

2019

PROPOSED HOTEL CLARKS - JAIPUR

TENDER DOCUMENTS FOR HOT WATER GENERATOR, WATER TREATMENT PLANT AND PUMPING MACHINERY SYSTEM

ARCHITECT

ARCHITECT NEERAV GUPTA,

L-1, KRISHNA MARG, C-SCHEME,

JAIPUR, RAJASTHAN

MEP Consultant

SAN ENGINEERS & CONSULTANTS

G-2, 10/55, SECTOR-10, CHITRAKOOT SCHEME,
JAIPUR, RAJASTHAN.

E-mail:- info@sanecpl.com



SUBHEAD : Supplying, Installing, Testing and Commissioning of Hot Water Generation System

SPECIAL CONDITIONS

1. The prices quoted shall be inclusive of excise, all taxes, VAT, works contract tax, service tax, freight, octroi etc.
2. The Owner has the right to delete any item from the scope of this contract.
3. The quantities as given in the Bill of Quantities are tentative. These can be increased or decreased as per the actual requirement at site.
4. Tenderer can quote for any additional item, which he thinks is required for successful operation of the machinery being offered by him
5. The contractor shall submit the **shop drawings** of the complete installation for the Consultant's approval with in 7 days of the award of the contract. The shop drawings shall give sufficient information for the required civil work to be done by other agency. The Contractor shall also submit the single line diagram (SLD) and the fabrication drawings of the pump control panels.
6. The contractor shall be responsible for the proper functioning of the **Hot Water Generation System** in terms of its performance.
7. **Statutory Approvals:** The Contractor shall be responsible for obtaining all statutory approval from the concerned department like Municipal Corporation, Pollution Control Board, Irrigation Department etc
8. Any equipment/item having any manufacturing defect shall be replaced free of cost.
9. The Contractor shall hand over all the catalogues, performance curves and warranty cards of the equipment supplied to the Owner.
10. The Contractor shall clean the site thoroughly of all rubbish/malba left out of his materials on completion of the work and dress the site to the satisfaction of the Owner at his own cost.
11. **Electricity & Water :** Electricity and water will be provided at site by the Owner. However, the Contractor shall make temporary arrangement on his own for tapping off from the nearest available distribution point.
12. **Site Conditions :** Before submitting the proposal/offer the tenderer must carefully consider the site constraints, as mentioned in the Section-C of Scope of Work.
13. **The offer shall have the following enclosures :**
 - a) List of similar projects undertaken in recent past
 - b) A technical note on the proposed system
 - c) System diagram
 - d) Details of the required electric load — installed as well as operational.
 - e) Operational and maintenance cost
 - f) Details of Civil Work required (in terms of sizes and volume)

**SUBHEAD : Supplying, Installing, Testing and Commissioning of Hot Water
Generation System**

SCOPE OF WORK

SECTION A: TURNKEY NATURE OF PROJECT:

This Contract is for execution of Hot Water Generation Systems on '**Turnkey Basis**', which shall include but not limited to the following :

a) Designing

Designing shall essentially include but not limited to the following :

- i) Preparation of general arrangement drawing with sufficient information for the Structural Engineering Consultant to design the structure of various components.
- ii) Selection of all mechanical and electrical equipment like boilers, heat exchanger, pumps, pipes, valves and other appurtenances, switchgear, cables etc.
- iii) Preparation of detailed engineering drawings

b) Supply and Installation of Mechanical & Electrical Equipment like Hot Water Generators (Non-IBR Type), Solar Water Heating System, Hot Water Storage Tank, Heat Exchanger, Day Oil Tank, Hot Water Circulators, Pipes, Valves and other appurtenances, etc. as generally described in Section C and of makes as mentioned in Section B of Scope of Work.

IMPORTANT NOTES

- i) It is understood that this Contract includes supply, installation, testing and commissioning of all the equipment, components etc. whether explicitly mentioned above or not for the successful commissioning of the Hot Water Generation System as per the parameters mentioned herein.
- ii) The tenderer must clearly indicate the material of construction, performance parameters, sizes etc of each equipment being offered by him.
- iii) Hot Water Generation is to be placed at terrace
- iv) The Civil Work like construction equipment foundations etc. is not included in the Scope of this work. However, the Contractor will have to provide complete details regarding the requirements of Civil Works, so that these can be executed by a separate agency.

- c) **Pipework :**
 - (i) All interconnecting pipework within the plant room.
 - (ii) Interconnection pipework with solar heating system
- d) **Electrical Works :** Control panel with starters, all interconnecting power and control cabling for hot water generators, pumps etc. from control panel to respective motors and drives, interlocking of fuel pumps, feed pumps etc.
- e) **Testing and commissioning of the Hot Water Generation Systems and pipework.**
- f) **Training the personnel of the Employer for operation and maintenance of the plant.**
- g) **Maintenance of the plant for 12 months commencing immediately after the commissioning.**

SECTION-B. LIST OF APPROVED MAKES/MANUFACTURES OF MATERIALS**NOTE :**

- i) All Brand Names/Manufacturers are Indian unless specified otherwise.

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
A) Plant & Equipment		
1.	Heat Pump	a) Daikin b) Raycold c) Smith
3.	Hot Water Recirculation Pumps	a) Grundfos b) ITT-lowara c) Wilo
4.	Plate Type Heat Exchanger	a) Alfa Laval b) GEA Ecoflux
5.	Mixing Tank	Custom Built fabricated as per IS:2828
6.	Solar Water Heating System	a) Solahart b) Honeywell
B) Pipes and Fittings		
1.	Mild Steel Pipes	a) Tata b) Jindal, Hissar
2.	G.I. Pipes	a) Tata b) Jindal, Hissar
3.	S. S. Pipes	a) Chockesy b) Décora b) Rattan Mani
4.	Standard M.S. Fittings	a) VS Engineering b) True Forge

c) Sant

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
5.	Forged Steel Fittings	a) VS Engineering b) JK Forging c) True Forge
6.	S. S. Fittings (Investment Casting)	a) H.S. b) Interfeed
7.	Galvanized Malleable Cast Iron Fittings	a) Unik Brand/Zoloto
C)	Valves & Other Appurtenances	
1.	Butterfly Valves	a) Audco b) KSB c) Danfoss
2.	Cast Steel Ball Valves	a) Zoloto, b) RB, Italy c) CIM, Italy
3.	Cast Steel Globe Valves	a) Sant b) Zoloto
4.	Globe Valves	a) Audco
5.	Dual Plate Check Valves	a) Advance
6.	T/Y Strainer	a) Leader b) Sant c) Zoloto
7.	Plug Valve	a) Audco
8.	Solenoid Valves	a) Rotex b) Festo c) Asco
9.	3 Way Valve	a) Rapid Cool b) Honeywell c) Danfoss d) Siemens

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
10.	Balancing Valve	a) Sant b) Advanc
11.	Temperature Controller	a) Vama Tafag
12.	Pressure Gauges	a) H. Guru b) Fiebig
13.	Temperature Gauges	a) H. Guru b) Fiebig
D)	Insulation	
1.	Liquid Resin Bonded Glass Wool	a) Lloyd Insulation
2.	Synthetic Polymeric Nitrile Rubber Compound Insulation	a) Armaflex b) Kaiflex
E)	Electric Switch Gear and Starters	
1.	Electric Switch Gear	a) Siemens b) L & T c) GE d) ABB e) Merlin Gerin f) Legrand
2.	PVC Insulated Armoured Power and Control Cables	a) Gloster b) Poly cab d) Havell's
3.	MCCB	a) L & T b) Merlin Gerin c) ABB d) Legrand
4.	MCB	a) ABB b) Merlin Gerin c) Legrand- Lexic Series

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
5.	Starters, Relays etc.	a) L & T b) ABB c) Control& Switch Gear
6.	Push button and indication lights	a) L & T b) Siemens c) Telemenaque d) Vaishno e) BCH
7.	Digital Voltmeter & Ammeter	a) AE b) Cadel c) Enercon
8.	Selector Switches	a) L & T b) Keycell c) Salzar
9.	HRC Control Fuses	a) L & T b) GE c) Siemens

HOT WATER GENERATION – CLARKS-JAIPUR

The hot water shall be generated according to the following calculations:

Hot water requirement, storage and generation capacity:

S. No	Usage	Average Consumption (Litres / day)
1.	Guest rooms with showers - per guest- <u>Hot water requirement for guest rooms considered as 60 ltrs. per guest per day..(2 guest per room)</u> for 32 Guests	90 2880
2.	Kitchen - per meal- <u>Hot Water Requirement for Kitchen considered as 6 litres per meal.</u> For 32 x 3 + 24 x 1.5 = 132 meals	6 792
3.	Staff - per member - <u>Hot Water Requirement for Staff considered as 9 liters per staff member per.</u> for 24 staff members	9 216
TOTAL		3888 Say 4000 litre per day

Hot Water Generation Rate:

Temperature of inlet water (assumed)	=	10° C
Temperature of hot water required	=	60°C
Average hot water requirement	=	4000 / 20
	=	200 liters / hour
Peak hourly hot water requirement	=	1/4 th of daily requirement
	=	1/4 x 4000
	=	1000 liters / hour

Hot water generation capacity to raise the temperature of 1000 liters of water by 50 °C in one hour

$$\begin{aligned} &= 1000 \times 50 \\ &= \mathbf{50000 \text{ K.Cal / hour}} \end{aligned}$$

Requirement of Hot Water For Space Heating:

Not Considered

Total heating requirement = 50000 K.cal/Hr.

It is proposed to install two nos. of mixing tanks so that if one goes under maintenance, then 75% load shall be catered by the other.

PROJECT : CLARKS-JAIPUR						
SUBHEAD : SUPPLYING, INSTALLING, TESTING AND COMMISSIONING OF HOT WATER						
GENERATION SYSTEM						
BILL OF QUANTITIES						
S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
1.0		HOT WATER GENERATORS AND OTHER ALLIED EQUIPMENTS.				
1.1						
		Supplying, Installing, testing and commissioning of air cooled type Heat Pump System capable of operation on a multimode basis; i.e. on air to water basis and ambient air to water basis. The switch over from one mode to other should be on auto basis. The Heat Pump System should be based on a closed circuit primary hot water flow of 60 °C out of the unit with 55 °C return for normal operation pattern. The Heat Pump System should however be designed for a limit of 65 °C out and 60 °C return. A suitable expansion vessel arrangement should be provided for based on primary flow hold up capacity and free cooling shall be dispose off in plant room, compressor having scroll type including grundfoss make pump.				
		Refrigerent				
		R-134a/417a				
		Output Heating capacity - 40 KW				
		(Input KW not more than 14KW)				
		Heat Pump(air cooled type) as described above	2	Nos.		
1.2		Supplying, installing, testing & commissioning of Hot Water Mixing Tank , fabricated as per IS:2825 — Code for Unfired Pressure Vessels and as per the following requirements :				
	i)	Shell: Shell fabricated with Boiler Grade Mild Steel sheet epoxy coated 8 mm thick and 10mm dish ends, having storage capacity and working pressure as specified below: The shall have 550 mm dia manhole cover.				
	ii)	Nozzles for Inlet, outlet, drain and other accessories shall be fabricated from MS Heavy duty ERW pipes, All connections shall be flanged type				
	iii)	Fittings and Instruments: Dial Type Pressure gauge- 100 mm dia 0 to 14 kg/cm2 with syphon and isolation valve, thermowell, safety relief valve etc.				

S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
	iv)	Insulation: The mixing tank shall be externally insulated with 50 mm thick mineral wool, covered with chicken wiremesh and cladded with 24 SWG. Aluminium sheet				
		Storage capacity : 1000 litres Working pressure: 6.5kg/cm²	2	No.		
	a	Cold Water inlet /Hot Out Le tPN16 Butterfly Valve 50 mm dia.	2	Nos.		
	b	Secandory Cold Water inlet line Butterfly Valve.50 mm dia.	2	Nos.		
	c	Cold Water inlet line Check Valve. 50 mm dia.	1	Nos.		
	d	Hot water inlet / outlet - secondary system				
		Ball Valve 50 mm dia.	4	Nos.		
	e	Hot water outlet connection to system				
		Butterfly Valve 50 mm dia.	2	No.		
		Check valve 50 mm dia.	2	No.		
	f	Hot water return water connection system				
		Butter fly valve 40mm dia.	2	Nos.		
		Check valve 40 mm dia.	2	Nos.		
	g	Inter connection to Mixing tank 50 mm dia.Butter fly valve	2	Nos.		
	h	Tank Drain connection Butterfly Valve 32mm dia.	2	Nos.		
	i	spare Point in Mixing Tank - 32 mm	2	Nos.		
	j	Temperature sensor at mixing tank suitable for differential temperature setting shall be made for Solenoid Valve on/off. The control / system shall be complete with necessary cabling / wiring along with support.	1	Nos.		
	k	Pressure Release Valve 25mm dia.	4	Nos.		
	L	Air Release Valve 15mm dia.	4	Nos.		
	M	Tem Prature Gauge	2	Nos.		
	N	Pressure Gauge	2	Nos.		
1.3		Supplying, installing, testing & commissioning of plate type heat exchanger (hot water to water type) with plates & nozzles of SS-304. Heat exchanger shall be designed as per TEMA standard and shall be provided with inlet.outlet connections with flanges, MS frame & all other standard accessories like thermometers, pressure gauges on inlet & outlets of primary and secondary circuits, etc., all complete and for the following duty parameters. (1W + 1S)				
		Capacity : 50,000 Kcal/hr.				
		Primary Circuit (Hot Water) Temperature				
		Inlet : 50°C				
		Outlet : 55°C				

S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
		Secondary Circuit (Water) Temperature				
		Inlet : 50°C				
		Outlet : 45°C	0	Nos		
1.3.1		Valves & Fittings on primary / secondary circuit				
	a	Ball Valve 65mm dia.	0	Nos		
	b	Check Valve 65mm dia.	0	Nos		
	c	Y-Stainer 65mm dia.	0	Nos		
	d	Dial type thermometer	0	Nos		
	f	Pressure Gauge	8	Nos		
1.4		Supplying, installing, testing and commissioning of hot water circulation pumps of following duty :				
	i)	The pumpsets shall be duly mounted on common fabricated base frame and shall be complete with mechanical seal, TEFC induction motor suitable for 220 volts / 415 volts, single phase / 3 phase, 50 cycles A.C. supply, 150 mm dia pressure guage with gunmetal isolation cock, anti vibration pads etc.				
	ii)	Material of Construction (M.O.C): Corrosion Resistant in general and suitable for hot water M.O.C : Casing — Cast Iron : Impeller — Stainless Steel : Shaft — Stainless Steel				
	a)	Hot Water Pumps (Primary /Secondary circuit of Hot Water Supply) suitable for upto 90°C Each set-(1 working + 1 standby)				
		Duty:				
		Discharge : 20000 LPH				
		Head : 20 M	0	Set		
1.4.1		Valves / Fittings :				
	a	Ball Valve 65mm dia.	0	Nos		
	b	Check Valve 65mm dia.	0	Nos		
	c	Y-Strainer 65mm dia.	0	Nos		
	d	Dial type pressure gauge	0	Nos		
	e	Dial type thermometer	0	Nos.		
	b)	Hot Water Pumps (Return Circuit from Hot Water Distribution System- suitable for upto 90°C (1 working + 1 standby)				
		Duty:				
		Discharge : 200 LPH				
		Head : 20M	1	Set		
1.4.2		Valves / Fittings :				

S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
	a	Butterfly Valve 50mm dia.	4	Nos		
	b	Check Valve 50mm dia.	2	Nos		
	c	Y-Strainer 50mm dia.	2	Nos		
	d	Dial type pressure gauge	2	Nos		
	e	Dial type thermometer	2	Nos		
1.5		Providing and fixing M.S. structural work fabricated from standard sections i.e. rounds, solid angles, slotted angles, channels including cutting to size, drilling, welding, fixing and welding to insert plates in RCC structural members as directed by Engineer-in-charge including cutting and making good the walls and floors (for staging of the equipment, supports, suspended floors, walk ways, ladders etc.)	500	Kg.		
1.6		Water Softening Plant				
		Supply, installation, testing & commissioning of water softening plant (FRP) for make-up water for Hot water generator comprising of multiport valve with brine ejector and plastic piping complete with brine tank with fittings and brine filtering media & complete charge of cation exchange resin as per specification for the capacity as given below :				
		Water Flow : 200 LPM				
		Incoming Hardness : 100 mg / Ltr (Approx.)				
		Working Pressure : 5 kg / Sqm				
		Outgoing Hardness : Comm. Zero				
		Water Softening Plant as described above	1	No		
1.7		Supply, installation, testing and commissioning of pressure reducing valve suitable for 15 LPM flow rate. suitable for provision at inlet of ACF with inlet pressure from hydropneumatic at 3.0 Kg / Cm2 (Maximum)	1	No		
		TOTAL for 'HOT WATER GENERATORS AND OTHER ALLIED EQUIPMENTS' carried over to SUMMARY			Rs.	
2.0		PIPEWORK FOR HOT WATER GENERATION SYSTEM				

S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
2.1		<p>Providing, jointing, testing & commissioning of following sizes of ERW heavy class MS (C-class) pipes conforming to IS-1239 with all accessories like all fittings including tees, elbows, reducers, union, flanges, rubber gaskets, washer including in all respects. (Pipework for Interconnecting piping between Hot Water Generator and PHE).</p> <p>Note: Fittings for pipes upto 50 mm diameter shall be socketed welded type and above 50mm these shall be heavy duty fabricated fittings.</p> <p>Insulation of Pipes : All hot water pipe shall be insulated with 50mm thick 100Kg/M3 density liquid resin bonded glass wool covered with chicken wiremesh and cladded with 24 SWG. Aluminium sheet</p>				
	a)	15 mm dia	0	RM		
	b)	20 mm dia	3	RM		
	c)	25 mm dia	3	RM		
	d)	32 mm dia	15	RM		
	e)	40 mm dia	12	RM		
	f)	50 mm dia	0	RM		
	g)	65 mm dia	0	RM		
	h)	80 mm dia	0	RM		
	l)	100 mm dia	0	RM		
2.2		<p>Providing, fixing, jointing Stainless Steel Seamless Pipes (Grade SS 304) including fittings i.e. tees, bends, elbows, unions, reducers, draining arrangement, flange joints, rubber insertion, nuts & bolts etc. as required including fixing of pipework on walls, slabs etc. (Pipework for Interconnecting piping between PHE and Mixing Tank).</p> <p>Insulation of Pipes : All hot water pipe shall be insulated with 50mm thick 100Kg/M3 density liquid resin bonded glass wool covered with chicken wiremesh and cladded with 24 SWG. Aluminium sheet</p>				
	a)	15 mm dia	RQ	RM		
	b)	20 mm dia	RQ	RM		
	c)	25 mm dia	RQ	RM		
	d)	32 mm dia	RQ	RM		
	e)	40 mm dia	RQ	RM		
	f)	50 mm dia	RQ	RM		
	g)	65 mm dia	RQ	RM		
	h)	80 mm dia	RQ	RM		
	l)	100 mm dia	RQ	RM		
2.3		<p>Providing, jointing, testing & commissioning of following sizes of SS 304 Flange confirming to BS 10 Table F (Each Flange) {COMMERCIAL MANUFACTURER}</p>				
	a)	32 mm dia	0	Nos.		
	b)	40 mm dia	0	Nos.		
	c)	50 mm dia	0	Nos.		
	d)	65 mm dia	0	Nos.		

S.NO.		DESCRIPTION	QTY	UNIT	RATE	AMOUNT
	e)	80 mm dia	0	Nos.		
2.4		Providing and fixing screwed end Bronze non return valves suitable for handling oil.				
	a)	40 mm dia	0	Nos.		
	b)	50 mm dia	0	Nos.		
	c)	65 mm dia	0	Nos.		
	d)	80 mm dia	0	Nos.		
2.5		Providing and fixing of Forged Brass ball valve (minimum working pressure of 16 bar) with operating handle suitable for hot water application(upto 90°C) and of approved make.				
	a)	20 mm dia	8	Nos.		
	b)	25 mm dia	7	Nos.		
	c)	32 mm dia	0	Nos.		
	d)	40 mm dia	0	Nos.		
2.8		Providing and fixing Cast Iron `Y` type Strainers with Stainless Steel (SS 304) perforated sheet screen suitable for working pressure of 10Kg/Cm2				
	a)	25 mm dia.	0	Nos.		
	b)	40 mm dia.	RQ	Nos.		
2.9		Providing, fixing, testing and commissioning pressure gauge of 150mm dia with Bronze stop cock	2	Nos.		
2.10		Providing in dial type thermometers for temperature measurement				
	a)	Suitable for Hot Water	2	Nos.		
2.11		Supply, installation, testing & commissioning a soft water feed tank for HWG and Solar panels tank of 500 ltrs capacity complete with insulation, nozzle for inlets / outlets, overflow / drain, high / low level probe inlet socket (threaded) and vent connections with flanges, side mounting type glass level indicator alongwith accessories and 400 mm dia manhole with bolted cover duly paint with red oxide as per specifications.				
	a	M S soft water tank complete as below for HWG	0	No.		
	b	Soft water inlet connect with inlet valve (Bronze Ball Valve with Forged Brass Stem). 25mm dia.	0	No.		
	c	HWG feed line Ball Valve 80mm dia.	0	No.		
	d	HWG feed line Strainer 40mm dia.	0	No.		
	e	Glass level indicator along with accessories	2	No.		
	f	Drain line valve (Bronze Ball Valve with Forged Brass Stem) 25mm dia.	0	No.		
	g	Float Ball Valve 25mm dia.	0	No.		

S.NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
2.1	Supply, installation, testing and commissioning of interconnecting system with solar system and heat pump along with piping, valves pipe insulation, bypass valve and piping etc. complete as required at site.	1	Job		
	(If required)				
	TOTAL for 'PIPEWORK FOR HOT WATER GENERATION SYSTEM' carried over to SUMMARY			Rs.	
3.0	ELECTRICAL WORKS				
	<u>ELECTRICAL INSTALLATION FOR HWG SYSTEM</u>				
3.1	Design, fabrication, assembling, wiring, supply, installation, testing and commissioning of motor control centre shall be fabricated out of 14 gauge CRCA sheet steel in form in 3b formation with reinforcement of suitable size angle iron, channel 'T' sections irons and/or flats wherever necessary. Cable gland plates shall be provided on top as well as at the bottom of the panels. Panels shall be treated with all anticorrosive process before painting as per specifications with 2 coats of red oxide primer and final approved shade of powder coated paint. 2 Nos. earthing terminals shall be provided for 3 phase, 4 wire, 50 Hz supply system. Lifting hooks shall also be provided in case of large panels. Approval shall be taken for each panel before fabrication. Cadmium Plated hardware shall be used in fabrication of panels.				
	<u>MCC – 1 (HWG)</u>				
	Incoming				
	100 amps TPN MCCB with the following accessories:				
	0-500 volts 96 x 96 mm square voltmeter with selector switch shall be protected by 2 amps TP MCB. 1 Set				
	0-100 amps 96 x 96 mm square ammeter with selector switch and 200/5 amps 10 VA CL:1 CTs. 1 Set				
	Phase indicating lamps shall be protected by 2 amp SP MCB 3 Sets				

S.NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
	<u>Bus Bar</u>				
	150 amps TPN (25 KA) aluminium bus bar with heat shrinkable insulation sleeves				
	Outgoings				
	3 Nos 63 amps FP MPCB outgoing feeders to 40KW for Hot Water Generator.				
	3 Nos. 40 amps TPN MPCB with direct online starter and outgoing feeder to 6 KW hotwater return pump motor. Each compartment shall contain auto/manual selector switch and an indicating lamp with MCB's for ON/OFF/Trip status of motor. (1W + 1S)				
	Spare MPCB of the following capacity				
	32 amps TPN MCB 2Nos				
	Spare MPCB of the following capacity				
	63 amps TPN MPCB 1No.				
	Necessary cable alleys, internal wiring, control wiring, interlockin shall also be included in cost of the panel.				
	Notes :				
	All MCCBs shall be of 25 KA breaking capacity and suitable for motor duty application.				
	Provision shall be made for providing potential free contacts to all pumps starters for connection to BMS				
	MCC – 1 Hot Water System as described above	1	No		
3.2	<u>CABLES, SUBMAINS & CABLE TRAYS:</u>				
	Supply, installation, testing and commissioning of following sizes of PVC sheathed PVC/XLPE insulated Aluminium/copper conductor power/control armoured cables of 1100V grade on surface of wall or in existing cable trays/masonry ducts/ hume pipe with fixing hardware etc. as required.				
	<u>Aluminium Conductor Armoured Cables :</u>				
a	4 C – 25 Sq mm PVC insulated Cu- conductor	40	RM		
b	3C – 2.5 Sq mm PVC insulated Cu-conductor	60	RM		
3.3	<u>Copper Conductor Armoured control Cables:</u>				
a	3C x 1.5 Sq mm PVC insulated, flexible cu-cables.	30	RM		
b	2C x 1.5 Sq mm PVC insulated, flexible cu-cables.	40	RM		

S.NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
3.4	<u>Cable Termination</u>				
	Supply & making end termination with brass compression glands for the following PVC/XLPE insulated PVC sheathed 1100 V grade cable including cost of crimping lugs/ ferrules, compression glands, solder cable sockets, insulation tape etc. complete as required.				
	Armoured cables (double compression type).				
a	4 C – 25 Sq mm PVC insulated Cu- conductor	6	Nos		
b	3C – 2.5 Sq mm PVC insulated Cu-conductor	4	Nos		
3.5	<u>Copper Conductor Armoured control Cables:</u>				
	(Double compression glands suitable for following armoured cables).				
a	3C – 1.5 Sq mm PVC insulated	20	Nos.		
b	2C – 1.5 Sq mm PVC insulated	20	Nos.		
3.6	<u>Perforated Type Cable Tray :</u>				
a	300 mm wide	0	RM		
b	150 mm wide	80	RM		
3.7	<u>EARTHING :</u>				
	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	18	RM		
b	8 SWG wire	100	RM		
	TOTAL for 'ELECTRICAL WORKS' carried over to SUMMARY			Rs.	
	GRAND TOTAL			RS.	

PROJECT : CLARKS-JAIPUR

SUBHEAD : Supplying, Installing, Testing and Commissioning of Water Treatment Plant

SPECIAL CONDITIONS

1. The prices quoted shall be inclusive of excise, all taxes, VAT, works contract tax, service tax, freight, octroi etc.
2. The Owner has the right to delete any item from the scope of this contract.
3. The quantities as given in the Bill of Quantities are tentative. These can be increased or decreased as per the actual requirement at site
4. The tenderer can quote for any additional item, which he thinks, is required for successful operation of the plant being offered by him.
5. The contractor shall submit the **shop drawings** of the complete installation for the Consultant's approval with in 7 days of the award of the contract. The shop drawings shall give sufficient information for the required civil work to be done by other agency. The Contractor shall also submit the single line diagram (SLD) and the fabrication drawings of the pump control panels.
6. The Contractor shall be responsible for the proper functioning of the Water Treatment Plant in terms of its performance.
7. Any equipment / item having any manufacturing defect shall be replaced free of cost.
8. The Contractor shall hand over all the catalogues, performance curves and warranty cards of the equipment supplied to the Owner.
9. The Contractor shall clean the site thoroughly of all rubbish / malba left out of his materials on completion of the work and dress the site to the satisfaction of the Project Manager at his own cost.
10. **Electricity & Water** : Electricity and water will be provided at site by the Owner. However, the Contractor shall make temporary arrangement on his own for tapping off from the nearest available distribution point.
11. **Site Conditions** : Before submitting the proposal/offer the tenderer must carefully consider the site constraints, as mentioned in the Section-C of Scope of Work.
12. **The offer shall have the following enclosures :**
 - a) List of similar projects undertaken in recent past
 - b) A technical note on the proposed system
 - c) System diagram
 - d) Details of the required electric load — installed as well as operational.
 - e) Operational and maintenance cost
 - f) Details of Civil Work required

SCOPE OF WORK

SECTION A. TURNKEY NATURE OF PROJECT :

This Contract is for execution of Water Treatment Plant on '**Turnkey Basis**', which shall include but not limited to the following :

a) Designing of Water Treatment Plant :

Designing shall essentially include but not limited to the following :

- i) Process Design
 - ii) Preparation of general arrangement drawing with sufficient information for the Structural Engineering Consultant to design the structure of various components.
 - iii) Selection of all mechanical and electrical equipment like pumps, motors, pipes, valves and other appurtenances, switchgear, cables etc.
 - iv) Preparation of detailed engineering drawings
- b) **Supply and Installation of Mechanical & Electrical Equipment** like pumps, filters, Softener, pipes, valves and other appurtenances, pump control panel, cabling etc. as generally described in Section F and of makes as mentioned in Section E of Scope of Work.

IMPORTANT NOTES

- i) It is understood that this Contract includes supply, installation, testing and commissioning of all the equipment, components etc. whether explicitly mentioned above or not for the successful commissioning of the Water Treatment Plant as per the parameters mentioned herein.
 - ii) The tenderer must clearly indicate the material of construction, performance parameters, sizes etc of each equipment being offered by him.
 - iii) The Civil Work like construction equipment foundations etc. is **not included** in the Scope of this work. However, the Contractor will have to provide complete details regarding the requirements of Civil Works, so that these can be executed by a separate agency.
- c) **Interconnecting Pipework** : All interconnecting pipework starting from the inlet to the Raw Water Feed Pumps up to the final outputs of treated water streams.
- d) **Electrical Works** : Pump control panel, all interconnecting power and control cabling for pumps, dosing pumps from control panel to respective motors and drives, interlocking of dosers, level controllers with cabling etc.
- e) **Testing and commissioning of the Plant (including the cost of the consumables).**
- f) **Operation of plant for three months from the date of commissioning including the cost of consumables.**
- g) **Training the personnel of the Employer for operation and maintenance of the plant.**
- h) **Maintenance of the plant for 12 months commencing immediately after the commissioning.**

SECTION B. RAW WATER CHARACTERISTICS

. The salient test results are as follows:

Parameters	Results
Turbidity:	25.1 NTU
Colour:	Less than 5 Hazens
Taste & Odour:	Agreeable
pH	7.30
Total Dissolved Solids:	1470 mg/lit
Total Hardness (as CaCO ₃):	220 mg/lit
Alkalinity (as CaCO ₃):	525 mg/lit
Chloride (as Cl):	174 mg/lit
Sulphate (as SO ₄):	128 mg/lit
Fluoride (as F) :	1.0 mg/lit
Iron (as Fe) :	0.08 mg/lit
Nitrate (as NO ₃) :	3.8 mg/lit
Calcium (as Ca) :	49.6 mg/lit
Magnesium (as Mg) :	41.5 mg/lit
Total Coliform (MNP/100ml):	8 mg/lit
E. Coli	Negative

SECTION C. TREATED WATER REQUIREMENTS

- 1) **Treated Water for Domestic Use (for bathing, washing, ablution etc) =50000 Litres/ day (Generation time to be considered 10 hours)**

Hardness = 50 to 80mg/litre
 pH = 7.0 – 7.5
 Other Parameter shall be as per IS: 10500

Important Note : It is understood that this Contract includes supply, installation, testing and commissioning of all the equipment, components etc. whether explicitly mentioned above or not for the successful commissioning of the Water Treatment Plant as per the parameters mentioned above.

SECTION D. TREATMENT SEQUENCE

- a) **MGF and Softener Based Water Treatment Plant for domestic water**

SECTION E. LIST OF APPROVED MAKES/MANUFACTURES OF MATERIALS**NOTE :**

- i) Tenderer must tick (i) the brand being offered. In case some other brand is being offered, it must be clearly stated and supporting document must be enclosed.
- ii) All Brand Names/Manufacturers are Indian unless specified otherwise.

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
A) Plant & Equipment		
1.	Raw Water Feed Pumps	a) Grundfos, Denmark b) Wilo-Germany
3.	FRP Vessels (Filter Shell)	a) Well-Mate, USA b) Aventura c) Pentair
4.	Metering Pumps	a) Asia,LMI b) Toshcon SESCO c) Etatron, Italy d) Grundfos, Denmark
5.	Polypropylene (PP) Chemical Grade Chemical Solution Tanks	a) Sintax b) Jindal
6.	Resin	a) Henkel b) Indion c) Tulsion
7.	Rotameters	a) Flowstar b) Instrumentation Engineers Ltd.
B) Pipes and Fittings		
1.	S. S. Pipes	a) Chockesy b) Décora b) Rattan Mani c) Apex
2.	S. S. Fittings (Investment Casting)	a) H.S. b) Interfeed
3.	PVC Pipes and Fittings	a) Astral
C) Valves		
1.	Butterfly Valves	a) Audco b) Advance c) Honeywell

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
2.	Brass/Bronze Ball Valves	a) Danfoss b) RB, Italy c) ARCO, Spain d) CIM, Italy
3.	Gunmetal Gate Valves, Non-return Valves	a) Leader b) Zoloto
4.	T/Y Strainer	a) Leader b) Zoloto
5.	Solenoid Valves	a) Danfoss b) Aira - Airmax
6.	Water Level Controller (Magnetic Float Type)	a) Janus b) Cirrus c) Elegant Control d) Swlitzer
7.	Diaphragm Valves	a) Saunders
8.	PVC Ball Valve	a) Astral
D) Electric Switch Gear and Starters		
1.	Electric Switch Gear	a) Siemens b) L & T c) GE d) ABB e) Merlin Gerin f) Legrand
2.	PVC Insulated Armoured Power and Control Cables	a) Gloster b) Cable Corporation of India c) Unicab d) Havell's
3.	MCCB	a) L & T b) Merlin Gerin c) ABB d) GE - Power
4.	MCB	a) L & T - Hager b) Merlin Gerin c) Legrand- Lexic Series d) GE - Power
5.	Starters, Relays etc.	a) L & T b) ABB c) Control & Switch Gear d) GE - Power

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
6.	Push button and indication lights	a) L & T b) Siemens c) Telemenaque d) Vaishno e) BCH
7.	Digital Voltmeter & Ammeter	a) AE b) Cadel c) Enercon
8.	Selector Switches	a) L & T b) Keycell c) Salzar
9.	HRC Control Fuses	a) L & T b) GE c) Siemens
E)	Miscellaneous	
1.	Water Level Controllers (Magnetic Float Type)	a) Janus b) Elegant Control c) Swlitzer
2.	HDPE Tanks	a) Sintex b) Durawell
2.	Anti-vibration Pads/Footings	a) Resistoflex b) Kanwal
3.	Vibrations Eliminators	a) Resistoflex b) Flexcons c) Arrowflex d) Kanwal
4.	Pressure Switches	a) System Sensor, U.S.A b) Danfoss c) Indfoss b) Swlitzer
5.	Pressure Gauges	a) H. Guru b) Fiebig
6.	Digital Water Quality Monitoring Equipment	a) Fluid Control System, USA b) Impell
11.	Water Flow Meter Turbine Type	a) Kranti b) Kent
12.	Scaltron – Scale remover	a) Fluid Dynamics b) Scale pro

PROJECT : CLARKS-JAIPUR					
SUBHEAD : Supplying, Installing, Testing and Commissioning of Water Treatment Plant					
SECTION F					
BILL OF QUNTITIES					
ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	1) The pump shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Head-Discharge (H-Q) characteristic curve over a range of 50% to 130% capacity				
	2) The total head capacity curve shall be continuously rising towards the shut off. The shut off head shall be at least 110% of the total head. The pump should deliver at least 125% of its rated capacity at 75% of the specified total head				
	3) Wherever mechanical seal has been asked for, it must be `factory fitted` at pump manufacturer`s works.				
	4) The Tenderer must submit along with his offer, the make and the model of the pump unit proposed by him. The tenderer must mention clearly wherever he is offering alternative material of construction for various types of pumps.				
	5) The Tenderer must fill all the blank fields				
1.0	WATER TREATMENT PLANT FOR GENERAL WATER SUPPLY				
1.1	Supplying, installing, testing and commissioning of raw water feed pump as per the following details :				
	The filter feed pump unit shall be complete with :				
	a) Pumps: Vertical Inline pump with mechanical seal				
	Material of Construction (M.O.C): Corrosion Resistant in general Pump Casing—Cast Iron/Stainless Steel Impeller — Stainless Steel Shaft — Stainless Steel				

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Shaft Sleeve — Stainless Steel				
	Duty:				
	Discharge (each pump) : 6 M ³ /hr.				
	Head : 25 M	2	No.		
	Details of Equipment offered (To be filled in by the tenderer)				
	Pumps				
	Make:				
	Model:				
	HP/KW:				
	M.O.C : Casing —.....				
	: Impeller —				
	: Shaft —				
1.2	Providing, installing, testing and commissioning vertical down flow type multi grade sand bed pressure capable of filtering 6 cum/hour of water at prescribed filtration rate of 10 cum/sq.m/hr. The filter shall comprise of msep, suitable for a test pressure of 6 kg/sq.cm. , complete with pedestal, access cover, MSEP underbed, 50 mm dia frontal piping and valves pressure guage, first charge of filter media. etc.	1	No.		
	Filteration unit as described above having following parameters				
	Dia - 600 MM (Min.)				
	Height of Vessel - 1850MM				
	Test Pressure - 6Kg/cm ²				
	Media Bed Depth - 900MM				
	Details of Filter offered (to be filled in by the tenderer)				
	DiaMM				
	Height on Straight.....MM				
	Test PressureKg/cm ²				
	Media Bed Depth.....MM				
1.3	Providing, installing, testing and commissioning of a ion-exchange resin based softener capable of producing required capacity for blending in treated water and get required quantity & quality water as specified in scope of work				

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
	Softner Shell : MSEP and fibreglass body with Polypropylene base,complete with pedestal, access cover, PVC underbed, complete with lid, air vent, water purge, pressure gauge, first charge of filter media etc.				
	Brine Solution Tank : Suitable size Brine Solution Tank with Electric agitator				
	Softner unit as described above having following parameters				
	Dia - 600 MM (Min.)				
	Height of Vessel - 1850MM				
	Test Pressure - 6Kg/cm ²				
	Quantity of Resin - 300 Liter (Min.)				
	Piping & Valves - 50 mm dia frontal piping and butterfly valves,				
	Details of Softner offered (to be filled in by the tenderer)				
	DiaMM				
	Height on Straight.....MM				
	Test PressureKg/cm ²				
	Quantity of Resin.....MM				
	Type and Make of Resin Indion .				
	Salt consumption per regeneration.....Kg.				
1.4	Providing, installing, testing and commissioning chemical doser comprising 100 litres capacity LLDPE(chemical grade) tank, electronic metering pump of 0 - 6 litres/hr. capacity injection fitting, solution delivery tube etc. including making electrical connection including interlocking with domestic supply pumping system, all complete.	2	No.		
1.5	Providing, fixing, jointing, testing and commissioning interconnecting pipe work in Schedule 50 PVC, isolating valves, by-pass connection of solenoid valves, pressure gauges with isolating cocks etc. (Battery limits of pipework: suction header with isolating valves of raw water feed pumps upto treated water tanks)	1	Lot		

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1.6	Providing, fixing, connecting, testing and commissioning of electrical panel, power and control cabling between pump panel, pumps, dosers, level controller, solenoid valves etc. Provision for BMS Connectivity. The panel should have sufficient no. of potential free contacts for connectivity with Building Management System for monitoring purposes	1	Lot		
1.7	Automation : The entire system is to be made fully automatic and intelligent.using state of the art automation components. The system shall start and stop as per the treated water level in the treated water reservoirs. Provision of level controllers in the treated water tank reservoirs is to be included in the Scope of Work.	1	Lot		
1.8	Supplying, installing, testing and commissioning of following water quality monitoring devices.				
	a) Online digital pH indicator	2	No.		
1.9	Providing hardness testing kit with reagents	1	No.		
1.10	Providing and fixing mechanical dry dial bulk water meter with specials as required, bolts, nuts, rubber insertions etc. of approved make				
	a) 50 mm dia nominal bore	1	No.		
1.1	Supply, installation, testing and commissioning of scaltron 40 mm non chemical water treatment system(catalytic technology) in line system, flow required 7000LPH, tube of ss-316, catalyst made by precious metal and approved by NSF, KIWA. Including flange and nut bolt etc.	1	No.		
	TOTAL of "Water Treatment Plant for General Water supply" carried over to SUMMARY			Rs.	

PROJECT : CLARKS-JAIPUR

SUBHEAD : Supplying, Testing and Commissioning of Pumping Machinery

SPECIAL CONDITIONS

1. The prices quoted shall be inclusive of excise, all taxes, VAT, Entry Tax, freight, octroi etc.
2. The Owner has the right to delete any item from the scope of this contract.
3. The quantities as given in the Bill of Quantities are tentative. These can be increased or decreased as per the actual requirement at site.
4. Tenderer can quote for any additional item, which he thinks is required for successful operation of the machinery being offered by him
5. The contractor shall submit the **shop drawings** of the complete installation for the Consultant's approval with in 7 days of the award of the contract. The shop drawings shall give sufficient information for the required civil work to be done by other agency. The Contractor shall also submit the single line diagram (SLD) and the fabrication drawings of the pump control panels.
6. The contractor shall be responsible for the proper functioning of the **Pumping Machinery** in terms of its performance.
7. **Statutory Approvals:** The Contractor shall be responsible for obtaining all statutory approval from the concerned department like Municipal Corporation, Pollution Control Board, Irrigation Department etc
8. Any equipment/item having any manufacturing defect shall be replaced free of cost.
9. The Contractor shall hand over all the catalogues, performance curves and warranty cards of the equipment supplied to the Owner.
10. The Contractor shall clean the site thoroughly of all rubbish/malba left out of his materials on completion of the work and dress the site to the satisfaction of the Owner at his own cost.
11. **Electricity & Water :** Electricity and water will be provided at site by the Owner. However, the Contractor shall make temporary arrangement on his own for tapping off from the nearest available distribution point.
12. **Site Conditions :** Before submitting the proposal/offer the tenderer must carefully consider the site constraints, as mentioned in the Section-C of Scope of Work.
14. **The offer shall have the following enclosures :**
 - a) List of similar projects undertaken in recent past
 - b) A technical note on the proposed system
 - c) System diagram
 - d) Details of the required electric load — installed as well as operational.
 - e) Operational and maintenance cost
 - f) Details of Civil Work required (in terms of sizes and volume)
 - g) A note on the Ventilation requirement for the Plant area

SCOPE OF WORK

TURNKEY NATURE OF PROJECT :

This Contract is for supply and commissioning of Pumping System and Allied Equipment on '**Turnkey Basis**', which shall include but not limited to the following:

a) Preparation of Shop Drawings :

- i) Preparation of general arrangement drawing with sufficient information for the civil work to be done by another agency.
- ii) Preparation of detailed engineering drawings including single line diagram showing power and control circuitry, fabrication drawings of the pump control panels.

b) Selection of all mechanical and electrical equipment: like Pumps, Pressure Vessel Motors, pipes, mixing tanks, valves and other appurtenances, switchgear, cables etc.

c) Supply, testing and commissioning of Mechanical & Electrical Equipment as generally described in Bill of Quantities

IMPORTANT NOTES

- i) It is understood that this Contract includes supply, testing and commissioning of all the equipment, components etc. whether explicitly mentioned or not for the successful commissioning of the Pumping System as generally described here.
- ii) The Tenderer must clearly indicate the material of construction, performance parameters, sizes etc of each equipment being offered by him.
- iii) The Civil Work like construction equipment foundations etc. is not included in the Scope of this work. However, the Contractor will have to provide complete details regarding the requirements of Civil Works, so that these can be executed by a separate agency.

d) Interconnecting Pipework :

All interconnecting pipework starting from the suction to delivery of the Pumping System

e) Electrical Works :

All interconnecting power and control cabling between pump control panel and motors and between level sensors and control panel.

f) Testing and commissioning of the Pumping System

g) Training the personnel of the Owner for operation and maintenance of the plant.

h) Maintenance of the pumping system for 12 months commencing immediately after the commissioning.

SPECIFICATIONS

1.0 GENERAL CONDITIONS

1.1 SITE CONDITIONS

It is assumed that before tendering the Contractor would have visited the site and familiarized himself with all the local conditions and means of transportation and communications. No claim of whatsoever nature would be entertained at a later date on account of the Contractor's ignorance of the local conditions.

1.2 STANDARD AND CODES OF PRACTICE

The work shall be carried out as per the enclosed Specifications of Work and Material and the construction drawings to be issued from time to time. These specifications shall be read in conjunction with CPWD specifications, National Building Code 1983, relevant Codes of Practice and Standards as issued by Bureau of Indian Standards (B.I.S.), all with the latest amendments wherever applicable.

1.3 WORKMANSHIP

All the work shall be carried out in a workmanship like manner and as per the best practices of the trade.

1.4 DRAWINGS AND DOCUMENTS

1.4.1 General

- i) The Drawings are intended as a guide to the firms tendering and give approximate positions of pipes, conduits, cable runs and/or equipment only and while measuring from these drawings, the Tenderer must make due and proper allowance for all necessary diversions from the straight line, rises or falls as may be required for the proper execution of the works.

Detail drawings in all cases shall be worked to in preference to those of a more general nature and figured dimensions where indicated shall be followed in preference to scale.

Where necessary, the exact positions of plant and/or equipment will be decided by the issue of further drawings, but no claim for extra payment due to insufficient information on this scope will be entertained.

In any case of doubt as to the interpretation of either Drawings and/or Specification, the Tenderer must refer the matter to the Owner prior to the submission of his Tender.

- ii) It is to be clearly understood that this Tender is to be absolutely inclusive for the proper completion of the whole of the works specified to the true intent and meaning of the specification and/or Drawings and the description therein contained shall be read conjointly and together and no error, inconsistency, discrepancy in the Drawings and/or Specification will relieve the Contractor of his obligations to include for an hand-over the work in the true meaning and intent of the Specification and/or Drawings, complete in every respect.

Should any portion of the works which would reasonably and obviously be inferred as necessary for the installation as a whole but not expressly specified, the Contractor shall provide and execute such work as part of the Contract and shall not be entitled to any extra payment of that account.

- iii) The Contract Drawings and such other drawings as may be furnished to the Contractor during the progress of the Works shall be considered as illustrating between the Drawings and the Specification, the Contractor shall execute the work in accordance with the decision of the Owner. If modifications are necessary, the Contractor shall submit modifications to the Owner for approval before such modifications are executed.
- iv) All Drawings and Specification are the property of the Owner.
- v) The Contractor will be required to give and obtain all necessary site and other particulars and to agree such details with the Owner. The Contractor must also obtain details of any other Contractor's work affected by his work and shall work in close co-operation with all such firms or persons concerned.
- vi) The Contractor shall be responsible for any damage caused to buildings and contents and works by reason of, arising out of, or incidental to, or in connection with the execution of any work in the Contract Documents.

The Contractor shall permit nothing to be done which may injure the stability of the Works, or existing buildings and no cutting through floors or walls will be allowed other than where required by the Drawings, without the sanction of the Owner.

- vii) The Contractor must prepare the shop drawings and shall submit to the Owner for approval, before the work is commenced. Three copies of all working details and installation drawings shall be submitted.

These drawings must be submitted by the Contractor as soon as possible after the order is placed to give ample time for all parties concerned to study and comment thereon.

- viii) The work described on any working drawings submitted shall be carefully checked by the Contractor for all clearances, field conditions, maintenance of architectural conditions and proper co-ordination with all trades on the job. To this end, the Contractor, during the construction drawing stage, shall ensure that he co-ordinates drawings of all other trades that might interfere with the proper installation of his work. No payment shall be made for any variations or alterations on site due to lack of knowledge of other trades. Any unresolved conflict between trades shall be referred to the Owner.

The equipment layout is to be detailed on the drawings, showing the exact method of installing and clearly illustrating components to be used in making all connections.

- ix) Pipework drawings must be fully detailed, showing all pipework in double line and indicating the precise size of fittings, valves and equipment, position of hanger supports with reference numbers must be indicated and a large scale detail must be given, showing the type and method of installation of each type of hanger. A schedule is to be included on each drawing, showing details of the type of hanger fixings and references number for each type.

All general layout drawings shall be drawn 1/50 scale, unless agreed otherwise with the Owner.

- x) The Contractor shall provide a detailed programme incorporating working drawing production, which can be read in conjunction with the building construction programme.
- xi) The Contractor shall prepare schedules and drawings showing precise details of holes in concrete, block works etc., base frames or support required and the like. The schedules shall show in detail the builder's work required to be performed by all other trades for the mechanical and electrical installations. These drawings and schedules, in an approved form, must be submitted to the Owner well in advance and his approval must be obtained before any structural work requiring holes or other modifications is constructed.
- xii) Signed and approved drawings will not be departed from unless a signed variation or omission certificate is issued in writing by the Owner. Drawings returned to the Contractor for alteration or amendment shall be re-submitted to the Owner for approval.

Amended or altered drawings shall show the nature of the amendment or alteration in a revision block on the drawing, together with the revision number or letter and the date of the revision.

- xiii) Should the Contractor prove unable to produce satisfactory "Working Drawings" or be unable to produce drawings to conform to the progress of the work, the Owner reserves the right to take whatever steps are necessary to have drawings undertaken by others and debit the Contractor's account.

Any decision taken by the Owner to have working drawings produced elsewhere will not relieve the Contractor of his contractual obligations and the Contractor must provide to the Owner all necessary details, physical dimensions, descriptive literature, etc., of all equipment to be incorporated on drawings within 10 days of a request from the Owner.

1.4.2 Manufacturers' Data

- i) Manufacturers' performance data, certified factory drawings of plant and machinery, giving full information as to capacity, dimensions, materials and all information pertinent to the adequacy of the proposed equipment shall be submitted for approval.

Manufacturer names, sizes, catalogue numbers and/or samples of all materials shall be submitted for approval.

Submittals and working drawings should, as far as possible be complementary so that drawings and submittals can be cross checked.

- ii) The copy of the placement of order with the manufacturer of the equipment shall be submitted to the Owner for his approval and must be accompanied by relevant drawings, technical data, catalogues and samples, where data, certified drawings or other required information is not available until after orders have been placed, the Owner will give provisional approval until all requested drawings and information have been supplied to the Owner and approved by him. It is the Contractor's responsibility to ensure that all necessary information is supplied to the Owner in accordance with the progress of the work.

1.4.3 Operating and Maintenance Manual

- i) The Contractor shall furnish six copies in bound form of an instruction manual containing all information applicable to this section of the Works. This manual is to be similar in design and content to those to be provided under other services.

The manual shall contain a comprehensive written description of the Works, outlining the operation of the systems and maintenance procedures.

1.4.4 "As Installed " Drawings

- i) The Contractor shall arrange to keep on Site a full set of drawings showing the progress of the Works, which must be kept upto date.

The Contractor shall keep a record as the work proceeds of any work installed not in accordance with the drawings. On completion of the Works the Contractor shall supply three clear coloured prints of each applicable drawing, showing the exact position of all apparatus, pipe lines, services, control valves, switchgear, etc., together with diagrams, schedules, etc. to the Owner's requirements and in addition one complete set of plastic negatives and soft copy on compact disk (CD).

The word "AS INSTALLED DRAWINGS" shall be clearly indicated on all drawings adjacent to the title block.

1.5 DISCREPANCIES IN THE DRAWINGS

Should there be any discrepancy due to in-complete description, ambiguity or omission in the drawings and other documents relating to this Contract found by the Contractor either before starting the work or during execution or after completion, the same shall be immediately brought to the attention of the Owner and his decision would be final and binding on the Contractor.

1.6 INSTRUMENTS FOR MEASUREMENT AND TESTING

The Contractor shall provide, free of cost, all equipments, instruments, labour and all other allied assistance required by the Owner or their representatives for measurement and testing of the works.

1.7 CO-ORDINATION WITH OTHER TRADES

The Contractor shall be responsible for coordinating this work with works of other trades sufficiently ahead of time to avoid unnecessary hold ups. Hangers, sleeves, recesses etc. shall be left in time as the work proceeds.

1.8 PROTECTION

All work shall be adequately protected, to the satisfaction of the Owner so that the whole work is free from the damage throughout the period of construction upto the time of handing over.

Special care must be taken to prevent damage and scratching of all fittings and fixtures. Tool marks on exposed fixtures shall not be accepted. Protective paper on fixtures shall be removed with hot water only at the final completion of the work.

Before handing over the work, the Contractor shall clean all elements of the complete installation, remove plasters, splashes, stickers, rust stains and all other foreign matter and leave every part in acceptable condition and ready for use to the satisfaction of the Owner.

2.0 CENTRIFUGAL PUMPS**2.1 DESIGN REQUIREMENTS**

- a) The pump shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Head-Discharge (H-Q) characteristic curve over a range of 50% to 130% capacity (for pumps other than fire pumps).
- b) The total head capacity curve shall be continuously rising towards the shut off. The shut off head shall be at least 110% of the total head. The pump should deliver at least 125% of its rated capacity at 75% of the specified total head (for pumps other than fire pumps).
- c) The required NPSH at duty point shall be at least 1.0M less than the available NPSH.
- d) Pumps shall run smooth without undue noise and vibration. The velocity of vibration shall be within 4.5 mm/sec. The noise level shall be limited to 85 dBA at a distance of 1.8M.
- e) The power rating of the pump motor shall be the larger of the following :
 - i) The maximum power required by the pump in the entire operating range.
 - ii) 115% of the power required at the duty point. Power requirement shall be worked out considering 1% negative tolerance on quoted figure of efficiency.

2.2 FEATURES OF CONSTRUCTION

- a) Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pump shall be interchangeable.
- b) Impeller shall be enclosed type, securely keyed to the shaft. Means shall be provided to prevent loosening during operation including rotation in reverse direction.
- c) Pump shall be provided with renewable type casing ring.
- d) The first critical speed of the pump rotor shall be at least 30 percent above the operating speed.
- e) Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing boxes.
- f) Stuffing boxes shall be of such design that they can be repacked by removing the gland and lantern ring.
- g) Pump shall be furnished complete with flexible coupling.
- h) Coupling guard, bolted to the base plate shall be furnished.
- i) The base plate for pump and motor shall be common. Suitable holes shall be provided for grouting. Foundation bolts shall be complete with nuts and washers.
- j) Suction and discharge connections shall be flanged.
- k) Pump impeller shall be dynamically and statically balanced.
- l) All accessories required for proper and safe operation shall be furnished with the pump.
- m) Wherever, mechanical seal has been asked for in Bill of Quantities, it shall be factory fitted at manufacturer's works.

2.3 MATERIALS OF CONSTRUCTION

Corrosion Resistant in general

- | | | | |
|----|------------|---|-------------------------|
| a) | Casing | : | Stainless Steel |
| b) | Impeller | : | Stainless Steel /Bronze |
| c) | Shaft | : | Stainless Steel |
| d) | Seal | : | Mechanical Seal |
| e) | Base Plate | : | CI/MS fabricated |

3.0 INDUCTION MOTORS

3.1 DESIGN REQUIREMENTS

The Motors shall generally conform to IS:325. In addition, the motors shall also meet the specific requirements as mentioned below.

3.2 PERFORMANCE CHARACTERISTICS

- a) Motors shall be capable of giving rated output, without reduction in the expected life span when operated continuously under the following supply conditions :
- b) **Supply Condition**
 - i) Variation in Supply Voltage +/- 10%
 - ii) Variation in Supply Frequency +/- 5%
 - iii) Combined Voltage and Frequency Variation +/- 10%
- c) Motors shall be suitable for full voltage direct-on-line starting or star-delta starting or any other method of starting as specified in "Equipment Parameters". When slipring motors are specified, liquid rotor starter shall be as per clause 128.
- d) Motors shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is 85% of the rated motor voltage.
- e) The locked rotor current of the motor shall not exceed 600% of full load current (subject to tolerance as per the applicable standard) unless otherwise specified.
- f) Motors shall be designed to withstand 120% of rated speed for two minutes without any mechanical damage, in either direction of rotation.
- g) The guaranteed performance of the motor shall be met with tolerance specified in applicable standard.

3.3 INSULATION

- a) Any joints in the motor insulation such as at coil connections or between slot and end winding sections, shall have strength equivalent to that of the slot sections for the coil.
- b) The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot, humid and tropical climate.
- c) The motors shall be provided with Class F insulation with temperature rise limited to that of class B insulation.

3.4 CONSTRUCTIONAL FEATURES

- a) The motor construction shall be suitable for easy disassembly and reassembly. The enclosure shall be sturdy and shall permit easy removal of any part of the motor for inspection and repairs.
- b) Motors weighing more than 25 kg. shall be provided with eyebolts, lugs or other means to facilitate safe lifting.
- c) The rotor bars shall not be insulated in the slot portion between the iron core laminations for squirrel cage motors.
- d) **Bearing :**
 - i) Greased ball bearings or roller bearings shall be of reputed make.
 - ii) The bearings shall be so constructed that the loss of lubricating fluid is kept to a minimum and greasing shall be possible without any dismantling operation.

e) Terminal Box :

- i) Terminal boxes shall be of weather proof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or approved equivalent mentioned shall be provided at cover joints and between box and motor frame.
- ii) The terminal box shall be suitable for bottom entry of cables.
- iii) The terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees/180 degrees.
- iv) The terminals shall be of the stud type with necessary plain washers, spring washers and check-nuts. They shall be designed for the current carrying capacity and shall ensure ample phase to phase and phase to ground clearances.
- v) Suitable cable glands and cable lugs shall be supplied to match specified cables.
- f) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection. These earthing points shall be in addition to earthing stud provided in the terminal box.

The valves shall be of full bore type and of quality approved by the Consultant/Owner.

4.1 MATERIALS OF CONSTRUCTION

- | | | | |
|----|-----------|---|---------------------------------------|
| a) | Body | - | Nickel plated brass/ nonferrous alloy |
| b) | Ball | - | Forged Brass |
| c) | Seat | - | Virgin PTFE |
| d) | Stem Seal | - | Nitrile Rubber |

5. BUTTERFLY VALVES

The valve shall be of cast iron conforming to relevant IS:13095. The valve shall be of quality approved by the consultant/Engineer-in-charge.

5.1 MATERIALS OF CONSTRUCTION

- | | | | |
|----|------------|---|------------------------|
| a) | Body | - | Cast Iron |
| b) | Shaft | - | Carbon steel |
| c) | Body Liner | - | EPDM / nitrile rubber |
| d) | Disc | - | Epoxy Coated C.I./D.I. |

6. NON-RETURN VALVES — DUAL PLATE (WAFER TYPE) CHECK VALVE

The valve shall be of quality approved by the consultant/Engineer-in-charge.

6.1 MATERIALS OF CONSTRUCTION

a)	Body	-	Cast Iron
b)	Shaft	-	Carbon steel
d)	Disc	-	Stainlees Steel (AISI 316)

7. PIPES AND FITTINGS

7.1 PIPE WORK

7.1.1 Materials

The pipe work shall be done in black mild steel pipes of 'Heavy' grade conforming to IS:1239 (Part I)-1990 for upto 150 mm dia pipe and IS:3589-1991 for pipes above 150 mm dia UNLESS MENTIONED OTHERWISE IN BILL OF QUANTITIES.

All fittings shall be of mild steel of suitable grade conforming to relevant Indian Standards All fittings shall have manufacturer's trade mark stamped on it. Fittings in M.S. pipe lines shall include elbows, tees, bends, reducers, nipples, union bushes, G.I. clamps of approved design, M.S. flanges with 3 mm rubber insertion, nuts, bolts, washers etc.

Screwed fittings shall be approved type black malleable hexagonal on all ends of the fitting suitable for screwed joints.

For welded joints forged steel fittings of approved type with "V" groove shall be used.

Fabricated fittings shall not be permitted generally. However, if use of any fabricated fitting is found necessary by the Project Manager, fabrication of such fitting shall be taken up by the Contractor on the written directives of the Project Manager in a workshop following proper welding procedures. For fabricating a 'Tee' connection pipes shall be drilled and reamed and joint only welded. Gas cutting of pipes shall not be permitted. Fabricated 'Tee' out of M.S. plates shall not be used.

All fittings shall be tested at manufacturer's work. The Contractor may be required to produce certificate to this effect from the manufacturers.

7.1.2 Jointing

The pipes and fittings upto 50 mm diameter shall be threaded joints using Teflon Tape on the threads. Joints for pipe and fittings above 50 mm diameter shall be welded joints. Care shall be taken to remove any burr from the end of the pipe after cutting..

7.1.2.1 Welded Joints

General

The welding of pipes in the field should comply with IS:816, 1969. Electrodes used for welding should comply with IS:814, 1991.

Joints between M.S. pipes and fittings shall be made with pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner Butt welded joints shall not be acceptable. Care shall be taken to remove any burr from the end of the pipe after cutting.

All welders must be fully qualified and proof of an operator's qualification shall be either the Contractor's record of suitable tests passed within the previous six months or tests made before the commencement of the work.

The Contractor must submit to the Owner the names of the welders who will be employed on the work, together with documentary evidence of their competency.

Any welder considered by the Owner as not having the skill necessary for the work will at once be barred from further welding on the site or in the Contractor's workshop.

The Owner may instruct the Contractor to cut out typical welded joints for inspection and the Contractor shall include for the removal of such pieces and re-making joints to the satisfaction of the Owner. The Contractor shall include in his Tender for the cost of removing all such pieces for inspection and re-making joints.

Care must be exercised by the Contractor to ensure that the welding flux does not project into the bore of the tube. All welds shall be good, clean metal, free from slag inclusions and porosity, of even thickness and regular contour, well fused with the parent metal and finished smooth.

Where site welding is carried out in proximity to inflammable materials, the Contractor must take special precautions to protect the materials from risks of fire.

Testing of Welded Joints

The welded joints shall be tested in accordance with procedure laid down in IS:3600 (Part I) : 1985. One test specimen taken from at least one field joint out of any 10 shall be subjected to test.

If the results of the tensile test do not conform to the requirements specified, retests of two additional specimen from the same section shall be made, each of which shall conform to the required specifications. In case of failure of one or two, extensive gouging (scooping out) and repairing shall be carried out as directed by the authority.

If internal pressures exceed 1.5 MPa (15 kgf/cm²), special attention should be given to the assembly of the pipe and the first run of weld.

Non-destructive testing of the completed weld may be carried out on pipe-lines by radiographic (see IS:4853 : 1982) or ultrasonic method (see IS:4260, 1986) as agreed upon between the Owner and the Contractor.

7.1.2.2 Screwed Joints

Joint for black steel pipes and fittings shall be metal to metal threaded joints using Teflon tape on the threads.

7.1.2.3 Flanged Joint

M. S. Flanges shall be as per IS: 6392 and shall be faced. Rubber or asbestos gasket shall be inserted between the joints.

Flange shall be provided on :

- a) Straight runs not exceeding 12-15 m on pipe lines 80 mm dia and above.
- b) Both ends of any fabricated fittings e.g. bends, tees etc. of 65mm or larger diameter.
- c) For jointing all type of valve, appurtenances, pumps, connection with other type of pipes, to water tanks and other places necessary and required as per good for engineering practice.

7.1.2.4 Unions

Provide approved type of dismountable unions on pipes lines 65 mm and below in similar places as specified for flanges.

7.1.2.5 Laying and Fixing

a) Above Ground :

Exposed pipes on walls and ceilings shall be fixed with standard pattern G.I. holder bat clamps on angle iron frames embedded in walls or suspended from ceiling. The clamps shall be spaced at regular intervals in straight lengths as per the following table :-

Dia of Pipe (mm)	Horizontal Length (M)	Vertical Length (M)
25	2.4	3.0
32	2.7	3.0
40	3.0	3.6
50	3.0	3.6
65	3.6	4.5
80	3.6	4.5
100	4.0	4.5
150	4.5	5.4

Additional supports are to be provided at every change of directions and branch-offs

b) Anchor Blocks

Suitably designed anchor blocks in cement concrete to encounter excess thrust due to water hammer and high pressure should be provided at all bends, tees and such other locations as directed by the Owner. Exact location, design, size and mix of the concrete block shall be approved by the Architect / Consultant prior to the execution of the work.

8. SUMP PUMPS

- a) The pumps shall run smooth without undue noise and vibration.
- b) The power rating of the pump motor shall not be less than the maximum power required from zero discharge to zero head.
- c) Pump shall be vertical, centrifugal, single stage, nonclog type.
- d) It shall be suitable for handling turbid water containing stringy materials.
- e) The pump shaft journal bearings shall preferably be grease lubricated. No external water will be made available for the lubrication of the bearings.
- f) Delivery piping with gun metal stainless steel non-return valve shall be supplied.
- g) Delivery pipe shall be as per IS:1239, heavy class.
- h) The maximum suspension length of pumps shall be 1.5 metre.
- i) Pump shall be operated automatically by providing magnetic float operated level controllers.

8.1 MATERIALS OF CONSTRUCTION

Materials of construction in general shall be as follows unless specified otherwise in Bill of Quantities :

a)	Casing	:	Cast Iron
b)	Impeller	:	Cast Iron
c)	Shaft	:	Carbon Steel
d)	Cover Plate	:	Steel

9. SUPPORT OF PIPEWORK AND VALVES

All necessary supports, saddles, slings, fixing bolts and foundation bolts shall be supplied to support the pipework and its associated equipment. Valves and other devices mounted in the pipe work shall be supported independent of the pipes to which they connect.

11. PUMP CONTROL PANELS

11.1 GENERAL

Pump control Panels are to be suitable for 3 phase 4 wire 415 Volts 50 Hz system with a fault level of 31MVA at 415 volts.

Panels are to be metal clad, cubicle type totally enclosed, floor mounted and air insulated. The total height of the switchboard is to be not more than 2100 mm. Panels are to be extensible on both sides and shall conform to IP - 43 as per IS :2147

11.2 STANDARDS

The equipment shall be designed to conform to the requirements of :

- i) IS : 8623 - Factory built assemblies of switchgear and control gear.
- ii) IS : 13497 - General requirements for switchgear and control gear for voltages not exceeding 1000 Volts.
- iii) IS : 2147 - Degrees of protection provided by enclosures for low voltage switchgear and control gear.
- iv) IS : 375 - Marking and arrangement of bus bars.

Individual equipment housed in the power control centre shall conform to the following IS specifications.

i)	Fuse Switch & Switch Fuse Units	-	IS : 13947
ii)	Air Circuit Breakers	-	IS : 13947
iii)	Moulded Case Circuit Breaker	-	IS : 13947
iv)	H.R.C. Fuselinks	-	IS : 9224
v)	Current Transformers	-	IS : 2705
vi)	Voltage Transformers	-	IS : 3156
vii)	Relays	-	IS : 3231
viii)	Indicating Instruments	-	IS : 1248
ix)	Integrating Instruments	-	IS : 722
x)	Control Switches & Push Buttons	-	IS : 6875
xi)	Auxiliary Contactors	-	IS : 2959, IS : 6875

11.3 CONSTRUCTION DETAILS

Cubicle shall be mounted on a base folded channel. All doors, sidewalls and interior separations shall be of CRCA MS sheet of 1.5/2MM thickness. CRCA sheets of 2mm thickness for load bearing members and 1.5mm for non-load bearing members. Insulation barriers and protective screens shall be provided wherever required.

Apparatus forming part of the power control centres shall have the following minimum clearances:

i)	Between phases	-	25 mm.
ii)	Between phases and neutral	-	25 mm.
iii)	Between phases and earth	-	25 mm.
iv)	Between neutral and earth	-	19 mm.

11.4 MOULDED CASE CIRCUIT BREAKERS

MCCB shall conform to IS - 13947 and be rated for the currents as shown on the single line diagram. They shall have a short circuit rating as specified elsewhere.

All MCCB shall be provided with an adjustable thermal overload trip device together with an adjustable magnetic short circuit release. The MCCB shall have a trip free toggle mechanism, and dolly shall come to midway position and the trip operates.

The operating mechanism shall be quick make and quick break and trip free and contacts shall be single break type with arcing contacts located within arc chutes.

The MCCB shall be suitable for both vertical and horizontal mounting.

11.5 CURRENT TRANSFORMERS

Current transformers shall be of the ring type suitably fixed between insulating pieces and clamped. They shall conform to the requirement of IS : 2705 and shall have current ratio and outputs and accessories as specified.

11.6 INSTRUMENTS

Indicating instruments shall be flush mounting type square of required size and conforming to the requirement of IS : 1248.

11.7 BUS BARS

The bus bar shall be of copper strip (unless specified otherwise in Bill of Quantities) designed for a continuous current of specified rating and fabricated from bars conforming to high purity electrical grade copper. Each bar shall be provided with flexible expansion links as approved.

The bars shall be suitably supported with fibre glass reinforced epoxy supports to withstand the short circuit forces possible.

Bimetallic washers shall be provided for joining of dissimilar metals electrically.

11.8 CONTROL WIRING

- i) All control wiring shall be carried out with 1100V grade single core PVC cable conforming to IS : 694 having stranded copper conductors of minimum 1.5 sq.mm. section potential circuits and 2.5 sq.mm. section for current transformer circuits.
- ii) Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance.

- iii) Wires shall be identified by numbered ferrules at each end. The ferrules shall be of the ring type and of non-deteriorating material. They shall be firmly located on each wire so as to prevent free movement.
- iv) All control circuit fuses shall be mounted in front of the panel and shall be easily accessible.

11.9 LABELS

Labels shall be of anodized aluminium, with white engraving on black background. They shall be properly secured with fasteners.

11.10 TESTS

The design of the Power Control Centres shall have been type-tested in accordance with following sections of Cl.8 : 1:1 of IS : 8623 :

- a) Verification of temperature rises limits.
- b) Verification of dielectric properties.
- c) Verification of short circuit strength.

Routine tests shall be conducted on each Power Control Centre in accordance with Cl. 8 : 1 : 2 of IS : 8623 and shall comprise :

- i) Inspection of the Power Control Centre is including inspection of wiring and electrical operational tests where necessary.
- ii) Dielectric tests.
- iii) Checking of Protective Measures and electrical continuity of the protective circuits.

11.11 METAL TREATMENT AND FINISH

All steelwork used in the construction of the switchboards should have undergone a rigorous metal treatment process as follows :

- i) Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.
- ii) Pickling in dilute sulphuric acid to remove oxide scales and rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.
- iii) A recognised phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.
- iv) Passivating in de-oxalite solution to retain and augment the effects of phosphating.
- v) Drying with compressed air in a dust-free atmosphere.
- vi) Powder coated to the specified shade of IS : 5. The total thickness of paint should not be less than 25 microns.

11.12 L.T. SWITCHGEARS

Commissioning checks and tests shall include all wiring checks and checking up of connections. Primary/secondary injection tests for the relay adjustment/setting shall be done before commissioning in addition to routine meggar test. Checks and tests shall include the following.

- a) Operation checks and lubrication of all moving parts.
- b) Interlock function checks, if any
- c) Continuity checks of wiring, fuses etc. as required.
- d) Insulation test : when measured with 500V meggar the insulation resistance shall not be less than 100 mega ohms.
- e) Trip tests and protection gear test.

12. CABLING

12.1 STANDARDS & CODES

This chapter covers the specifications for supply and laying of Medium Voltage cables.

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVC insulated heavy duty cables	IS 1554 – 1988
Code of practice for installation and maintenance of power cables	IS 1255 – 1983
Conductors for insulated electrical cables	IS 8130 – 1984
Drums for electrical cable	IS 10418 – 1982
Methods of test for cables	IS 10810 – 1988
Recommended current rating	IS 3961 – 1987
Recommended short circuit rating of high voltage PVC cables	IS 5891 – 1970

12.2 DELIVERY, STORAGE AND HANDLING

Cables shall be delivered at site in original drums with manufacturer's name clearly written on the drum

Manufacturers recommendation particularly in respect of sealing shall be strictly followed.

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418.

During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90° C

Both ends of cables shall be properly sealed to prevent moisture ingress

Drums shall be stored in well ventilated area protected from sun and rain

Drums shall always be rested on the flanges and not on flat sides.

Damaged battens of drums etc. shall be replaced.

Movement of drums shall always be in direction of the arrow marked on the drum.

For transportation over long distance, the drums shall either be mounted on drum wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps.

While transferring cable from 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum.

Cables with kinks or similar visible defects like defective armouring etc shall be rejected.

Cables shall be supplied at site in cut pieces as per actual requirements.

12.3 CABLES

Medium voltage cables shall be aluminium conductor PVC insulated, PVC sheathed armoured conforming to IS 1554. Cables shall be rated for a 1100 Volts.

The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium $\frac{3}{4}$ H or H temper.

Conductors shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer's name and trade mark at every meter length. Cores shall be provided with following colour scheme of PVC insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	Red and Black
3 Core	:	Red, Yellow and Blue
3 $\frac{1}{2}$ / 4 Core	:	Red, Yellow, Blue and Black

12.4 LAYING OF CABLES

12.4.1 General

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables and 15 times the overall diameter for 11 kV cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement can not be met, medium voltage cables shall be laid above HT cables.

12.4.2 In Masonary Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches with chequered plate/RCC covers to be provided by OWNER. Cables shall be laid on painted MS supports of approved design grouted in trench walls at intervals not exceeding 600 mm. If required, cables shall be arranged in tier formation inside the trench. Cables shall be dressed properly so that the clear spacing between the cables shall not be less than the diameter of the cable. Suitable clamps, hooks and saddles shall be used for securing the cables in position. The cost of supplying and fixing cable support work shall be deemed to be included in the rates for laying of cables. Complete details of this support work shall be shown in shop drawings to be prepared by the Contractors and submitted for Owner's/ approval before execution. Works shall be carried out only as per approved shop drawing. Wherever so specified, trenches shall be filled with fine sand.

12.4.3 On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sq mm	Saddles 1 mm thick	45 cm
MV & HV	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sq mm and above	Clamps 3 mm thick 40 mm wide	60 cm

Note : The fixing intervals specified apply to straight runs. In the case of bends, additional clamping shall be provided at 30 cm from the center of the bend on both sides.

12.4.4 Cable Trays

Cable trays, of sizes as per schedule of quantities and drawings, shall be of doubled bend channel design unless otherwise stated. Cable trays shall be fabricated from minimum 2 mm thick perforated sheet steel and shall be complete with tees, elbows, risers, and all necessary hardware. Trays shall be galvanized or painted as specified. Cable trays shall be erected in perfect level and plumb and shall comply with the following:

Trays shall not have sharp edges, burrs or projections injurious to cable insulation.

Trays shall include fittings such as bends, risers etc. for changes in direction and elevation.

Trays shall be supported adequately at minimum 1 m distance from the building structure by means of painted/galvanized MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid. Cost of support arrangement shall be included in the rates quoted for supply and installation of trays. Complete details of this support arrangement shall be shown in shop drawings to be prepared by the Contractors and submitted for Owner's approval before execution. Works shall be carried out only as per approved shop drawing.

Each run of cable tray shall be completed before laying of cables.

Cable trays shall be exposed and accessible.

12.4.5 Laying in Pipes/Closed Ducts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts.

Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable.

These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations.

Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid under roads, pavements etc.

The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing.

Pipes shall be continuous and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing.

No deduction shall be made for sand and bricks not used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles.

12.4.6 Laying of Cables in Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of OWNER shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

12.4.7 Cable Entry into Buildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

12.4.8 Cable Joints

Cable joints shall be resorted to and permitted only if length of cable run is more than standard cable drum length. Cable joints shall not be permitted in any other circumstances. Wherever unavoidable these joints shall be made with specific approval of OWNER, and shall form a part of cable run.

12.4.9 Measurement of Cable Runs

The cable runs shall be measured upto the outer end of the boxes without any allowances for overlap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc for laying as required.

12.4.10 Cable Loops

At the time of the installation approximately 3 meters of surplus cable shall be left as below or as directed by Engineer-in-charge.

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the Owner.

12.4.11 Termination/Jointing of Cables

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable lugs shall be adopted for all cable terminations. Double compression brass glands shall be used. Any termination without use of proper crimping tool shall be liable to be rejected.

In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment.

12.5 TESTING OF CABLING

12.5.1 Tests at Manufacturer's Works

12.5.1.1 Type Tests

Cables shall be subjected to type tests and acceptance test at manufacturers work as per IS : 1554 – 1988 carried out in accordance with appropriate parts of IS : 10810 – 1984. Copies of the type test reports shall be furnished if so required

12.5.1.2 Routine Test

Cables shall be subjected to routine test as per IS : 1554 – 1988, as below.

- a) Conductor resistance test
- b) High voltage test at room temperature.

Copies of routine tests carried out at manufacturers works shall be furnished alongwith the cables

12.5.2 Testing at Site

12.5.2.1 Before Laying

All cables before laying shall be pressure tested for one minute with 1000 volts megger. Cable cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors

12.5.2.2 After Laying

After laying and jointing, cables shall be subjected to a 1.5 minutes AC/DC pressure test.

13. PLANT AND EQUIPMENT

13.1 GENERAL

All plant and equipment shall be new and of appropriate grade and quality suitable for and adequately protected against the prevailing climatic conditions and in accordance with specifications and shall be of approved manufacture. Any plant which is found to be unsuitable for use under these conditions shall be dismantled and replaced by suitable entirely at the expense of the Contractor.

The complete installation shall be carried out in a neat and orderly manner by competent personnel with adequate experience of respective trade of work.

Materials shall be the best of their type available and shall conform to the appropriate standards. Materials of constructions shall be certified by a recognised testing authority and shall be suitable for use in the stipulated

environment. Installation of materials and equipment shall be strictly in accordance with manufacturer's recommendations.

13.2 TESTING AND COMMISSIONING

13.2.1 General

The Contractor shall be responsible for testing and commissioning the entire services installation described in these specifications and will demonstrate the operation of the system of the entire satisfaction of the Owner/Architect.

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purposes.

The entire pipe work in the plant room shall be tested at minimum 14 kg/cm² pressure. The test pressure shall be maintained for at least 2 hrs.

13.2.2 Water for Testing

Water for testing shall be obtained by the Contractor from an approved source. It shall be free from bacterial contamination, silt, grit, sand etc. After testing, the Contractor shall satisfactorily dispose off all water, or it may be re used providing it is clean and is not contaminated.

13.2.3 Test Records

The Contractor shall be responsible for the keeping all records of tests and on completion shall provide records and reports of the tests in triplicate. All test records shall clearly identify the item of the test and must be signed by a witness to the test.

13.2.4 Unsatisfactory Works

If the tests reveal unsatisfactory materials, installation or adjustment, the Contractor shall, at his own expense, carry out such alternations or replacements as may be necessary to rectify the defective work. The Contractor shall then repeat the tests as necessary to establish the satisfactory nature of the alterations or replacements.

13.2.5 Testing at Works

All plants and equipments shall be tested at maker's works before despatch and the test certificate in duplicate shall be forward to Owner/Architect.

The Contractor shall similarly provide a set of manufacturer's certified test curves for any pump installed under the Contract. All tests shall be in accordance with the appropriate Indian Standards.

13.2.6 On Site Testing

The Contractor shall provide on site all the necessary instruments, plant, equipment, materials, water, electricity and labour necessary for carrying out the specified tests. All tests shall be carried out as required to meet the construction programme and the contractor shall include for all necessary isolation and other works as may be required for testing the whole or parts of the installation. The Contractor shall also be responsible for re-testing, if necessary, until satisfactory tests are achieved.

13.3 IDENTIFICATION OF PIPES LINES & EQUIPMENT

All pipeline installation shall be provided with a colour identification system. The system in general shall be as per IS:2379-1983-Specification of Colour Code for the Identification of Pipe Lines. The colour identification system shall comprise of :

- a) Basic Identification Colour over the whole length of pipe
- b) Code indication bands for precise determination of the contents being carried by the pipe

The code indication bands shall be minimum 150mm wide and shall be placed at all junctions, at both sides of valves, service appliances, bulk heads, wall penetrations and at any other place where identification is necessary.

The colour of code indication bands shall be as directed by the Owner/Architect.

The direction of flow shall be clearly marked on the pipe lines.

The equipment shall be identified with identification plates as directed by the Owner/Architect

14. LIST OF APPROVED MAKES/MANUFACTURES OF MATERIALS**NOTE :**

i) All Brand Names/Manufacturers are Indian unless specified otherwise.

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
A) Plant & Equipment		
1.	Packaged Hydropneumatic Systems	a) Grundfos, Denmark b) Wilo, France
2.	Clear Water Pumps	a) Grundfos, Denmark b) Wilo, France
3.	Drainage & Sewage Pumps	a) Grundfos, Denmark b) Wilo, France
4.	FRP Vessel	a) Pentair b) Aventura
4.	Mixing Tank/ Calorifier	Custom Built fabricated as per IS:2828
B) Pipes & Fittings (ISI Marked or Approved Quality)		
1.	Mild Steel Pipes/ G.I. Pipes conforming to IS:1239	a) Tata b) Jindal, Hissar
2.	Mild Steel Pipesconforming to IS:3589	a) Swastik b) Prakash Surya c) Jindal, Hissar
3.	Standard M.S. Fittings	a) VS Engineering b) True Forge c) Sant

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
4.	Forged Steel Fittings	a) VS Engineering b) JK Forging c) True Forge
5.	G.I. Pipes	a) Tata b) Jindal, Hissar
6.	G.I. Fittings	a) "R" Brand b) Unik Brand
7.	S. S. Pipes	a) Chockesy b) Décora c) Rattan Mani d) Apex
8.	S. S. Fittings (Investment Casting)	a) H.S. b) Interfeed
9.	PVC Pipes and Fittings	a) Supreme b) Prince c) Finolex
C)	Valves	
1.	Butterfly Valves	a) Danfoss b) Audco c) KSB d) Viking
2.	Brass/Bronze Ball Valves	a) RB, Italy b) CIM, Italy c) Danfoss,
3.	Gunmetal Gate Valves, Non-return Valves	a) Leader b) Zoloto
4.	T/Y Strainer	a) Leader b) Zoloto
5.	Solenoid Valves	a) Danfoss b) Aira - Airmax
6.	Diaphragm Valves	a) Saunders
7.	PVC Ball Valve	a) Plastro Plasson b) Astral
8.	Dual Plate NRV	a) Advance

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
D)	Electric Switch Gear and Starters	
1.	Electric Switch Gear	a) Siemens b) L & T c) ABB d) Merlin Gerin e) Legrand f) GE - Power
2.	PVC Insulated Armoured Power and Control Cables	a) Skytone b) Polycab
3.	MCCB	a) L & T b) Merlin Gerin c) Legrand
4.	MCB	a) L & T - Hager b) Merlin Gerin c) Legrand
5.	Starters, Relays etc.	a) L & T b) ABB c) Control & Switch Gear d) GE - Power
6.	Push button and indication lights	a) L & T b) Siemens c) Telemenague d) Vaishno e) BCH
7.	Digital Voltmeter & Ammeter	a) AE b) Cadel c) Enercon
8.	Selector Switches	a) L & T b) Keycell c) Salzar
9.	HRC Control Fuses	a) L & T b) Siemens

S.NO.	MATERIAL	BRANDNAME / MANUFACTURER
E)	Miscellaneous	
1.	Water Level Controllers (Magnetic Float Type)	a) Janus b) Elegant Control c) Switzer
2.	Anti-vibration Pads/Footings	a) Resistoflex b) Kanwal
3.	Vibrations Eliminators	a) Resistoflex b) Flexcons c) Arrowflex d) Kanwal
4.	Pressure Switches	a) System Sensor, U.S.A b) Danfoss c) Indfoss d) Switzer
5.	Pressure Gauges	a) H. Guru b) Fiebig
6.	Expansion Bolts	a) Hilti
7.	G.I. Hangers for Pipes / Adjustable Hanger	a) Chilly
8.	Welding Rods	a) Advani b) Victor c) Maruti
9.	Cable tray	a) Pic b) Pilko c) National d) Slotco

Note :

The Contractor shall provide the materials as per the MAKE or BRAND indicated above.

PROJECT : CLARKS-JAIPUR						
SUBHEAD : Supplying, Testing and Commissioning of Pumping Machinery						
BILL OF QUANTITIES						
S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
	NOTES :					
	1) The pump shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Head-Discharge (H-Q) characteristic curve over a range of 50% to 130% capacity					
	2) The total head capacity curve shall be continuously rising towards the shut off. The shut off head shall be at least 110% of the total head. The pump should deliver at least 125% of its rated capacity at 75% of the specified total head					
	3) All associated piping, valves & other appurtenances shall be paid separately as per relevant items					
	4) Wherever mechanical seal has been asked for, it must be ' factory fitted ' at pump manufacturer's works.					
	5) The Tenderer must submit along with his offer, the make and the model of the pump unit proposed by him. The tenderer must mention clearly wherever he is offering alternative material of construction for various types of pumps.					
	6) The Tenderer must fill all the blank fields					
1.0	RAW WATER TRANSFER PUMPS AND CONTROL PANEL					
1.1	Supply and commissioning of raw water transfer pumps as per following details: The pump unit shall be complete with :					
	a) Pumps: Horizontal / vertical monoblock booster pumpset with mechanical seal					
	Material of Construction (M.O.C): Corrosion Resistant in general					
	: Casing — Stainless Steel					
	: Impeller — Stainless Steel					
	: Shaft — Stainless Steel					
	Motor: 2900 RPM; 3Ph 415V 50Hz					
	Insulation Class - B Min					
	Protection - IP44 Min.					
	Duty:					
	Discharge : 5 M ³ /hr.					
	Working Head : 20 M	2		No		

S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
	b) Common fabricated base frame, duly painted.					
	Details of Equipment offered (To be filled in by the tenderer)					
	Pumps					
	Make:					
	Model:					
	HP/KW:					
	M.O.C : Casing —..... : Impeller — : Shaft —					
1.2	Supply and commissioning of electric pump control panel metal clad cubicle type suitable for 415 V AC three phase 4 wire 50Hz supply system. The panel shall be completely compartmentalised and complete with relays, contactors, starters, sequence controller, Copper Bus Bars, designation labels as per requirement, continuous earth bar, panel separators, protective screens, cable clamping support system, top/bottom cable gland plates for incoming and out going cable entries as per details given below:					
	Sequential pump controller is to keep both the pumps operational but with one remaining standby at any particular moment.					
	Note: The start stops operation of the pumps shall be controlled with magnetic float type level sensors in the overhead tank. The cost of level controller to be mounted in the pump panel and level sensors in under ground and over head tanks is to be included in this item. However, control cabling between sensors and the panel will be paid separately as per the actual measurement under a separate item.					
	There shall be an audio visual alarm in case any pump fails to start.					
	INCOMING					
	32A FP MCB - 1 No.					
	BUSBARS					
	A set of 100A 415V 50Hz 3 Ph 4 wire Copper busbars.					
	INSTRUMENTS FOR INCOMER					
	— Ammeter 0-40A with Selector Switch (including a set of CTs 40/5A) — Voltmeter 0-500V with selector switch. — A set of phase indicating light with HRC fuses.					
	INSTRUMENTS ON OUTGOINGS					

S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
	— Ammeter with selector switch for each pump. — Indication lights for ON-OFF indication for each pump					
	Selector switch for auto/manual mode selection for the pumping system					
	OUTGOING FEEDERS					
	For Pumps					
	16A 10KA TP MCB, 3.0HP DOL starter, overload relay, single phase preventer, timer etc. - 2Nos.	1		Set		
	Notes: 1) Switchgear and starter ratings are indicative. The Tenderer shall quote for the actual rating required as per the pump model proposed by him.					
	2) Provision for BMS connectivity. The panel should have sufficient no. of potential free contacts for connectivity with Building Management System for monitoring purposes					
	TOTAL for " Raw Water Transfer Pumps and Control Panel" carried over to SUMMARY				Rs.	

S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
2.0	HYDROPNEUMATIC SYSTEMS					
2.1	Supply, testing and commissioning of clear water packaged hydropneumatic pumping system for general water supply (with variable frequency drive for each pump) as per following details:					
	The packaged unit shall be complete with :					
	a) Pumps: Vertical monoblock booster pumpset with mechanical seal and VFD- 3 nos. (2 working+1 standby)					
	Material of Construction (M.O.C): Corrosion Resistant in general : Casing — Stainless Steel -AISI 304					
	: Impeller — Stainless Steel -AISI 304					
	: Shaft — Stainless Steel - AISI 316					
	: Pump Head — Cast Iron					
	: Base — Cast Iron					
	: Motor Stool — Cast Iron					
	Motor: 2900 RPM; 3Ph 415V 50Hz					
	Insulation Class - F					
	Protection - IP54 Min.					
	Duty:					
	Discharge (each pump) : 3 M ³ /hr.					
	Working Pressure : 5.5 kg/sq.cm.					
	b) Pressure Tank: FRP vessel with replacable polyetheruethane (PEU) bladder certified for drinking water. Minimum 8 Bar pressure rating — 2 Nos. each of 300 to 350 Lts. Capacity.					
	c) Interconnecting Pipe work, Valves and Vibration Eliminators : Common suction & delivery headers in Stainless Steel (Grade 316). Isolating valves, non return valves and vibration eliminators on suction & delivery sode of pumps.					
	d) Common fabricated base frame, duly painted.					
	e) Power and control cabling between panel and pumps.					
	f) Accessories like presure guages, pressure switches etc.					
	g) Electric control panel mounted on the skid for automatic operation of pumps comprising incoming switch fuse unit/MCBB, digital voltmeter & ammeter with selector switches, over load and under voltage protection devices, single phase preventors, MCB and DOL starter for each pump, indicating lights etc. all complete.					
	h) Programmable Control System					
	Programmable Control System shall be PLC based, duly authenticated by the Pump Manufacturer.	1		Set		

S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
	Details of Equipment offered (To be filled in by the tenderer)					
	Pumps					
	Make:					
	Model:					
	HP/KW:					
	M.O.C : Casing —..... : Impeller — : Shaft —					
	Pressure Tank					
	Make:					
	Model:					
	Capacity					
	M.O.C : Shell —..... : Bladder —					
	Valves					
	Make:					
	Type:					
	Size: Suction side —..... Delivery side — NRV —					
	Type of Programmable Logic Controller —					
	Notes: 1) Switchgear and starter ratings are indicative. The Tenderer shall quote for the actual rating required as per the pump model proposed by him.					
	2) Provision for BMS connectivity. The panel should have sufficient no. of potential free contacts for connectivity with Building Management System for monitoring purposes					
	TOTAL for "Hydropneumatic Systems" carried over to SUMMARY				Rs.	

S.NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT
3.0	SUBMERSIBLE DRAINAGE PUMPS				
3.1	Supply, testing and commissioning drainage pumping system in the sumps of basement comprising of the following:				
	a) 2 Nos. Vertical fully floodable type submersible drainage pumps in close coupled design single stage, suitable for handling minimum 12 mm dia solids.				
	Duty				
	Discharge of each pump : 10 M ³ /hr.				
	Working Head : 15 M				
	Material of Construction (M.O.C): Corrosion Resistant in general				
	: Bearings — Anti friction, prelubricated ball bearings, packed with grease for life.				
	Motor: — Dry Motor with built in over load protection				
	Protection - IP68.				
	Insulation Class - F				
	b) Electric control panel for automatic operation of pumps as per the water level in the sump.The pump operation shall be controlled with magnetic float type level controller .The Panel shall comprise of incoming MCB, digital voltmeter & ammeter, On-Off lamps, starters with circuit breakers for each pump, rotating start sequence, both pumps to work simultaneously to meet peak flow There shall be an audio-visual alarm, if any pump fails to start.				
	c) Power cabling between panel and pumps.				
	d) Pump suspension systemwith Stainless Steel Sling wire with 'U' clamp.	2	Set		
	Details of Pump offered (To be filled in by the tenderer)				
	Make:				
	Model:				
	HP/KW:				
	M.O.C : Casing —..... : Impeller — : Shaft —				
	TOTAL for "Submersible Drainage Pumps" carried over to SUMMARY			Rs.	

S.NO.	DESCRIPTION	QTY		UNIT	RATE	AMOUNT
	PLUMBING PANEL					
4.0	Supply, testing and commissioning of electric distribution board , metal clad cubicle type suitable for 415V AC single phase 50Hz supply system. The panel shall be completely compartmentalised and complete with Copper Bus Bars, designation labels as per requirement, continuous earth bar, panel separators, protective screens, cable clamping support system, top/bottom cable gland plates for incoming and out going cable entries as per details given below:					
	MAIN PANEL - WATER PUMPING SYSTEM					
	INCOMER					
	250A 25KA FP MCCB with rotary handles - 1 No.					
	BUSBARS					
	A set of 400A 415V 50Hz 3 Ph 4 wire aluminium busbars.					
	INSTRUMENTS FOR INCOMER					
	A set of instrumentation with a set of Current transformer 250/5A with Ammeter 0-250A, Selector Switch, Voltmeter 0-500V with selector switch and a set of phase indicating lights with HRC fuses.					
	OUTGOING FEEDERS					
	32A DP 10KA MCB - 2 Nos.					
	25A FP 10KA MCB - 2 Nos.					
	40A FP 10KA MCB - 2 Nos.					
	63A TPN 25KA MCCB with rotary handle - 5 Nos.					
	100A TPN 25KA MCCB with rotary handle - 2Nos.	1		Set		
	TOTAL for "Cabling" carried over to SUMMARY					
					Rs.	
	GRAND TOTAL				RS.	