboard, submain switches and cable tee-offs shall be as indicated in the schedules.

Switches and isolators mounted in cubicle type switch-boards are to be enclosed in separate sheet metal compartments, and mechanical interlocks are to be provided between the cubicle doors and the switch operating mechanisms, so arranged that the cubicle door may not be opened with the switch in the 'ON' position. Similarly it shall not be possible to close the switch with the cubicle door open, except that provision shall be made within the cubicle for authorized persons to defeat the mechanical interlock for test purposes, and close the switch with the door in the open position.

The 'ON' and 'OFF' positions of all switches and isolators shall be clearly indicated by a mechanical flag indicator or similar device.

In TPN switch units, bolted neutral links are to be fitted. For single pole and neutral switches and isolating switches, the neutral conductor is to be taken through a bolted link.

g) Contactors :

Contactors or control relays are to be single or triple pole, conforming to IS : 13947-1993 (part IV Section 3). The rating shall be as noted on the drawing but in any case, shall not be less than 10A or the rating of the circuit, whichever is the greater. All ratings shall be "continuous" and all contacts shall be silver plated. Contactor coils shall operate from the supply provided.

h) Measuring Instruments and Protection Relays :

All ammeters and voltmeters for use in conjunction with switch-gear are to be of the moving iron pattern to comply with relevant Indian Standard.

Unless otherwise specified, all meters are to be 96mm dial square flush pattern with quadrant scales.

Ammeters with scale deflections greater than 100A installed in the Switch Board shall indicate all phase and neutral currents.



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All ammeters shall have a continuous overload capability of 120% of the upper limit of the scale for two hours. Each ammeter shall be provided with an adjustable red index pointer to indicate the normal full load current.

Ammeters shall be provided for motors of 5.5KW or larger and they shall be capable of starting current and shall have a compressed overload scale for this purpose. Motor current reading shall be provided on one phase only.

Voltmeters shall be of accuracy Class 2 and have expanded scales.

Voltmeters shall be connected to the incoming side of the power supply through 6 ampere MCB's.

Mechanical zero adjustment shall be provided for voltmeters and ammeters by means of a screw slot at the face of the meters.

Energy and maximum demand meters shall be installed as specified. Energy meters shall provide a direct, single, digital reading, without the need to apply multiplication factors.

Earth fault and overcurrent protection relays shall be as specified in the drawings.

Current transformers for measurement and protection shall be of ring pattern, clamped on readily removable, bolted copper links with accessible terminals.

Selector switches of the rotary type shall be provided to enable all phase currents and all phase and phase to neutral voltages to be read.

Instrument MCB shall be mounted on the panel adjacent to their associated instruments.

All instrument and indicating lamp wiring behind hinged front panels shall be protected by clear acrylic sheets.

The arrangement, scale deflections and ratios of all instruments and relays shall be approved prior to assembly of the associated switchboard.

i) Labelling :

All items of equipment on the switchboard shall be labeled to indicate function with black Traffolyte labels and white engraved lettering securely fixed with chrome plated screws. Lettering shall be at least 10mm high. Labels to all switches , isolators and the like shall indicate the supply and cable details. All labels shall be approved prior to engraving.

The use of adhesive labels will not be permitted. All electrical equipment not mounted on the switchboard shall also be labeled as specified above.

j) Time Delays.

Time delays shall be provided to prevent the simultaneous starting of any two motors above 3.5 kW and to prevent short cycling of automatically controlled motors.

k) Control Switches.

All control switches shall be of the rotary type of approved manufacturer.

Each control switch shall be panel mounted and engraved to clearly indicate the equipment controlled or function of the switch.

l) Indicating Lamps. :

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Indicating lamps shall be individual flush mounted units. Lamps shall have chromium plated and polished solid brass body and ring with metallic threaded section and shall be circular in shape of approximately 22 mm diameter.

Indicating lamps shall be of 240/110 V and rated to withstand not less than 20% continuous over voltage.

Lamps shall be well ventilated and the design shall permit removal of lamp glasses and bulbs from the front of the unit without the need of any special tool.

A push button lamp test facility shall be provided for all switchboards.

Indicating lamps shall be colour coded as follows:

Green	-	Motor stopped, circuit breaker OFF.
Amber	-	Supply available.
White	-	Valve open, circuit breaker auto trip.
Red	-	Motor running, circuit breaker ON.
Blue	-	Valve closed.

Control circuit shall be of 240V supply.

m) Push Button Switches:

Push button switches shall comply with and be tested and certified to relevant Indian standard. Electrical rating shall be 500V AC or 250 V DC as appropriate. Push buttons for alarm duty shall be minimum of 2 amp rated Push buttons for control duty shall be 10 amp rated.

Push buttons shall be individual flush mounted units with metallic chromium plated and polished solid brass body and ring, circular in shape and approximately 20mm diameter.

Unless specified otherwise, push buttons shall be colour coded as follows :

Green	-	Start motor
White	-	Open valve
Red	-	Stop motor
Blue	-	Closed valve.
Black	-	Reset protection/alarm, lamp test
Yellow	-	Accept alarm

n) Earth System :

All metal work associated with the switchboard installation not forming part of a phase or neutral circuit shall be bonded together and shall be solidly and effectively earthed through the system provided by the Main Electrical Contractor. Continuous earth bus suitable to withstand prospective short circuit current shall be provided. Hinged doors shall be connected to earth through adequately sized flexible braids. It shall be the responsibility of this Contractor to ensure that adequate means of earthing are provided.

o) Cabling :

A cabling zone clear of busbars, switch and circuit breaker chambers shall be provided in such a manner to give minimum difficulty in connecting sub-main cables entering the switchboard for connection to switch units or circuit breakers. The cabling zone shall be fully isolated from any live metal part so that future cabling and alterations can be carried out in complete safety without the necessity of shutting down the complete switchboard.

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p) Terminal Blocks :

Terminal blocks for control wiring shall be rated not less than 20 amp and shall clamp the wire securely between two plates secured by a captive screw.

Terminal blocks shall have easily removable copper links to short circuit adjacent terminals or shall be fitted with suitable holders where required. Pinch screw type terminal blocks will not be acceptable.

Cables having the same number shall be terminated at adjacent terminals and connected by means of cable links at the terminal block. The incoming cable cores shall be terminated at the lower or outer side of the block, and the outgoing cable cores at the upper or inner side of the terminal block, and cable links on any free side.

Terminal blocks at different voltage, shall be segregated into groups, distinctively labeled and provided with permanent rigid barriers. Terminals in groups shall have separate non-combustible transparent plastic covers.

100% spare terminals shall be provided on each terminal block.

q) Wiring Diagrams :

Prepare construction layouts and functional wiring diagrams of all switchboards, which shall be reviewed prior to commencement of any work thereon.

The wiring diagrams shall show control circuits separate from main circuits and shall indicate the size of each conductor and the colour, number and/or terminal connection designation of each control conductor.

Switchboard drawings shall include a schedule of all equipment mounted therein, including make, model, and where applicable, fuse rating and set point of all variable adjusters.

Circuit diagrams shall be mounted near the switchboard in an approved location and shall be covered with either glass or clear Perspex sheet not less than 3mm thick.

r) General Requirements :

The Contractor shall ensure that the switchboards ordered can be accommodated (together with the control cubicles) in the space provided.

A rubber insulating mat shall be placed in front of the switchboard for its entire length.

#### **4.0 PVC INSULATED ARMoured COPPER CABLE :**

Cables of this type are to be 1100 volt grade complying to IS-1554-1998 with each conductor of the same cross sectional area.

PVC insulated and colour coded cores shall be sheathed with PVC which shall serve as a bedding for galvanized strip armouring. The armouring shall be covered with an outer PVC sheath.

Cables shall be terminated in a gland fitted with an armour clamp. The gland body shall be provided with an internal conical seating to receive the armour wires ensuring that the armour wires are tightly clamped between the armour cone and conical armour seating.

The minimum bending radius for power cables shall be twelve times the overall cable diameter.

When cables are run on a wall they shall be cleated at distances not exceeding 1 meter.

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## **5.0 PVC INSULATED ALUMINIUM CABLES :**

PVC insulated aluminium cables shall comply with IS:1554-1988 (Part I). Cables are to be 1100 volt grade depending on size.

## **6.0 WIRING :**

The current carrying capacity is to be in accordance with IEE Wiring Regulations and is to be limited by the allowable voltage drop.

All wiring shall be carried out on the loop-in system. For conduit wiring systems, wiring shall be drawn into the conduits after the whole of the conduit installation has been completed. No joints or connectors will be allowed in any such cables, except that connectors may be used in accessible positions within lighting fittings or device outlet boxes.

All cables shall be colour coded consistently over their entire length . Red, yellow and blue shall be used for phase conductor and black and green for neutral and earth respectively.

The maximum number of cables that may be accommodated in a given size of conduit, cable tray, trunking is not to exceed the number given in the Indian Standard.

Where wiring penetrates fire walls, then these shall be sealed using fire retardant pillows packed tightly on both sides of the penetration. Internal fire barriers within trunking shall also be provided. All fire retardant materials used shall be to the approval of the Architect and local authorities.

Floor penetrations for cable risers shall be made weatherproof progressively during construction to minimize damage due to the weather.

Where wiring penetrates vapour barriers, adequate air tight seals shall be provided. Wiring shall enter the low temperature area via conduit and the conduit itself shall be sealed internally to provide an airtight barrier within the conduit.

All wiring associated with equipment necessary for fire and smoke control shall be provided.

## **7.0 CONDUIT :**

All conduits shall be heavy gauge galvanized/black enameled ERW steel complying with relevant Indian Standard. No conduits shall be less than 25 mm nominal diameter.

Conduit shall be concealed in concrete as construction proceeds, and so arranged as to drain naturally to outlet boxes. Prior to laying, this Contractor shall check with the Contractor responsible for the building work that conduits of the sizes proposed will not affect the structural integrity of the concrete. Sealing caps shall be placed on all conduits before concrete pouring commences to ensure no water enters the conduit. Expansion couplings shall be fitted at all building expansion joints.

Surface conduits shall in no circumstances be fixed to floor slabs.

All conduit systems are to be installed fully in accordance with the requirements of the IEE Regulations.

All conduits shall be swabbed through to clean out all dirt, burrs and moisture.

All sets and bends in conduit runs are to be formed on site with bending machines. Distortion of conduits due to bending is not acceptable.

Runs between draw-in boxes are not to have more than two right angle bends or their equivalent and the length of such runs shall be limited to 12 m to permit easy drawing-in of cables.

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Flexible conduit shall be used for final connections to equipment subject to vibration.

The conduit shall be watertight with the provision of separate earth wire enclosed for earth continuity. All flexible steel conduit shall be PVC sheathed.

The contractor shall make good any damage to the finish of all conduits including threads cut at site, by painting damaged areas with two coats of aluminium primer paint.

Supply for review prior to installation conduit layout drawings for the entire installation. The approved set shall be kept upto date on site and on completion, three sets of record drawings shall be provided for record purposes.

#### **8.0 CONDUIT BOXES:**

All conduit junction boxes are to be malleable iron (surface mounted) or mild steel (concealed) and of standard pattern.

Standard pattern boxes are to be used with conduits up to and including 25 mm diameter. Rectangular pattern boxes are to be used for conduits of 25 mm diameter and larger. For the drawing-in of cables, standard pattern through boxes are to be used. All conduit boxes are to be galvanized finish.

Adaptor boxes are to be of galvanized zinc passivated mild steel not less than 3 mm thick. Boxes are to be not less than 5 mm deep and of such dimensions as will enable the largest size cable for which the conduit run is suitable to be drawn in without excessive bending of the cables. Covers of approved material with fixing screws are to be provided. All boxes are to be drilled for holes according to the conduit entries required.

All conduit entries to adaptor boxes, outlet boxes and switchgears are to be made with couplings and hexagonal male bushes.

The protective coating of the boxes shall be heavy both inside and outside.

#### **10.0 CABLE TRAYS:**

Cable trays are to be of a perforated pattern 1.6mm minimum mild steel with returned edges galvanized overall.

Trays shall be supported from the soffit of structural slabs and beams by mild steel rods not less than 6mm diameter and underslung mild steel angles, or alternatively, supported on steel angle brackets secured to walls. The former method shall be preferred where practicable. All supports and hangers shall be hot-dipped galvanized with bolts and nuts electroplated.

#### **11.0 MOTORS:**

All motors shall be of a type constructed to relevant Indian Standard.

Motors shall be selected to obtain the most suitable drive for the specified equipment, as recommended by the equipment manufacturers. Squirrel cage induction motors are preferred. Motors shall generally be three phase. Motors 1 KW or less may be single phase.

Ratings shall be based on continuous duty in the prescribed environment or an ambient temperature of 43 degree C whichever is the more demanding.

Motors in all cases shall be entirely suitable for the duty. A margin of not less than 10% shall be provided between the continuous rating of the motors (without overloading) and the maximum power absorbed by the item of equipment (as installed) under its most arduous operating condition, taking account of the characteristics of the driving machine. All motors up to 30 KW shall have full load efficiency of not less than 85% and power factor of not less than 85. Motors of

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rating greater than 30 KW shall have full load efficiency of not less than 90% and power factor of not less than 0.85.

Winding insulation and general construction of the motor casing, terminal block etc. shall be to Class F, allowing 80 degree C temperature rise above ambient, unless otherwise specified.

All motors shall have an isolating switch adjacent to and within sight of the motor. The switch shall be such that all conductors to the motor are isolated in one operation.

Motors up to and including 3.7 KW shall be fitted with ball bearings at both ends. Larger motors shall be fitted with roller or deep groove ball bearings. Motors operating with vertical shafts shall be equipped with bearings designed to counter unbalanced end thrust. Except where noted, motors shall have a synchronous speed not exceeding 1500 rpm.

Motors shall be mounted on a common bed plate with the driven machine wherever possible. The whole assembly shall be supported on vibration isolating material or springs to eliminate the transmission of noise and vibration into the structure. All holding down bolts required shall be supplied and fixed by this Contractor.

Each box shall be fitted with normal bottom or top cable entry. With exception of motors with ratings less than 1 KW, all boxes shall be capable of being turned to a further 3 positions, 90 degrees apart without affecting the terminal base or terminals. Standardise frame sizes for all applications so that the minimum practical number of motors need be carried as spares. Ensure that motors of different frame sizes spared by a single motor be provided with adaptor plates, oversize couplings, oversize terminal boxes, standard keyways etc to facilitate replacement.

Motors of a particular type or application shall be of the same manufacturer.

Motors above 7.5 KW shall be provided with suitably sized tinned brass cable sockets. The type of cable terminations shall be as shown on the drawings. Three phase motors shall be fitted with separate earthing terminals.

On all motors over 25 kg in weight, lifting eyes or lugs shall be supplied.

Unless specified otherwise, enclosures for motors shall be as follows :-

Hazardous areas	:	Flame proof
External	:	TEFC – Tropical
In forced air flow	:	TE non-fan cooled or TEFC
Areas subject to hosing	:	Hoseproof
All other areas	:	TEFC

All motors shall be provided with name plates. Motors shall have a maximum SPL of 85db(A) at 1 metre.

## **12.0 STARTERS:**

Contractors used in starters shall be of Class AC3 type provided with silver alloy contacts. Auxiliary contacts shall be provided to facilitate the connection of interlocks, status indication and auxiliary controls. Unless explicitly described, a minimum of one normally open and one normally closed contact shall be provided.

Each starter shall be completed with protection incorporating the following features :

- overload protection in each supply phase adjustable from 80 to 120% of full rated load.
- Manual reset
- Phase failure protection
- Ambient temperature compensation
- An auxiliary contact to signal an overload condition.

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Contactors or complete starters not mounted in switchboards shall be contained in metal or approved plastic enclosures with conduit entries, shrouded “stop” and “start” push buttons and a manual “reset” button, which may be combined with the “stop” button.

### **13.0 EARTHING:**

All metal work associated with the electrical installation but not forming part of a phase or neutral circuit shall be bonded together and solidly and effectively earthed.

Metal conduit, ducts and cable armour shall be earthed at the switch-board at which they originate by means of locknuts, screwed connection or cable gland.

The electrical resistance of metallic enclosures or framework to earth shall be low enough to permit the passage of current necessary to operate the device protecting the associated circuit.

The size of all earth continuity and bonding conductors shall be in accordance with the Local Regulations.

All earth conductors fixed or run outside the building shall be protected against corrosion and mechanical damage.

### **14.0 SPARES:**

The Contractor shall supply the following items as spares :-

- a) Any other spares as indicated in the Schedules.

### **15.0 MOTOR CONTROL CIRCUITS:**

For each motor provide the following :-

- a) On-off-auto test switch
- b) Blue power on light
- c) Green pilot light
- d) Red fault light
- e) Auxiliary contacts for remote stop-start.
- f) Auxiliary contacts for remote status indication.

(Items e and f to be connected to a labeled terminal strip in the switchboard).

### **17.0 ISOLATING SWITCHES :**

All items of equipment shall be provided with isolating switches adjacent to the item of equipment in an accessible position.

Isolators shall be capable of being padlocked in either the on, auto or off positions.

Isolators for motors and equipment which are essential for fire and smoke control shall be labelled as specified elsewhere and in addition a second label with white lettering on a red background reading :

**WARNING – ESSENTIAL FOR LIFE SAFETY**

Do not switch off except in absolute emergency shall be provided.

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E) **TECHNICAL DATA**  
( To be furnished with the Tender)

**1.0 RAW WATER PUMPS:**

Description:

Pump:

Quantity :

Make :

Model :

No. of Stages :

Power Requirement :

Efficiency (%) :

Pump Type

Capacity/ Discharge in l.p.s. :

Total Head :

Suction end I.D. :

Delivery end I.D. :

Material:

a) Body :

b) Impeller :

c) Shaft :

Type of impeller :

Is it suitable for direct coupling. :

Motor:

Make :

Model :

R.P.M :

Rating :

Over Load Capacity :

Class of Insulation :

Details of Additional  
protection in winding :



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Motor Efficiency (%)	:
Is it suitable for direct coupling to pump ?	:
Type of rotary movement	:
Size and type of cable for Connections	:

## **2.0 SOFT WATER TRANSFER PUMPS:**

### Description:

#### Pump:

Quantity	:
Make	:
Model	:
No. of Stages	:
Power Requirement	:
Efficiency (%)	:
Pump Type	:
Capacity/ Discharge in l.p.s.	:
Total Head	:
Suction end I.D.	:
Delivery end I.D.	:

#### Material:

a) Body	:
b) Impeller	:
c) Shaft	:
Type of impeller	:
Is it suitable for direct coupling.	:

#### Motor:

Make	:
Model	:
R.P.M	:

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Rating	:
Over Load Capacity	:
Class of Insulation	:
Details of Additional protection in winding	:
Motor Efficiency (%)	:
Is it suitable for direct coupling to pump ?	:
Type of rotary movement	:
Size and type of cable for Connections	:

### 3.0 SOST WATER LIFTING PUMPS:

#### Description:

#### Pump:

Quantity	:
Make	:
Model	:
No. of Stages	:
Power Requirement	:
Efficiency (%)	:
Pump Type	:
Capacity/ Discharge in l.p.s.	:
Total Head	:
Suction end I.D.	:
Delivery end I.D.	:

#### Material:

a) Body	:
b) Impeller	:
c) Shaft	:
Type of impeller	:
Is it suitable for direct coupling.	:

---

Motor:

Make	:
Model	:
R.P.M	:
Rating	:
Over Load Capacity	:
Class of Insulation	:
Details of Additional protection in winding	:
Motor Efficiency (%)	:
Is it suitable for direct coupling to pump ?	:
Type of rotary movement	:
Size and type of cable for Connections	:

**4.0 R.O WATER LIFTING PUMPS:**

Description:

Pump:

Quantity	:
Make	:
Model	:
No. of Stages	:
Power Requirement	:
Efficiency (%)	:
Pump Type	:
Capacity/ Discharge in l.p.s.	:
Total Head	:
Suction end I.D.	:
Delivery end I.D.	:

Material:

a) Body	:
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b) Impeller	:
c) Shaft	:
Type of impeller	:
Is it suitable for direct coupling.	:
<u>Motor:</u>	
Make	:
Model	:
R.P.M	:
Rating	:
Over Load Capacity	:
Class of Insulation	:
Details of Additional protection in winding	:
Motor Efficiency (%)	:
Is it suitable for direct coupling to pump ?	:
Type of rotary movement	:
Size and type of cable for Connections	:

## 5.0 TREATED WATER FEED PUMPS:

### Description:

#### Pump:

Quantity	:
Make	:
Model	:
No. of Stages	:
Power Requirement	:
Efficiency (%)	:
Pump Type	:
Capacity/ Discharge in l.p.s.	:

---

Total Head :

Suction end I.D. :

Delivery end I.D. :

Material:

a) Body :

b) Impeller :

c) Shaft :

Type of impeller :

Is it suitable for direct coupling. :

Motor:

Make :

Model :

R.PM :

Rating :

Over Load Capacity :

Class of Insulation :

Details of Additional  
protection in winding :

Motor Efficiency (%) :

Is it suitable for direct  
coupling to pump ? :

Type of rotary movement :

Size and type of cable for  
Connections :

**6.0 HYDROPNEUMATIC PUMPS:**

Quantity :

Pump :

Make :

Model :

Discharge in LPS :

Head (Meters of WC) :

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Efficiency (%)	:
No. of Stages	:
Suction End I.D.	:
Delivery End I.D.	:
Details of N.P.S.H.	:
Vibration Isolation Detail	:
Skid Details	:
Operating Weight	:
Overall Dimension (mm)	:
Mechanical Seal Detail	:

Material :

Body	:
Impeller	:
Type of Impeller	:
Shaft	:
Is it suitable for direct coupling	:

Motor :

Make	:
Model	:
Power Requirement (HP/KW)	:
R.P.M.	:
Rating	:
Over Load Capacity	:
Class of Insulation	:
Details of Additional protection In winding	:
Motor Efficiency (%)	:
Is it suitable for direct coupling to pump?	:
Type of rotary movement	:
Method of starting	:

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Size and type of cable for connections	:
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Pressure Vessel :

Make	:
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Model Number	:
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Material of construction (Vessel/Bladder)	:
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Dimension	:
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Overall capacity	:
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Cut-in/Cut-out setting	:
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Capacity at specified cut-in/cut-out	:
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Overall dimension of skid Mounted system	:
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Weight (Static/Dynamic)	:
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**7.0 DUAL MEDIA FILTER:**

Quantity	:
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Make	:
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Model	:
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Fluid Handled Type	:
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Control System	:
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Material of Construction	:
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Diameter	:
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Height on straight	:
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Filtering media	:
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Effective media size (mm)	:
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Media Uniformity Coefficient (U)	:
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Minimum Filtration Rate ( $\text{m}^3/\text{m}^2\text{-hr}$ )	:
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Maximum head losses (m)	:
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Service flow rate	:
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Minimum Working Pressure (Bar)	:
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Design pressure	:
Back wash duration	:
Back wash rate ( $\text{m}^3/\text{m}^2\text{-hr}$ )	:
Total time per one operating cycle(hr)	:
Pressure drop across the filter	:
Maximum inlet turbidity (NTU)	:
Turbidity in filtered water	:

**8.0 ACTIVATED CARBON FILTER:**

Quantity	:
Make	:
Model	:
Fluid Handled	:
Type	:
Filter Body Material	:
Minimum Working Pressure	:
Control System	:
Filtration rate ( $\text{m}^3/\text{hr}/\text{m}^2$ )	:
Regeneration rate ( $\text{m}^3/\text{hr}/\text{m}^2$ )	:
Time for regeneration (min)	:
Total time per one operating cycle(hr)	:
Minimum filtration rate ( $\text{m}^3/\text{hr}/\text{m}^2$ )	:
Maximum head loss	:
Basic wash rate ( $\text{m}^3/\text{m}^2\text{-hr}$ )	:
Time for back washing (min)	:
Total time per one operating cycle (hr)	:

**9.0 HIGH PRESSURE PUMP :**

a) Pump

Quantity	:
Make	:
Model	:



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Fluid Handled	:
Pump make	:
Type	:
Material of construction	:
Casing material	:
Impeller material	:
Shaft material	:
Service flow rate (m <sup>3</sup> /hr)	:
Total Head (m)	:
NPSH Details	:

b) Motor

Make	:
Model	:
Motor (kW)	:
Type of Motor	:
Starting current	:
Full load current	:
Speed of motor (RPM)	:

**10.0 REVERSE OSMOSIS MODULES:**

Membranes make	:
Material	:
Percentage recovery	:
Feed flow rate	:
Product flow rate	:
Reject flow rate	:
Feed Pressure	:
Tube material	:

**11.0 ANTI SCALENT DOSING SYSTEM:**

**A) PUMP:**

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Pump model	:
Pump Type	:
Make	:
Material of construction	:
Flow rate	:

**B) TANK:**

Capacity	:
Material of Construction	:

**12.0 CHLORINE DOSING SYSTEM:**

**A) PUMP**

Model	:
Pump type	:
Make	:
Material of Construction	:
Flow rate	:

**B) DOSING TANK:**

Duty	:
Capacity	:
Material of construction	:

**13.0 PH CORRECTION SYSTEM:**

**A) PUMP**

Model	:
Pump type	:
Make	:
Material of Construction	:
Flow rate	:

**B) DOSING TANK**

Duty	:
Capacity	:
Material of construction	:

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#### 14.0 CLEAN IN PLACE PUMP

Make	:
Capacity	:
Head	:
Type	:
Material of construction	:
Pump motor	:
Electrical supply	:
Motor Make	:

#### 15.0 SULPHIDE DOSING SYSTEM:

##### A) PUMP

Model	:
Pump type	:
Make	:
Material of Construction	:
Flow rate	:

##### B) DOSING TANK:

Duty	:
Capacity	:
Material of construction	:

#### 16.0 WATER SOFTENER :

##### Location :

Quantity	:
Item No.	:
Tag No.	:
Description	:
Quantity	:
Make	:
Model No.	:

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Rated Capacity	:
Flow Rate (cum/hr)	:
Input Water Hardness (PPM)	:
Output Water Hardness (PPM)	:
Quantity of Resin (Ltrs)	:
Salt Required per Generation (Kg)	:
Working Pressure (Kg/Sq.cm)	:
Test Pressure (Kg/Sq.cm)	:
Regeneration Cycle	:
Inlet Max Head (Kg/Sq.cm)	:
Regeneration	:

**Material of Construction**

Pressure Vessel	:
Pipes	:
Valves	:
MOC of Brine Tank	:
Capacity of Brine Tank (Ltrs)	:
Dimension of Brine Tank	:
Inlet Valve Size (mm)	:
Outlet Valve Size (mm)	:
Drain Valve Size (mm)	:
Working Height (Kg)	:

**17.0 SUMP PUMPS :**

Description:

Pump:

Quantity	:
Make	:
Model	:
No. of Stages	:

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Power Requirement :

Efficiency (%) :

Pump Type

Capacity/ Discharge in l.p.s. :

Total Head :

Suction end I.D. :

Delivery end I.D. :

Material:

a) Body :

b) Impeller :

c) Shaft :

Type of impeller :

Is it suitable for direct coupling. :

Motor:

Make :

Model :

R.P.M :

Rating :

Over Load Capacity :

Class of Insulation :

Details of Additional  
protection in winding :

Motor Efficiency (%) :

Is it suitable for direct  
coupling to pump ? :

Type of rotary movement :

Size and type of cable for  
Connections :

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## SCHEDULE # 1

### STARTER CONTROL SCHEME FOR PUMPS

S. NO.	DESCRIPTION
1	Auto/manual /test mode selector switch.
2	ON/OFF operation from Local/remote with selector switch.
3	ON/OFF/TRIP indication at local.
4	ON/OFF/TRIP indication at remote with potential free contacts.
5	Working/Standby selection.
6	Level controller with sufficient nos. of low/high level switches with electrodes and control wiring for the same for automatic operation of pumps to achieve the functional requirement shall be provided. Control wiring between the water level controller and the level switches shall not be paid separately.

### III) LIST OF APPROVED MAKES OF MATERIALS FOR WATER TREATMENT :

S.No.	MATERIAL	MAKES
1.	Hydropneumatic System	Grundfos/ D.P (Holland)/ Ebra
2.	Virable Frequency Drive(VFD) for Hydropneumatic system	Danfoss/ABB/Siemens
3.	Hydropneumatic System + RO High Pressure Pump/RO Water Feed Pump /CIP Pump	Grundfos/ITT-Lowara//DP Holland/ ebra
4.	FRP Pressure Sand Filter/Activated Carbon Filter /Iron Removal Filter	Ion exchange / thermax
5.	Water Softner	Ion exchange / thermax
6.	F.R.P Vessel	Pentair/Structural
7.	Resin	Thermax/ Doshi Ion Exchange/ Ion Exchange
8.	Water Supply Pumps	Groundfos/D.P./Ebra
9.	Sump Pumps (Sewage, Drainage & Storm Water)	Grundfos/ D.P (Holland)
10.	R.O High pressure feed pump.	Grundfos/ WILO / ITT-Lowara
11.	Dosing Pump	Asia LMI/Meter Pump (Italy)/Groundfos
12.	Motor	Kirloskar/ Siemens/ Crompton/ Marathom
13.	Flow Meter	B-Meter / Kranti/ Aster
14.	Conductivity Meter	VATS /Hanna (Italy)
15.	PH Meter	VATS/Hanna (Italy)
16.	R.O Membrane	DOW (USA)/Hydronautic (USA)/Koch
17.	RO Pressure Tube	Pentair Code Line/Equivalent
18.	Pressure Switch	Indfoss/ Potter
19.	G.I. Pipes /MS pipe	Tata /Jindal (Hissar)
20.	G.I. fittings (Heavy Duty)	Unik/ 'R' brand/Zoloto 'M'
21.	UPVC Pipe & Heavy Duty Fittings (Class 'IV')	Supreme/Prince/Finolex
22.	S.S. Pipe (304 & 316) & Fittings	Remi/ Ratnamani/ Viega
23.	Ball Valve	
a)	Forged Brass	Zoloto/ Tiemme
b)	S.S. Ball Valve	Audco/Shenco/Tiemme

S.No.	MATERIAL	MAKES
23.	Butterfly valves	Advance/ Adco
35.	Non return valve	Zoloto/ Leader/Advance
26.	Float Valve	Leader
27.	Foot Valve	Kirloskar/ Kalpana
28.	Expansion Joints/Vibration Eliminator	Resistoflex/ Kanwel
29	Pressure Gauges	Fiebig/ H Guru
30.	Level Controller	Femac
31.	Strainers	Emerald/Zoloto
32.	Air Vent Valve	Rapid Control
33.	Flanges	Class 150
34.	Electrical Panel	Adlec/Vidyut Control/ System Project Engineer
35.	Power Cables & Control Cables	Universal /Grandlay
36.	PVC insulated copper wires	Rajnigandha/Skytone/ Finolex
37.	Single phase preventor	L & T/ Siemens
38.	Thermal Relays	L & T/Alstom/ Siemens
34.	Lamps	L & T/ GE/ BCH/ Siemens
39.	Lugs	Dowell/Lotus
40.	Relays/Push buttons	L & T/Alstom/ Siemens
41.	Current Transformer/ Ammeter/Voltmeter	Kappa/ Automatic Electric
42.	Time delay relay/limit switch	Cutler Hammer/ L&T
43.	Controls	Honeywell/ Seimens/ Danfoss
44.	Electric Motors	Siemens/ Kirloskar/ Crompton
45.	Starters/Switches/Contractors	L & T/Siemens
46.	Annunciator/ level indicator	Minilac
47.	ACB/MCCB	L&T/ Merlin Gerin/ Siemens
48.	Miniature Circuit Breakers	L&T/ GE/ MDS/ Siemens
49.	Conduits	AKG / BEC/ Steel / Craft



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## VI) LIST OF DRAWINGS FOR WATER TREATMENT PLANT

S. No.	DRAWING TITLE	DRAWING NO.
1.	Basement Drainage Layout	W.T.P.-1
2	Plant Room Layout	W.T.P.-2
3	Schematic Diagram For Filtration	W.T.P.-3
4	Electrical SLD	W.T.P.-4

**PROJECT:CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR  
HALL AT SRI HARMINDER SHAB, AMRITSAR**

**SUMMARY OF COST FOR WATER SUPPLY PUMPS, DRAINAGE PUMPS  
AND WATER TREATMENT UNIT**

16-04-2018

<b>PART NO.</b>	<b>DESCRIPTION</b>	<b>AMOUNT (Rs.)</b>
1	HYDROPNEUMATIC SYSTEM	
2	WATER TREATMENT SYSTEM	
3	DRAINAGE PUMPS	
4	ELECTRICAL WORKS	
	<b>TOTAL</b>	

**PROJECT:CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR  
HALL AT SRI HARMINDER SHAB, AMRITSAR  
PART - 1  
BILL OF QUANTITIES FOR HYDROPNEUMATIC SYSTEM**

16-Apr-18

S. No.	Description	Unit	Qty	Rate	Amount
<b>A)</b>	<b>SUPPLY OF EQUIPMENT:</b>				
<b>1.0</b>	<b>VFD BASED HYDROPNEUMATIC SYSTEM:</b>				
	Supply, installation, Testing and commissioning of compact self contained Hydropneumatic system as follows.				
	Vertical In-line, Multistage , centrifugal pumps with SS-304 casing and impeller and SS -304, shaft, CI base & head TEFC motor 3 phase,2900 rpm as per IEC Norm, IP 55, Insulation class F, Low noise level. ( with mechanical seal)				
	All Pumps shall have individual VFDs along with Control Panel				
	450 Ltrs Pressure vessal of SS Make with Double Diaphram suitable for 10 bar pressure				
	Supply of complete skid mounted hydropneumatic system Complete with (Skid mounted/wall mounted /floor mounted) electrical control panel comprising of all accessories such as PLCs, pressure switches, pressure transducers, control wiring and any other necessary etc., compriisng of all pumps, pressure vessel, electrical control panel complete with all isolation valves, NRV, pressure gauge, suction and delivery header. (list to be provided by the vendor).				
	(Vendor to submit performance curves and technical catalog of the proposed model for review & information).				
	The pump shall be selected for performance at best efficiency point. However, the pump selection shall be suitable for performance with set point @ + 20% of the rated head.				
<b>1.1</b>	No of pumps : 3 Nos (2 w +1s ) Water Flow Rate ; 75 m3/hr (Each) Head : 70 M KW : 15 KW (Each) ( To be checked by Vender)	Set	1		
	<b>TOTAL</b>				

**PROJECT:CONSTRUCTION/EXTENSION OF GURU RAMDAS LANGAR  
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**PART-2  
BILL OF QUANTITIES FOR WATER TREATMENT SYSTEM**

16-Apr-18

S.NO.	DESCRIPTION	UNIT	QTY	RATE (Rs.)	AMOUNT (Rs.)
A)	<b>WATER SUPPLY PUMP &amp; WATER TREATMENT UNIT:</b>				
1.0	<b>PUMPS &amp; EQUIPMENTS FOR WATER SUPPLY:</b>				
	Supply, Installation, Testing and commessioning of following equipment with accessories complete as requires :				
1.1	<b>Horizontal Centrifugal water supply pumps (suitable for positive suction) consisting of the following: (Location: Plant Room).</b>				
	2 Nos. pumps (1 Working + 1 Standby) each pump shall have S.S 304 impeller, S.S. 304 shaft fitted with mechanical seal, C.I. connections, directly coupled with totally enclosed fan cooled [TEFC] induction motor 2900 RPM mounted over M.S fabricated base plate complete, including suitable vibration eleminations pads, pressure gauge with gun metal isolation cock. Each pump shall be suitable for automatic/manual operation. Each pump shall be suitable for 415 ± 10% volts, 3 phase, 50 Hz A.C supply & shall be having the following requirement:				
a)	<u>Filter Feed Pumps:-</u>				
i)	Flow rate (capacity) : 34 M <sup>3</sup> /Hr].				
ii)	Head : 35 Mtrs.				
iii)	RPM : 2900				
iv)	Motor KW : 7.5 KW				
v)	Quantity : 2.0 Nos ( 1W +1S)	Set	1		
vi)	Make : Grundfos/DP/Ebara				
2.0	<b>MULTIGRADE PRESSURE SAND FILTER :</b>				
2.1	Vertical self supporting dual media filter fabricated from MS sheet as per IS : 2825, pressure gauges at inlet & outlet, sample cock, GI class 'C' face piping, CI butterfly valves and all accessories, with initial charge of filter media for dual media filter, painting inside with epoxy paint and outside with two coat of red oxide primer and two or more coat of synthetic enamel paint of approved colour or as per engineer incharge complete in all respects.				
	Capacity - 34.0 m3/Hr				
	Filtration rate - 12000 lph/sqm				

S.NO.	DESCRIPTION	UNIT	QTY	RATE (Rs.)	AMOUNT (Rs.)
	Filter dia (approx.) - 2000 mm				
	Working pressure - 3.5 Kg/Sq.cm				
	Test pressure - 5.5 Kg/Sq.cm				
i)	Supply	Set	1		
ii)	Installation, testing & commissioning	Set	1		
3.0	<b>ACTIVATED CARBON FILTER :</b>				
3.1	Vertical self supporting Activated Carbon Filter (ACF) fabricated from MS sheet as per IS : 2825, pressure gauges at inlet & outlet, sample cock, GI class 'C' face piping, CI butterfly valves and all accessories, with initial charge of filter media for activated carbon filter, painting inside with epoxy paint and outside with two coat of synthetic enamel paint of approved colour or as per engineer in charge complete in all respects.				
	<b>Activated Carbon Filter for Domestic Water Supply System:-</b>				
	Capacity - 34.0 m3/Hr				
	Filtration rate - 10000 lph/sqm				
	Filter dia (approx.) - 2000 mm				
	Working pressure - 3.5 Kg/Sq.cm				
	Test pressure - 6.0 Kg/Sq.cm				
i)	Supply	Set	1		
ii)	Installation, testing & commissioning	Set	1		
4.0	<b>WATER SOFTENER :</b>				
4.1	MSRL Water softener fabricated from MS plate as per IS : 2825 (shell & thick dished ends) with inside rubber lined complete with initial charge of resins, GI class 'C' face piping, CI butterfly valves, pressure gauge, hydraulic brine injector with agitator and accessories, painted outside with two coat of red oxide primer and two or more coat of synthetic enamel paint, including suitable PVC/HDPE brine tank of 2 regeneration capacity complete with resins of approved quality and make.				
	<u>Hardness</u>				
	Inlet - 300 PPM				
	Outlet - 50 PPM				
	Incoming flow : 7.0 m3/hr				

S.NO.	DESCRIPTION	UNIT	QTY	RATE (Rs.)	AMOUNT (Rs.)
	Regeneration period : 1 hrs.				
	OBR : 56				
	Volume of resin Required : 644 kg.				
	Operating pressure : 3.5 Kg/Sq.cm				
	Test pressure : 6.0 Kg/Sq.cm				
	Suggested size : 700 mm dia x 1200mm (HOS)				
	Brine Tank size : 500 mm dia x 750 mm (HOS)				
	Supply	Set	1		
	Installation, testing & commissioning	Set	1		
5.0	<b>pH CORRECTION DOSING SYSTEM :</b>				
	Supply, installation, testing & commissioning of pH correction dosing system comprising of one No. HDPE (Chemical grade) of 100 liters capacity dosing tank having with a positive displacement diaphragm dosing pump having variable flow rate of 0-6 LPH to maintain the pH not less than 8.0. The motor shall be supplied complete with necessary polypropylene piping, valves, strainers lower level	Set	1		
6.0	Supplying complete testing kit with all chemicals complete suitable for conducting test on water quantity. The test kit shall be suitable for measuring, TDS, PH, hardness, iron content etc.	L.S	R.O.		
7.0	Providing, fixing, testing and commissioning of Electronic Level indicator including sensor, Display Panel, cabling and all fitting and accessories (For Underground Water Tank/Overhead Tank).	Set	R.O.		
	<b>PLANT ROOM PIPES :</b>				
8.0	Providing and fixing in position <b>GI pipes (heavy class 'C')</b> of approved make conforming to IS: 1239-1982 complete with GI fittings (heavy class 'C') conforming to IS: 1879 (Part I to X) such as tees, crosses, plugs, sockets, elbows, reducers, unions, flanges, sleeve pieces, check nuts etc. G.I clamps & hanger, structural steel supports as required/directed at site.				
a)	80 mm dia	RM	R.O.		
b)	100 mm dia	RM	30		
c)	125 mm dia	RM	2		
d)	150 mm dia	RM	4		
e)	200 mm dia	RM	R.O.		

S.NO.	DESCRIPTION	UNIT	QTY	RATE (Rs.)	AMOUNT (Rs.)
9.0	<b>Painting the exposed G.I pipe</b> with two coat of synthetic enamel paint of approved shade as per pips colour code over a coat of primer complete.				
a)	80 mm dia	RM	R.O.		
b)	100 mm dia	RM	30		
c)	125 mm dia	RM	2		
d)	150 mm dia	RM	4		
e)	200 mm dia	RM	R.O.		
10.0	Providing and fixing <b>G.I. Suction/delivery headers</b> conforming to heavy class including all flanged connection as per drawing/site requirement, supports from wall, floor and ceiling etc. including dead end flanged connection for pumps including all fittings & support (maximum length = 3.5 m).				
a)	100 mm	RM	5		
b)	125 mm	RM	2		
c)	150 mm	RM	4		
11.0	Providing and fixing <b>butterfly valve</b> , wafer end type class PN 1.0 as per IS:13095-1951, including rubber gasket, flanges, nuts, bolts, washers & painting complete as required.				
a)	100 mm dia	Each	11		
b)	125 mm dia	Each	2		
c)	150 mm dia	Each	1		
12.0	Providing and fixing <b>C.I dual plate non-return valve</b> tested to a pressure not less than 20 Kg/Sq.cm, including rubber gasket, flanges, union, nuts, bolts, washers & painting complete.				
a)	80 mm dia	Each	R.O.		
b)	100 mm dia	Each	2		
c)	125 mm dia	Each	R.O.		
d)	150 mm dia	Each	R.O.		
13.0	Providing and fixing gun metal <b>non return valves</b> vertical/horizontal tested to 20 Kg/Sq.cm as per IS 778				
a)	32 mm dia	Each	R.O.		
b)	40 mm dia	Each	R.O.		
c)	50 mm dia	Each	R.O.		

NARINDER SINGH COLSULTING ENGINEERS

S.NO.	DESCRIPTION	UNIT	QTY	RATE (Rs.)	AMOUNT (Rs.)
14.0	Providing and fixing C.I. Y type suction strainer with gunmetal or brass internal parts installed outside water.				
a)	65 mm dia	Each	R.O		
b)	80 mm dia	Each	1		
c)	125 mm dia	Each	2		
d)	150 mm dia	Each	2		
15.0	Providing and fixing <b>rubber expansion joints</b> with control unit (to provide relief from stresses at pipe flanges) as per specification of manufacturer.				
a)	65 mm nominal bore	Set	R.O.		
b)	80 mm nominal bore	Set	R.O.		
c)	100 mm nominal bore	Set	2		
d)	125 mm nominal bore	Set	2		
e)	150 mm nominal bore	Set	2		
	<b>TOTAL</b>				



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**PART - 3**

**BILL OF QUANTITIES FOR DRAINAGE PUMPS**

16-Apr-18

S. No.	Description	Unit	Qty	Rate	Amount
<b>A)</b>	<b>SUPPLY OF EQUIPMENT:</b>				
	<b>SUBMERSIBLE DRAINAGE SUMP PUMPS:</b>				
<b>1.0</b>	<b>Drainage Pumps :</b> Vendor to submit proposed pump model with duty curve. Submersible Centrifugal Non Clog Cutter Sewerage Pumps. Supply of continuous duty submersible centrifugal non-clogging sewerage pumps complete with 3 phase motor with all necessary protection and mechanical seal Including supply of automatic discharge coupling (ADC) without guide rail. Base frame or tripod where applicable shall be provided.				
<b>1.1</b>	<b>SUMP NO-1</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal KW : 2.2 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		
<b>1.1</b>	<b>SUMP NO-2</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		
<b>1.2</b>	<b>SUMP NO-3</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : Plant room- <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		

NARINDER SINGH COLSULTING ENGINEERS

S. No.	Description	Unit	Qty	Rate	Amount
1.2	<b>SUMP NO-4</b> Flow Rate : 8.64 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Bodv. C.I. impeller and S.S. shaft KW : 1.5 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		
1.2	<b>SUMP NO-5</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		
1.2	<b>SUMP NO-6</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal KW : 2.2 KW ( Ratings to be varified by the Vender)	Nos.	2 (1W+1S)		
	<b>TOTAL</b>				

S. No.	Description	Unit	Qty	Rate	Amount
<b>B)</b>	<b>INSTALLATION OF EQUIPMENT:</b>  Submersiable Centrifugal Non Clog Sewerage Pumps complete with 3 phase motor with all necessary protection and mechanical seal etc.  Receiving at site , unloading , starring , handling , hoisting, installation in position effective connection , anchoring , granting , testing and commissioning above equipment all complete with necessary indigenous accessories as required to complete the installation.  Supply installation testing and Commissioning of Suitable Electrical Starter panel including provision of interlocking and automatic operation of Pumps with pumps operation at various levels of controls and power wiring from the panel to equipment.				
1.1	<b>SUMP NO-1</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW	Nos.	2 (1W+1S)		
1.1	<b>SUMP NO-2</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW	Nos.	2 (1W+1S)		
1.2	<b>SUMP NO-3</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : Plant room- <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW	Nos.	2 (1W+1S)		
1.2	<b>SUMP NO-4</b> Flow Rate : 8.67 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 1.5 KW	Nos.	2 (1W+1S)		

S. No.	Description	Unit	Qty	Rate	Amount
1.2	<b>SUMP NO-5</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW	Nos.	2 (1W+1S)		
1.3	<b>SUMP NO-6</b> Flow Rate : 10.8 m3/Hr Head : 10-12 Mts Solid Handling : 10-15 MM Location : <b>Basement</b> Purpose : Disposal MOC : C.I. Body, C.I. impeller and S.S. shaft KW : 2.2 KW	Nos.	2 (1W+1S)		
	<b>TOTAL</b>				
<b>C)</b>	<b>SUPPLY &amp; INSTALLATION:</b>				
<b>1.0</b>	<b>Delivery Header and Interconnectivity Pipe for Sewage Pumps :</b>				
<b>1.1</b>	<b>G.I. Delivery Header :</b>  Supply, Installation, testing & commissioning of G.I. Suction / delivery header heavy duty (class 'C') including all flanged connections as per drawing / site requirement, support from wall floor and ceiling etc. including dead end flanged connection for pump including all fittings & supports, painting, civil breakage and making good the same. (Maximum length 5.0m) (For Sewage Submersible Pumps).				
a)	50 mm dia	RM.	R.O		
b)	65 mm dia	RM.	28		
c)	80 mm dia	RM.	85		
d)	100 mm dia	RM.	R.O		

S. No.	Description	Unit	Qty	Rate	Amount
<b>1.2</b>	<b>Ball Valve :</b>  Providing and fixing Ball valve with hard chrome plated ball inside PTEF (Teflon) seat & ring with chrome plated centre handle with female BSP threads complete in all respect.				
a)	25 mm dia	Each	R.O		
b)	32 mm dia	Each	R.O		
c)	40 mm dia	Each	R.O		
d)	50 mm dia	Each	R.O		
<b>1.3</b>	Providing and fixing C.I. Double acting air valve of approved quantity with bolts, nuts, rubber insertion tail pieces, tapers etc if required as complete.				
a)	25 mm dia	Sets	6		
<b>1.4</b>	<b>Non-Return Valve :</b>  Supply, installation, testing & commissioning of CI dual plate type non-return valve (PN 10) complete with 2 Nos. matching flanges, rubber insertion, nuts, bolts and washer etc. of following sizes with locking arrangement.				
a)	50 mm dia	Each	R.O		
b)	65 mm dia	Each	12		
c)	80 mm dia	Each	R.O		
d)	100 mm dia	Each	R.O		
<b>1.6</b>	<b>Butterfly Valve :</b>  Supply, installation, testing & commissioning of CI slim seal butterfly valves Class (PN 10) complete with 2 Nos. matching flanges rubber insertion, nuts, bolts and washer etc. of following sizes :-				
a)	50 mm dia	Each	R.O		
b)	65 mm dia	Each	12		
c)	80 mm dia	Each	R.O		
d)	100 mm dia	Each	R.O		
	<b>TOTAL OF "C"</b>				
	<b>TOTAL OF PART-3</b>				

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**PART - 4**

**BILL OF QUANTITIES FOR ELECTRICAL WORK**

16-Apr-18

S.NO.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
<b>1.0</b>	<b>ELECTRICAL:</b>				
<b>1.1</b>	<b>M.V. SWITCH GEARS &amp; DISTRIBUTION BOARDS:</b>				
<b>1.1.1</b>	<b>MCC / PANEL BOARDS:</b> Design, manufacture, supply installation, testing and commissioning of following MCCs / panels suitable for 415 V, 3 phase, 4 wire, 50 Hz power distribution system. The panel shall be suitable for Out-door installation in IP 65 protection, free standing, floor/wall mounting, sheet metal clad, cubicle, dead front, dust and vermin proof type compartmentalised design fabricated out of 14 SWG sheet steel, complete with aluminium bus bars, separate earth bus bar to be provided through out the length of the panel. The incoming and outgoing feeders shall be accommodated in a modular multitier arrangement, adequate size cable alley, painting, earthing, numbering, danger plate etc as required as per specifications . <b>PLUMBING PANEL</b> Comprising of the following: <b>Incoming:</b> One (1) no. 200A 35KA TPN MCCB. <b>Metering &amp; indication :</b> One (1) No. digital volt, current & Frequency (VAF) Meter with suitable ratio 15VA cast resin Cts and control MCBs One(1) set each of three (3) nos. phase indicating lamps with control MCB. <b>Busbars:</b> Electrolytic high conductivity Alluminium four pole busbars rated at 300 amps having a maximum current density of 1 amp per sq mm insulated with heat shrinkable PVC sleeves. <b>Outgoing:</b> One (1) no. 125A, 16 KA TPN MCCB. One (1) no. 100A, 16 KA TPN MCCB. Two (2) nos. 63A, 10 KA 4P MCB's 'C' curve type. Seven (7) nos. 32A, 10 KA 4P MCB's 'C' curve type. Vacant Space only for 4 nos. future 4P MCBs <b>Note:-</b> All MCCBs shall be provided with thermal magnetic protection releases for short circuit & overload protection. All MCCBs shall be (Ics=100% Icu) with 0.8 - 1 x In adjustable overload protection release. All MCCBs shall be provided with spreader terminals, phase barriers and rotary handle operating mechanism. Terminal blocks shall be provided for MCB feeders in cable alley.	Nos.	1		
<b>1.1.2</b>	<b>FILTER FEED PUMP STARTER PANEL</b> <b>Incoming :</b> One (1) No. 63A 4P MCB (10 KA) "C" curve type <b>Metering &amp; Indication :</b> One (1) No. digital volt, current & Frequency (VAF) Meter with 63A/5A CL 1.0, 15VA cast resin CTs and control MCBs. One (1) set of three (3) nos. phase indicating lamps with fuses.				

NARINDER SINGH CONSULTING ENGINEERS

S.NO.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
	<b>Busbars:</b> Electrolytic high conductivity Aluminium three pole and neutral busbars rated at 100 amps having a maximum current density of 1.0 amp per sq mm insulated with heat shrinkable PVC sleeves as shown in single line diagram. <b>Outgoings :</b> One (1) No.32A, 10 KA, 4P MCB 'C' curve type. One (1) No. 6A, 10 KA, DP MCB 'C' curve type. Two (2) nos. TP MPCBs suitable for 7.5KW Motor Two (2) nos. DOL starter (7.5KW) with auto/manual switch, over load relay, ON/OFF/TRIP indication lamps, ON/OFF push buttons, contactors suitable for auto/manual, remote/local operation, indication, Ammeter with selector switch and suitable ratio CTs etc. as required. Vacant Space only for 2 nos. future 4P MCBs. <b>Notes:</b> MPCB for starter feeders shall be provided with magnetic release only for short circuit protection. Starter shall have provision of controlling from three locations (i.e from MCC, near motor and remote). Starter shall have sufficient number of potential free contacts, aux. contactors etc. for Building Management system / PLC control, interlocking and for remote on/off/trip indications. The bidder shall select the ratings as per type -2 co ordination charts of the make to be used. All AHU starters shall be provided with one (1) no. 6A fuse with fuse base for control circuit. All MCBs shall be rated for motor duty.	Set	1		
1.3	Supply, installation, testing and commissioning of mushroom head "Emergency stop" push buttons with NC contact in sheet metal enclosure suitable for outdoor use. Push button shall have the feature Push to lock & turn to release.	Nos	R.O.		
1.4	Supply, installation, testing and commissioning of Start + Stop push button station with NO +NC contact in sheet metal enclosure suitable for outdoor use with start/stop marking.	Set	2		
2.0	<b>CABLES, SUB MAINS &amp; CABLE TRAYS:</b>				
2.1	<b>1.1 KV Cabling</b> Supply, installation, testing & commissioning of following sizes of PVC sheathed XLPE insulated Al/copper conductor power/muticore control ARMOURED cables of 1.1 KV grade on wall or in existing cable tray /masonry ducts/hume pipe with fixing hardware etc as required.				
2.1.1	<b><u>Aluminium Conductor armoured Cables :</u></b>				
a)	3.5 core 95 sqmm XLPE AL cable	RM	50		
b)	3.5 core 35 sqmm XLPE AL cable	RM	45		
2.1.2	<b><u>Copper Conductor armoured Cables :</u></b>				
a)	3 core 1.5 sqmm XLPE Cu cable	RM	60		
b)	3 core 2.5 sqmm XLPE Cu cable	RM	R.O.		
c)	3 core 4 sqmm XLPE Cu cable	RM	60		
d)	4 core 6 sqmm XLPE Cu cable	RM	300		
e)	4 core 10 sqmm XLPE Cu cable	RM	R.O.		
f)	4 core 16 sqmm XLPE Cu cable	RM	15		

NARINDER SINGH CONSULTING ENGINEERS

S.NO.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
2.2	Supply and making end termination with brass double compression glands for the following XLPE insulated PVC sheathed & armoured 1100 V grade cable including cost of crimping lugs/ferrules, compression glands, solder, cable sockets, insulation tape etc complete as required.				
2.2.1	<b>Aluminium Conductor armoured Cables :</b>				
a)	3.5 core 95 sqmm XLPE AL cable	Nos.	2		
b)	3.5 core 35 sqmm XLPE AL cable	Nos.	2		
2.2.2	<b>Copper Conductor armoured Cables :</b>				
a)	3 core 1.5 sqmm XLPE Cu cable	Nos.	4		
b)	3 core 2.5 sqmm XLPE Cu cable	Nos.	R.O.		
c)	3 core 4 sqmm XLPE Cu cable	Nos.	4		
d)	4 core 6 sqmm XLPE Cu cable	Nos.	12		
e)	4 core 10 sqmm XLPE Cu cable	Nos.	R.O.		
f)	4 core 16 sqmm XLPE Cu cable	Nos.	2		
2.3	<b>Cable Trays :</b> Supply and installation of ladder type/perforated type cable trays of the following sizes fabricated out of perforated hot dip galvanised MS sheets of minimum 2 mm thick with 75 mm flange to be installed horizontally or vertically. The cable tray shall be complete including cost of bends, elbows, cross, tees, reducers etc as per drawings/site condition and rate shall include cost of anchor fasteners, screws, nuts, bolts and misc. other fixing hardware painting of support structure etc as required. <b>Note :</b> i) Structural steel such as ISMC, ISA, flats, rods etc to be used for cable tray/bus duct support shall be included in the cost of tray. ii) The cable tray shall be factory built. Bidder shall include in his price, required numbers of Tees, Crosses, Bends, Elbows etc as required as per actual site conditions. Bidder may refer to the drawings for estimation purpose. <b>Perforated Type Cable Tray :</b>				
a)	450 mm x 40 x 40 x 2 mm thick	RM	RO		
b)	300 mm x 40 x 40 x 2 mm thick	RM	50		
c)	150 mm x 25 x 25 x 2 mm thick	RM	50		
d)	75 mm x 25 x 25 x 2 mm thick	RM	60		
2.4	<b>Cable Tray Support Structure :</b> Supply, fabrication and installation of cable support structure as per drawings/specification/ site requirement and the direction of Project manager/Consultant comprising of ISMCs, ISA's flats rods, turnbuckles etc for supporting cable trays in multitier formation. The rate shall include painting with 2 primer coats of red oxide and two finishing coats of approved enameled paint.				
		Kg.	750		
3	<b>EARTHING :</b> Supply, installation, testing & commissioning of following sizes of GI strip/wire clamped to wall, cable trays complete as required including inter connection between lengths at joints, all fixing accessories saddles, clamps etc. and other fixing hardware material as required for proper installation.				
a)	25 x 3 mm strip	RM	100		
b)	8 SWG wire	RM	RO		
c)	10 SWG wire	RM	500		
	<b>TOTAL OF ELECTRICAL WORKS CARRIED OVER TO SUMMARY</b>	<b>Rs.</b>			