

Sl. No.	Design Criteria	Unit	350	400	500	450
	Dia of wash water inlet main	DN(mm)	350	400	500	450
	Backwash drain pipe / valve					
	Velocity considered	m/sec	1.5	1.5	1.5	1.5
	Backwash drain flow	m ³ /hr	680	1020	1632	1190
	Backwash drain pipe / valve	DN(mm)	400	500	650	600
	Air Scouring Line					
	Velocity considered	m/sec	20	20	20	20
	Flow to individual bed	Nm ³ /hr	900	1350	2150	1550
	Pipe / Valve size to individual bed	DN(mm)	250	250	250	250
9	Filtered Water Channel					
	Flow through filtered water channel	m ³ /hr	950.00	2200.00	4800.00	2675.00
	Velocity considered	m/sec	0.53	0.58	0.71	0.59
	Cross sectional area channel	m ²	0.497	1.054	1.880	1.250
	Size of channel considered (W) x (LD) + (FB)	m	1.0 x 0.5 + 0.3	1.0 x 0.5 + 0.3	1.25 x 1.5 + 0.3	1.0 x 1.25 + 0.3
	Throat width of parshall flume	mm	150	300	450	300
	Depth of water : Measured in Flume converging section Ref: Parshall Flume Data and Useful information from NALCO Water Hand Book Dimensional Chart for Parshall Flume is enclosed					
	Depth of channel considered	m	0.4	0.75	1	0.8
	Velocity of water considered	m/sec	0.8	0.8	0.8	0.8
	Therefore, width of channel	m	0.69	0.85	1.39	0.97
	Feed channel size considered (W) x (LD) + (FB) for 10 m length	m	0.70 x 0.40 + 0.3	0.85 x 0.75 + 0.3	1.40 x 1.00 + 0.3	1.00 x 0.80 + 0.3
10	Sludge Sump					
	Sludge flow to Sludge sump	m ³ /day	798.00	1848.00	4032.00	2247.00
	i.e	m ³ /hr	33.3	77.0	168.0	93.6
	Retention time considered	Hrs	2	2	2	2

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Sl. No.						
	Volume of sump required	m ³	66.50	154.00	336.00	187.25
	Depth of sump considered	m	3.5	4	4	4
	Area of sump required	m ²	19.00	38.50	84.00	46.81
	Size of sump provided (L) x (W) x (LD) + (FB)	m	5.0 x 4.0 x 3.5 + 0.5	7.5 x 5.2 x 4.0 + 0.5	10.0 x 8.5 x 4.0 + 0.5	8.0 x 6.0 x 4.0 + 0.5
11	Chemical Dosing System					
11.1	Alum Solution Dosing Tank					
	No of tanks	nos	2	2	2	2
	Design Raw water flow capacity	m ³ /hr	950.00	2200.00	4800.00	2675.00
	Alum dosage rate at peak demand as per NIT	mg/l	50	50	50	50
	Specific gravity of alum solution		1.1	1.1	1.1	1.1
	Alum requirement	kg/Hr	47.5	110	240	133.75
	Volume of tank for 1 hr storage with 5 % solution	m ³ /hr	0.86	2.00	4.36	2.43
	Retention time considered	Hr	12	12	12	12
	Volume of tank required for 12 hrs storage	m ³	10.36	24.00	52.36	29.18
	Size of each alum tank (L) x (W) x (LD) + (FB)	m	2.5 x 2.0 x 2.0 + 0.5	4.0 x 2.5 x 2.5 + 0.5	5.0 x 4.0 x 2.5 + 0.5	3.5 x 3.0 x 2.5 + 0.5
	Alum Solution Dosing Pumps					
	No of pumps 1(W) + 1(S)	nos	2	2	2	2
	Capacity of each dosing pump required	LPH	1500	1500	1500	1500
	Capacity of each dosing pump provided	LPH	1500	1500	1500	1500
	Head	m	20	20	20	20
	Alum requirement for one month (100 % chemical)					
	= Alum requirement x 24 x 30	kg	34200	79200	172800	96300
	i.e	Tonne	34.2	79.2	172.8	96.3
	Considering bulk density of alum	T/m ³	1.1	1.1	1.1	1.1
	Volume of alum required	m ³	31.09	72.00	157.09	87.55
	Storage area required for stack height of 2 m	m ²	15.55	36.00	78.55	43.77
	Area provided	m ²	20.00	40.00	80.00	45.00
11.2	Polyelectrolyte Solution Dosing System					
	No of dosing tanks	nos	2	2	2	2

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S/No	Description	Unit	1	2	3	4
	Design raw water flow capacity	m ³ /hr	950.00	2200.00	4800.00	2675.00
	PE dosage rate at peak demand as per NIT	mg/l	0.3	0.3	0.3	0.3
	Specific Gravity of PE		1.05	1.05	1.05	1.05
	PE requirement	kg/hr	0.285	0.66	1.44	0.8025
	Volume of tank for 1 hr storage with 0.5 % solution	m ³ /hr	0.054	0.126	0.274	0.153
	Retention time considered	Hrs	12	12	12	12
	Volume of tank required for 12 hrs storage	m ³	0.651	1.509	3.291	1.834
	Volume of tank provided	m ³	0.70	1.60	3.30	1.90
	Size of each PE tank (L) x (W) x (LD) + (FB)	m	1.0 x 1.0 x 1.0 + 0.5	1.5 x 1.0 x 1.0 + 0.5	2.0 x 1.5 x 1.0 + 0.5	2.0 x 1.0 x 1.0 + 0.5
	PE solution dosing pump					
	No of pumps 1(W) + 1(S)	nos	2	2	2	2
	Capacity of each dosing pump required	LPH	100	100	100	100
	Head	m	20	20	20	20
	PE requirement per month	Tonne	0.205	0.475	1.037	0.578
	No. of drums each of 200 kgs	nos	1.03	2.38	5.18	2.89
	Area requirement @ 0.5 m ² per drum	m ²	2.05	4.75	10.37	5.78
	Storage area provided	m ²	3.00	5.00	11.00	6.00
11.3 (a)	Hypochlorite Dosing System (Additional Facility)					
	No of dosing tank	nos	2	2	2	2
	Design filtered water outlet flow	m ³ /hr	791.67	1833.33	4000.00	2229.17
	Hypochlorite dosing rate	mg/l	3	3	3	3
	Chlorine content in hypochlorite solution	%	6	6	6	6
	Hypochlorite solution (6%) requirement	kg/hr	39.58	91.67	200.00	111.46
	Volume of dosing tank required for 1 hr storage	m ³ /hr	0.040	0.092	0.200	0.111
	Retention time considered	hrs	12	12	12	12
	Volume of tank required for 12 hrs storage	m ³	0.48	1.10	2.40	1.34
	Volume of tank provided	m ³	0.60	1.20	2.40	1.40

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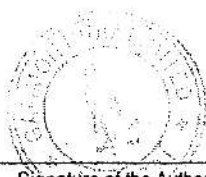
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Sl No	Size of each tank: As per manufacturer standard		2 x 350 lt	2 x 600 lt	2 x 1500 lt	2 x 1000 lt
11.3 (b)	Hypochlorite Solution Dosing Pump					
	No of pumps	nos	2	2	2	2
	Capacity of each dosing pump required	lt/hr	5000	5000	5000	5000
	Capacity of each dosing pump provided	lt/hr	5000	5000	5000	5000
	Head	m	15	15	15	15
	Provide one no. HDPE tank of 10 cum. Capacity to store hypochlorite solution					
	No of days of storage provided	days	10	4.5	2.1	3.75
	Provide 2 (1W + 1S) nos unloading pumps each of capacity 5 m ³ /hr @ 15 m head					
	Chlorination					
	Chlorination system will be provided					
Chlorine Tonner -	No of days storage	30	30	30	30	
	No of tonner	3	6	12	8	
	Total 30 + 8 = 38 chlorine tonner may be purchased with licesences for handling hazardous chemicals. Every week 8 cylinders have to be replaced and 8 will be on transit.					
11.4	Filtered water storage tank over chemical house is provided to supply service water for chemical solution preparation, flushing, floor washing etc.					
	Size of overhead tank (L) x (W) x (LD) + (FB)	m	3.5 x 2.5 x 1.2 + 0.3	3.5 x 2.5 x 1.2 + 0.3	3.5 x 2.5 x 1.2 + 0.3	3.5 x 2.5 x 1.2 + 0.3



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SECTION - H

TECHNICAL SPECIFICATIONS FOR ELECTRIC MOTORS, CONTROLS ETC.

1. General

- 1.1 This specification covers the design, manufacture, testing, supply, erection and commissioning of the motor control system, and electric motors and other electrical installations such as lighting, grounding and cabling etc, for the water treatment plant and shall be considered as an integral part of the relevant specification for equipments of the treatment plant.

The equipments shall be designed, manufactured and tested in accordance with latest Indian Standards and code of practice published by the Bureau of Indian Standard when ever available.

The Electrical equipment shall also conform to the latest I. E. Riles as regards safety, earthing etc.

1.2 Systems Particulars

Voltage	6000 V
Frequency	50 Hz + 3%; Phase - 3 Phase 4 wire
Fault Level	25 MVA at 415 Volts.

1.3 Climatic Condition

Climatic conditions are tropical, humid and dusty, maximum humidity often reaches 100% but the conditions of maximum humidity and maximum temperature do not occur simultaneously. The atmosphere is polluted as such the conditions are conducive to fungus growth and corrosion.

Maximum ambient temperature	45 ⁰ C
Annual rainfall	3000 mm (Approx.)
Elevation	Below 10 meters (Max.)

2. Motors

- 2.1 Motors of treatment plant shall be of squirrel cage type induction motors capable to operate at a supply voltage 415 V + 10%, 50 Hz + 3% with class 'B' insulation horizontal type & shall conform IS 325/1970 (Pt-II) for use as prime mover to dry water treatment plant pump of various capacity. Performance curve of Motors are to be furnished.
- 2.2 Air Circuit Breakers / Oil circuit Breakers are to be used as per requirement for supplying power to the motor.
- 2.3. The motor terminals shall be suitable for entry of requisite number of cables of armoured P. P. C 1.1 kv grade.

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- 2.4 Over load (Bimetal type), under voltage, over current earth fault relays are to be provided for motors above 50 k.w rating.
- 2.5 Motors shall be provided with local/ remote start stop push button stations and lock out switches located near the motor wherever specified.
- 2.6 Motors shall be capable of starting against full load and accelerate satisfactorily at a minimum voltage of 85% of the rated terminal voltage.
- 2.7 Locked rotor current of motors at rated terminal voltage shall not exceed 600% of the rated full load current and the safe stalls time of the motor shall be less than the corresponding accelerating time.
- 2.8 The capacity, speed, starting torque and other characteristics of the motors such as axial thrusts, accelerating and stalled time capacities etc. shall be as required for the driven equipment. Motor for indoor type shall be designed for at least 50⁰C temperature over 45⁰C & for outdoor type this shall be 50⁰C over ambient 50⁰C.
- 2.9 All motors shall be provided with ball and / or roller bearings. The chemical pump drive motors shall have life sealed bearings. Motors shall be suitable for one cold and two hot starts in quick succession.
- 2.10 The following data for the motors proposed to be supplied shall be furnished at the time of submitting the tender :

1. Name of the Manufacturer
2. Application (i.e. driven equipment)
3. Quantity
4. Motor Horse Power (BHP)
5. Guaranteed input to motor with pump operating at duty point (KW)
6. Type of enclosure
7. Class of insulation
8. Voltage (Volts)
9. Frequency (Hz)
10. Phases
11. Type of bearings
12. Temperature rise over an ambient temperature of 45⁰C (°C)
13. Type of starting
14. Starting current (max) % of full load
15. Starting torque (max) % full load

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- 16. Accelerating time
- 17. Full load speed
- 18. Rated power factor
- 19. Motor efficiency
 - a) At full load b) At 75% full load
- 20. Confirmation that back to back guarantee from the manufacturer shall be furnished.

2.11 Motors shall be subjected to necessary type and routine tests to prove that they are free from electrical and mechanical defects and establish that the design and construction of the motors are satisfactory.

2.12 Requisite (but not less than six) copies of certified dimensioned outline drawings, test reports and instruction books of the motor shall be submitted by contractor for Engineer's approval.

3. Starting Equipment (Motor Control Centre)

3.1 The design, manufacture and testing of various equipment covered by this Specification shall comply with the latest issue of Indian Standard specification.

3.2 The incoming breaker of the Main M.C.C. shall be draw out type of required amperage (details to be submitted by the Tenderer) Electrically/Manually operated air circuit breaker. The breaker shall be provided with CTs and P.T.C. for metering and protection. The protection includes over load, earth fault, under voltage and differential.

3.3 The motor starter unit shall be fully draw out type incorporating in isolating switch, high rupturing capacity fuse, contactor type air circuit breaker suitable for Direct on line auto/manual, local/remote starting.

3.4 Where H.R.C. fuses are used, proper Co-ordination to prevent undue tripping under starting condition shall be ensured.

3.5 The isolating switch shall be capable of breaking safely the full load current of the associated motor.

3.6 The motor control centre shall be sheet steel cubicles, indoor/outdoor, floor mounting free standing type. It shall be totally enclosed, dust tight and vermin proof. It shall be of modern design of nearly U-shape having vertical and inclined faces. So that it can be operated conveniently by the person sitting in a revolving chair in front of the M.C.C.

The motor control centre shall be sheet steel cubicle, indoor/outdoor, floor mounted free standing vertical type. It shall be totally enclosed, dust-tight and vermin proof.

3.6.1 The sheet steel used shall not be less than 2.0 mm thick and the surface shall be free from dents and hammer marks.

3.6.2 The cubicle shall be of uniform height and depth throughout its length and suitable barriers shall be provided between the modules associated with outgoing circuits.

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3.6.3 It shall be of front type with all switches, push buttons, indicating lamps on the front, the rating of switch fuses, contactors, etc, shall suit the rating of the driven equipment and shall be arranged neatly in different compartments.

3.6.4 The frame work of MCC shall have the switches, switch fuse units, starters and contractor etc. in multi-tier compartments independent of back plate.

The compartment shall be so inter locked that it shall not be possible to open the door with switch in closed position.

3.6.5 The number of tiers to be provided in such panel shall be determined on the following basis :

For motor up to 6 HP 4 Tiers

For motor over 5HP & up to 50 HP 3 Tiers

For motor over 50 HP 2 Tiers

3.6.6 The M. C. C shall be provided with aluminum alloy bus bars suitable for the required current capacity with mechanical strength properties approximating closely with that of copper. The busbar shall be housed in separate chamber and shall be supported on unbreakable, non-hygroscopic supports rigidly held to the frame work of the chamber and shall be painted to identify various phases.

3.6.7 A cable compartment shall be provided for each module for easy termination of all incoming and outgoing cables. Adequate supports shall be provided for the cables where necessary.

3.6.8 The cable compartment shall be provided with covers which can be removed for easy access during cabling.

3.6.9 The M.C.C. shall be completely factory wired with P.V.C insulated wire of minimum 1.5 sq. mm copper and shall be fitted with identification ferrules at each end.

3.6.10 The termination shall be of adequate current rating and sizes to suit individual feeder requirements. Suitable cable lugs shall be provided for cable connections.

3.6.11 The Contactor contact points shall be silver plated and rated to carry the maximum short circuit current without any damage or pitting.

3.6.12 There shall be adequate number of N/O and N/C auxiliary contacts suitably rated on each breaker. These contacts shall be operated mechanically from the main shaft of the breaker and shall be so located as to be accessible from the front.

3.6.13 The auxiliary contacts in the trip circuits shall close before the main contact s and shall open after the main contacts have opened. All other contacts shall close simultaneously with the main contact.

3.6.14 The M.C.C. shall be supplied complete with cable boxes for the incoming. Cable entry shall be at the bottom of panel. Sufficient space for entry of power and control cables shall be provided in motor control centers.

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- 3.6.15 The M.C.C panels shall be provided with copper ground bus which shall be securely mounted across the inside base of the panels. No solder connection will be accepted.
- 3.6.16 Each M.C.C shall be provided with a 250 volts, 250 watts heater complete with switch. The switch shall be mounted inside and easily accessible on opening the panel front door.
- 3.6.17 The M.C.C. units shall be provided with identification and circuit levels, name plates etc.
- 3.6.18 One synchronous clock of suitable dimension shall be provided on top the M.C.C. panel.
- 3.6.19 The N.C.C shall be provided additional loops as per details overleaf and also any other additional loops as may be considered necessary.

Sl. No.	Equipment/Unit	Provision for Spare over actual number of motors as per N.I.T.
1.	Flash Mixer	1
2.	Alum Agitator	2
3.	Clarifier Bridge / Scraper	2
4.	Flocculator	2
5.	Sludge pumping	1
6.	Back ash water pumping	1
7.	Recirculation of waste water	1
8.	Sir blower	1
9.	Chlorination Booster	1
10.	Alum solution make up water pumping	1
11.	Rest of the motors	1
12.	Lighting	2

- 3.7 The motor starters shall be housed in separate compartments and the various compartments shall be joined together to form a rectangular free standing rigid assembly with dead front. The whole assembly along with the buses shall be suitably reinforced and braced to withstand all mechanical and electrical forces resulting from an dead short circuit, They shall be tropicalised and provided with heaters for stand by duty.
- 3.8 All motor starters shall be provided with thermal C/C protection. While providing fuse for protection, co-ordination must be ensured to the effect that the 415 volts incoming feeder breakers do not trip before the fuse blows. If considered necessary timer relays shall be included in the scope of supply.
- 3.9 All feeders and starters above 5 kw shall be provided with Ammeters with current transformer of proper rating.

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3.10 All tests shall be performed in accordance with relevant ISS test codes and arrangements made for witnessing by the Engineer, at the premises of the manufacturer.

The Contractor shall supply 6 (six) copies of certified test reports of the factory test carried out on each breaker.

3.11 The tenderer shall submit a list of spares recommended by the supplier for three years of operation of the M.C.C. along with their item wise price.

3.12 The following drawing and type test reports in triplicate shall be submitted along with the tender for the purposes of preliminary study :

- i) General outline and dimension drawings of the motor control centre giving as many details as possible.
- ii) Wiring and control diagram.
- iii) Reports of type test conducted on prototype switch gear.
- iv) Illustrative and descriptive literature.

4. Power and Control Cable

4.1 All 415 V power cables shall be of 1.1 KV grade standard aluminum conductor, PVC insulated armoured and the control cables shall be of copper conductor, PVC insulated armoured, All power and control cables shall be laid neatly in covered masonry cable trenches, while selecting cable sizes suitable de-rating factor shall be considered. Tenderers shall furnish a list giving type, size and length of the cable proposed to be used.

4.2 Cable use for clarifier power supply shall have at least two spare cores each. Free end of the spare cores shall be properly sealed and clamped.

4.3 All cables within buildings shall be laid neatly on walls or on trays as the case may be and shall be readily accessible for inspection and /or replacement.

5. Current Collector on Circular Clarifier Bridge

5.1 Current collector rings shall be constructed from phosphor bronze (or equal approved materials) of ample cross section and shall be widely spaced to facilitate maintenance and obviate flashover.

The shall be contained in brush holders fitted with adjustable springs for applying the correct pressure on the brushes throughout their life.

The brush gear must be designed so that no current is carried by the springs,. The whole brush assembly shall be continuously rated and shall be capable of removal as a unit without disturbing the collector rings.

The current collector ring assembly shall be properly insulated and housed in a dust, vermin, weather and splash proof enclosure and shall be securely fixed with central pivot /or turntable as appropriate. The enclosure shall have thorough anti-rust treatment. The central rotating member shall have ball bearing at both ends.

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Automatic Control of Plant

The system of control and protection for unmanned automatically controlled plant shall be such that the plant is protected against further damage should any piece of apparatus fail and shall be capable, should the electricity supply fail, of restarting correctly on resumption of supply.

Annunciator Panel

An annunciator panel suitable for operation of 230 volts, AC supply shall be provided in the control room to give an audible and visual indication of the following condition :

- 1) Faulty operation of all motors.
- 2) Low level indication of alum solution storage tank.
- 3) Low level indication of alum dosing tank.
- 4) High level indication of alum dosing tank.
- 5) Permissible maximum flow condition of raw water.
- 6) System malfunction in flash mixer.
- 7) System malfunctions in clarifloculators.
- 8) Low pressure condition in air-vessel for pneumatic valve operation.
- 9) Maximum and minimum water level in filter feed launder.
- 10) Maximum water level in filter waste channel.
- 11) Chlorine drum change over panel.
- 12) Failure of chlorinator motive water supply.
- 13) Maximum head loss condition in individual filters.
- 14) Maximum liquid level in sludge pump pit.

The annunciator panel shall be self contained units with the alarm relays associated with particular windows, mounted on the housing behind the facia.

The panel shall have push button for 'Accept' 'Reset' and 'Test' position. The alarm relays shall be mounted in sealed cases and shall be interchangeable. There shall be a common alarm for audible indication for all fault conditions.

The visual indication shall not be normally visible. The inscription shall be visible only when particular facia lamp glows steadily. The replacement of lamps and facia inscription shall be possible from front of the unit.

The alarm sequence shall be as under :

- a) Alarm relay pick up and seal in. Alarm is energized and simultaneously the particular facia window lighted up.

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- b) Operator presses the 'accept' push button alarm is silenced but the facia lamp glows steady.
- c) Operator presses the 'Reset' button. The alarm relays shall reset provided the fault is removed.
- d) Operator presses the 'Test' button, all lamps of the annunciator panel are lighted up unless a lamp has blown.

- 7.6 The annunciator shall operate satisfactorily between 80% and 110% of the rated voltage.
- 7.7 The annunciator panel shall have provision for 4 (four) Blanks to accommodate any facia in future.

8. LEVEL CONTROLLERS

- 8.1 Operation of motors and annunciator through preset levels in tanks shall be by means of level relays sensing by immersed electrodes.

9. ILLUMINATION

- 9.1 Internal lighting shall be provided in all buildings of the plant including the weigh bridge cabin. Lighting shall also be provided near all outdoor equipment of the plant and for general outdoor inspection at night (for security) around each superstructure unit.
- 9.2 The wiring for lights, fans, weigh bridge, flow metering instruments, plugs and power plug points shall be carried out nearly through heavy gauge, galvanised surface conduits with necessary junction boxes.
- 9.3. The intensity of illumination for lighting of different sections of the plant shall be between 120-200 lux depending on the working condition of the related section and shall be properly co-ordinate to keep balanced three phase voltage.
- 9.4 Industrial type fluorescent lamps with vitreous enameled reflect complete with chokes, starters, etc, of renowned and approved manufacture shall be used in all places of the plant except in control room, laboratory, entrance ball and chlorination room where decorative fluorescent fittings with diffusers shall be used.
- 9.5 In Clarifier Bridge deck industrial type dispersive reflector, vitreous enameled finish shall be used.
- 9.6 250 watt mercury vapour lamps shall be provided at the following places :
 Entrance to chemical house,
 Entrance to chlorine drum room,
 Entrance to Filter Annexe building.
 Rear entrance to Filter house.
- 9.7 A three pin 5 Amps, lighting plug shall be provided on each switch board for controlling lights and fans.

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10 CELLING, EXHAUST, CABIN & PEDESTAL FANS

10.1 There shall be 8 Nos. ceiling fans of 1400mm sweep in control room 6 Nos. in entrance hall and 3 Nos. in laboratory and requisite number of exhaust fans in laboratory and as specified elsewhere. Cabin fans of 400 mm sweep are to be provided over each control desk of Fitter Beds provision shall be kept also to supply 6 Nos. 600 mm sweep industrial type pedestal fans.

11 POWER PLUG

11.1 There shall be 6 Nos. 15 Amps power plug in the filter house, 2 Nos. in control room; 2 Nos. in pump room and 4 Nos. in the laboratory in the chemical house. There shall be of industrial type.

12 GROUNDING STATION

12.1 In and around the plants a grounding grid, shall be established with embedded steel rods. The steel rod risers shall be welded to the grid as per I.S.3043, where from tapings shall be extended for earthing of all electrical equipment to comply with the Indian Electricity Rules amended to date.

13 CONTROL SWITCHES IN THE LABORATORY

13.1 All electrically operated instruments to be used in the laboratory shall be completely wired with necessary control switches.

14 ELECTRICAL TESTING EQUIPMENT

14.1 The following electrical testing equipment shall be supplied :

1 No. Multi-range Tong Tester.

1 No. Avo-meter.

15 INSPECTION

15.1 All the electrical equipment and accessories must be of reputed and approved make and shall conform to relevant I.S. Specifications. Where I.S. Specifications are not available relevant B. S. or A.S. Specifications will apply. All the installations must be in accordance with the Indian Electricity Rules and I.S. Codes of practice of latest edition.

15.2 It shall be the responsibility of the Contractor to take the approval of Government, Inspector for Electrical installation. All costs for getting the approval shall be borne by the Contractor.

16 LABELS

16.1 All electric motors, Starters, Switchgears, Distribution boards, Isolating Switches, Switch fuse units pillars and other similar items shall be labeled as to their function as specified in Cl. 1.1 and 1.2 in Section I.

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SECTION - I

TECHNICAL SPECIFICATIONS FOR EQUIPMENTS

1 LABELS

- 1.1 All valves, reduction gears and other similar items shall be labeled as to their function. The letters shall be aggravated on the underside of a beveled colourless transparent plastic level not less than 3mm thick engraving being filled, and the underside painted and sealed to form a complete label having white letters with background to standard practices. A list of label designations shall be submitted to the Engineer for approval before manufacture.
- 1.2 All labels must be affixed to apparatus before final acceptance tests are carried out.

2. GUARDING OF SHAFTS

- 2.1 All rotating shafts, couplings, gears, flywheels, belt drives, etc. shall be fully guarded, and comply to the requirement of the Indian Factories Act. Guards shall be designed to provide ready access to bearings, greasing points, thermometer pockets and other check points to allow routine observations to be made by the operating staff without danger or the need to dismantle any part of the guard. Hinged doors let into the guards with adequate fastenings shall be provided where necessary to facilitate access to the check points.
- 2.2 Guards shall be of mild steel of an approved gauge and be of the fully covered in type and securing arrangements for guards shall be of substantial construction.
- 2.3 All mild steel used in the production of guards shall be hot dipped galvanized and nuts, bolts, and washers shall be anodized unless otherwise specified.
- 2.4. Drawings of guards etc. shall be submitted to the employer for approval before manufacture.

3. GENERAL REQUIREMENT, WORKMANSHIP & DESIGN OF PLANT

- 3.1 The plant shall be new of sound workmanship and of robust design.
- 3.2 The General mechanical and electrical design of the plant (Water Treatment Plant, Clear Water Pumping Station & UGR) and particularly that of the bearings, contacts and other wearing parts shall be governed by the need for long periods of service without frequent maintenance and attention being necessary and with adequate corrosion protective measures.
- 3.3 Unless otherwise specified, all items of plant shall be rated for continuous service at the specified duties under the prevailing atmosphere and operational conditions on site.
- 3.4 All component parts of the plant shall be manufactured to a strict systems of limits and complete interchangeability of similar parts is required.
- 3.5 All parts subject to wear shall be readily accessible.
- 3.6 Provision shall be made for taking up wear in all bearings and other wearing-parts or for easy replacement if adjustment is not practicable. Ball & roller bearings shall be interchangeable all with similar items from alternative makers. Parts list shall include alternative reference numbers & maker.
- 3.7 The positions of all greasing and oiling points shall be arranged so as to be readily accessible for routine servicing. Where necessary, to achieve this, suitable extension pipes shall be fitted,

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Lubrication grease points shall comprise hexagon headed nipples, except where the lubrication required is of a special nature; in such event they shall be fitted with metal labels to indicate the special lubricant required. Where continual grease or oil feeding is required the capacity of the reservoir shall be sufficient for not less than seven days continuous service.

- 3.8 Suitable packers and/or shims shall be fitted for ease of adjustment and re-alignment of all machinery units; particular attention shall be given to combine sets.
- 3.9 Where fitted bolts, spigots or other means for precise location are not employed in the assembly of the plant, locating dowels shall be fitted on completion of erection, to the satisfaction of the Engineers.
- 3.10 All pipes shall be checked for alignment and matching of flanges or connections before being secured; they shall not be sprung into position.
- 3.11 If during the defect liability period any moving parts show, in the opinion of the Engineer, signs of undue wear or unsuitability for the purpose for which they are installed they shall be replaced free of cost notwithstanding that they may otherwise be working in a satisfactory manner.

4. STEEL STRUCTURAL

- 4.1 All steel structural shall conform to IS : 226-1962 except for M.S. Plates over 20 mm thickness which shall conform IS : 2062 - 1962.
- 4.2 Rails will be carbon or medium manganese steel, conforming to latest IRS T-12 or IRS -T-18 specifications.
- 4.3 For detailing and construction of welded connections all provisions of IS : 816 (latest) & IS : 823 (latest) shall apply.
- 4.4 All rivets and bolts are to be generally of 20 mm or 22 mm dia, except where otherwise required or noted.

Where no load is shown in the trusses, bracings or latticed members, minimum 2 Nos. 20 mm dia, rivets, bolts or equivalent welding to be provided. Bolted connections shall be provided at temporary sides and ends where future extensions are indicated.

- 4.5 All connections are to be riveted, welded or fitted with high strength friction grip bolts except for hand rails and cat walkways which may be bolted (black bolts). Unless otherwise stated, all bolts under direct tension are to be provided with one spring washer.

5. BOLTS AND NUTS

- 5.1 M. S. bolts and nuts shall conform to IS : 1363, 1364 and 1367 (latest). All nuts, bolts and washers coming in contact with water shall be anodized/galvanised by process which does not make the threads uneven. All bolts, nuts and washers coming in contact with any corrosive liquid or in corrosive atmosphere shall be made of stainless steel, 316 or Nylon depending upon the nature of the service.

6. CHEQUERED PLATES, ETC.

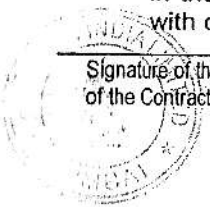
- 6.1 These shall be manufactured from structural steel complying with the requirements of IS : 226. They shall be of specified size, thickness and pattern as per relevant drawings or as directed by the Engineer. For cover plates, stiffeners shall be provided where necessary or as detailed in the drawings. Cover plates will generally be chequered plates (unless otherwise specified) with or without stiffeners. If required and necessary, the Contractor shall also prepare detailed

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floor plans for the layout of the cover plates for floors and platforms so as to include all openings, cuts, etc. and so as to match the patterns of adjacent cover plates to raise the cover plate on sides, so as to provide slopes in the floors and platforms to drain away any liquid falling on the floors and platforms. In such cases, slopes shall be provided as shown in the drawings or as directed by the Engineer. Necessary gutters at the ends of platforms shall be provided for sloping floors and platforms as shown in the drawings or as directed by the Engineer. Where necessary, kerbs of flats shall be provided around openings and cuts so as to prevent liquids falling to lower floors and platforms.

7. OPEN THREAD MESH PLATING

- 7.1 The Contractor shall supply and install galvanised (hot dipped after fabrication) mild steel open thread mesh flooring at pipe trenches and on the rotating bridge decking including all kerbing. The plating shall be designed to withstand a maximum uniformly distributed load of 1000 kg/m². The plating shall be divided into panels weighting not more than 50 kg. and each complete with nosings all round. Cut outs shall be provided and trimmed so that the plating may be removed without disturbing the machinery.

8. HAND RAILING

- 8.1 Double rows of 30 mm, dia. G.I. tubular hand railing fixed in C. I. Stanchions shall be provided on the edge of the walkways and platforms as specified. The stanchions shall be fixed with mild steel rag bolts with chromium plated cap nuts. The stanchions shall not be less than 1000 mm high and placed at a distance not exceeding 2500 mm. The hand railing shall be fixed true to exact line and level. C.I. Stanchions and hand-railing layout shall be of architectural design with pleasing appearance.

9. PAINTING (STEEL STRUCTURES)

- 9.1 The recommendations contained in IS : 1477 - "Code. of Practice for painting"

The surface, after preparation, shall be given two coats of red lead primer before painting.

- 9.2 Surface preparation.

- 9.2.1 Paints shall only be applied to surface which have been adequately prepared as defined in this specification.

- 9.2.2 All surfaces to be painted shall be thoroughly cleaned and dried. No painting shall be carried out in damp weather, or whilst dampness prevails from any cause, or during adverse weather conditions such as dusty, windy weather or dew, rain and such moist atmosphere prevails.

- 9.2.3 The surface to be painted shall be cleaned of all rust, dirt, loose mill scale, oil, grease, or any other foreign matter which might affect the painting. After completion of the pre-cleaning, the surface shall be immediately covered with the primer.

- 9.2.4 Where the coat of the primer has been damaged exposing original metal surface, a fresh primer coat shall be applied after cleaning.

9.3 APPLICATION OF PAINTS OR PRIMER

- 9.3.1 Priming coat shall be applied by brushes, under coat and finish coat shall be applied by spray painting or brush. Painting by rags or cloth is not allowed, Areas adjacent to spray painting shall have protection from blown spray.

- 9.3.2 Before drawing the paint from the container it should be well stirred and should be stirred at intervals in a smaller container used for painting with smooth clean stick while it is being applied by brush.

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9.3.3 In no case subsequent coat or coats shall be applied over another until the previous coat has been left for at least 24 hours for drying.

9.3.4 Coverage of paints (sq.m/ litre) shall be governed by the manufacturer's specification.

9.4 Material specification - Primer and synthetic Enamel Paint

9.4.1 The primer coat shall be of red lead primer unless otherwise specified.

9.4.2 Synthetic Enamel Paint shall be high gloss alkyd enamel with excellent flow and quick drying properties offering outstanding exterior durability under varying weather conditions. This paint should be suitable for all types of surfaces over respective primers and under-coatings.

Compositions - The material shall be based on synthetic resins. It shall be free from nature resins or modified natural resins and shall be of such a composition as to satisfy the requirement of I.S. 2932.

9.4.3 Where contact with water is expected, the metallic surface shall be protected with anticorrosive epoxy paint as instructed as approved by Engineer.

9.5 Preparation of paints

All paints shall be thoroughly and carefully stirred and mixed before use in accordance with the manufacturer's recommendations. Thinners shall only be added to paints as and when recommended by the paint manufacturer.

9.6 Storage of Paints

All the paints shall be stored in Air-tight containers; precautions shall be taken by the Contractor against any possible fire hazards.

The Contractor will take care to see that whenever the paint container is opened the entire quantity of the paint is used for the day's work in order to ensure that fresh paint is used every day.

The Contractor shall not be allowed to bring into the site those containers of paint which are not sealed by the paint manufacturer or those on which the manufacturer's seal is broken.

9.7 Extent of Painting

All structural steel work like frames, bridge, stirrer, railing, ladders, platforms piping supports structures, etc. associated with the plant shall be painted. Pipes, valves, pumps and Motors shall be epoxy coated as detailed in this tender document.

9.8 Inspection

Each coat of paint shall be inspected and approved before the succeeding coat is applied.

If any defects are observed, the portion will be repainted by the Contractor, after removing the old paint

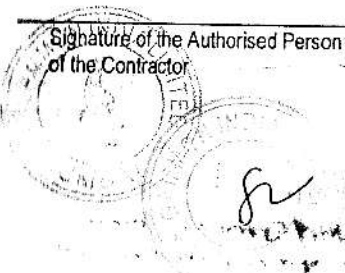
9.9 Colour Code

This will be decided by the employer and informed to the Contractor before starting the job.

9.10 System of painting

Following system shall be followed for painting of all metal parts and all priming. Over coating and finishing paints shall be of well known make. The Contractor shall furnish the details of paints to the Engineer for approval of paints before commencement of painting work.

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I. SUBSTRATE :

STRUCTURAL STEEL /CAST IRON

	<u>Primer-coating</u>	<u>Over-coating</u>	<u>Finishing</u>
System A (to be followed unless otherwise specified)	Red Lead Primer (two coats) 50 microns	Approved quality under coat (one coat) 25 microns	Approved quality Synthetic Enamel (3 coats) 75 microns.
	Total D. F. T. = 150 microns		
	Drying = 24 hours between coats.		
Systems B (after a metallic coat of zinc to a thickness of (0.075 mm)	Etch Primer (one coat) 25 microns	Zinc Chromate Primer (one coat) 25 microns	Approved quality Synthetic Enamel (two coat) 50 microns
	Total D. F. T = 100 microns		
	Drying - Retch primer to over-coated within 2 hours : Give 12 hours drying between subsequent coats.		
System C (in case of damage to steel work during transportation assembly, storage etc.)	Pre-treatment Metal pretreatment solution (one coat).	Finishing Patch prime and finish bare metal as per the existing.	
System D (for parts immersed under water, metal to be cleaned by shot blasting)	Priming Approved quality Primer (one coat) 25 microns	Finishing Approved quality pitch epoxy coating (two coats) 200 microns	
	Total D. F. T = 225 microns.		
	Drying = 24 hours between coats		
	Full Cure = 7 days.		

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