

GUJARAT WATERSUPPLY & SEWERAGE BOARD

GANDHINAGAR

(A WHOLLY OWNED GOVERNMENT OF GUJARAT UNDERTAKING)



Name of Work: Comprehensive Operation & Maintenance of Civil & Electromechanical assets such as Open Wells, Intake wells/structures or offtake structures, Elevated Service Reservoirs (E.S.R), HGLR, Sump, Water Treatment plant, Chemical House, Staff quarters, Pump house, all Bulk Transmission and Distribution pipelines, valves, pumping machinery & electrical equipment etc for the Ahwa water supply scheme, including supply of **6.46 MLD** potable water to all the, 69/villages, 01/Town for 06 months period. Taluka: Ahwa District: Dang based on Check Dam and Open Wells, Including PAC Solution/Alum but excluding supply of, Bleaching Powder, Water and Energy Charges.

Estimated Cost: Rs. 73,65,320.00

VOLUME – III

Technical Specifications

Chief Engineer

Gujarat Water Supply & Sewerage Board

Zone –6, Surat

THIS PAGE IS LEFT INTENTIONALLY BLANK.

: GENERAL SPECIFICATIONS:

1. The contractor will be required to provide to the satisfaction of the GWSSB, a fully qualified or experienced & trust worthy Engineer, who will have experience of building or Engineering work & who will be always available on site of work during the progress of work. GWSSB has full powers to remove such Engineer from the work within 24 hours notice to the contractor who will immediately thereon appoint another qualified Engineer. The contractor shall provide office accommodation for him.
2. The contractor shall give to the Municipality, Police & other authority notice etc. that may be required by law & obtain requisite license for temporary obstructions, on closures, opening in to common sewage water etc. & pay all necessary legal fees & charges to Municipalities & other Authorities & also neighbouring properties where necessary. The contractor shall repair well any damage to adjoining premises whether public or private & may provide night lights etc. as may be required on site. They will also construct as per enclosures & fences for the protection & convenience of the working people & the public during the progress of work & perfectly restore the adjoining ground premises on completion of work.
3. Specifications shall also be superseded all other dimension.
4. The contractor shall provide suitable stone with flat top of temporary benchmark. Page required for lining out & the contractor without any extra cost shall provide fixing the necessary levels. If required such stones may be build in masonry at such places & in such manners as the GWSSB or his assistant in charge of the work determines.
5. For all persons connected with the work contractor are required to make their own arrangements for a sufficient supply of water of a quality & quantity & at such places on the work as may be ordered by the GWSSB
6. Whenever the GWSSB may deem shoring necessary the contractor shall perform the same in the best possible manner with the best possible materials & to the satisfaction of the GWSSB. The contractor shall be providing such kind of shoring as the GWSSB may consider.
7. If the trenches near houses or other building require shoring & strutting the contractor shall carry out the same at their own cost. Such precautions to safeguard existing structures with utmost care are taken. After the work is completed near such buildings the contractor may remove stores & make good any cuttings or holes or any other damages done to the private properties.
8. The contractor will be required to provide at his own cost pumping engines etc. required to keep the trenches of the foundations & all other excavations clear or the water shall be continued so long time than power to GWSSB may stop the work. For the purpose of keeping the excavation as dry as possible, the work of pumping, if necessary he divided into sections or separate portions to be determined by the GWSSB & temporary dam or barriers will have to be put by the Contractor. Sump pits for suction pipes of the pumping sets to work will have to be excavated & to such depths as the GWSSB may determine. The contractor to the satisfaction of the GWSSB shall fill up such sumps after completion of work. The contractor will not be paid extra for any temporary dams or sump of their removal or filling.
9. Every portion of the work & site shall be kept clear of accumulation of debris from time to time.
10. Not with standing that all proper precautions may have always taken by the Contractor during the progress of work the contractor shall be held responsible for all damages. Whether to the work under execution or to any other property of to lives persons, during the progress of work the period of maintenance.
11. The site of the work after the completion of the work shall be given in charge to the Engineer in charge in neat & clean condition after removing all the rubbish lying in the compound & filling all pits & hollows & levelling the ground in good condition.

Signature of Contractor

Deputy Executive Engineer
P.H. San. Sub Din,
GWSSB, Ahwa

WTP

SPECIFICATION

Item No. 1 Filter Media

Effective size of filter sand 0.45 to 0.70 mm, uniformity coefficient not more than 1.7 nor less than 1.3, depth of filter 0.75 M, free board 50 cm, gravel 0.45 M in depth, sand and Gravel Conforming to IS : 8491 (i) – 77, backwash by air wash(if specified) and hard wash by water, standard appurtenances (to be specified), rate of flow controller, filter gauge, sand expansion gauge, etc.

Filtration shall be by gravity through a bed of hard gained silica (Quartz) sand of minimum thickness 70 cm. Filter sand shall be of effective size 0.60 mm and uniformity coefficient of 1.50.

The sand depth shall be checked with the help of following formula

$$Qd^3/h = L \times B \times 29323$$

Q = m³/m²/hr.

d = sand size in mm.

h = Terminal loss of head in m.

L = Depth of bed in m.

B = Break through index bent

4 x 10⁻⁴ to 6 x 10⁻³

Assume 4 x 10⁻⁴

Filter Support:

Filter sand shall rest on a gravel bed of not less than 0.40 m. thickness in the event of piped under drain system, or any directly on the suspended floor in case of nozzle under drain system to suit a particular design.

Filter Sand:

Filter sand shall be of hard and resistant quarts or quartzite and free of clay, mica, shale, dirt, loam organic impurities, later soluble iron and manganese. Effective size shall be 0.45 to 0.70 mm. Uniformity coefficient shall not be more than 108 nor less than 1.3. The weight loss on contact with N hydro-chloric acid shall not exceed than 5% weight after 24 hours. Ignition loss should not exceed 0.7 percent by weight. The friability weight loss after mixing for 15 minutes (750 strokes) shall be less than 10% and for 30 minutes (1500 strokes) shall be less than 20%.

The specific gravity of the sand shall be in the range of 2.55 to 2.65 silica content should not be less than 90% wiring loss should not exceed 3% IS 8419 (Part-I) 1947 entitled filtration media. Sand and gravel may be referred for other details.

Filter media and charging:

The contractor shall supply the filter media for the works and shall submit with his tender details of the source from which the proposed to draw his supplies of filter sand and verify that sufficient quantities of satisfactory filter sand can be obtained, packed stored on site and the filter shells charged in accordance with his work programme. 6.8.1 Within the two months of the date of acceptance of tender, the contractor shall submit to the Engineer to 20 Kg. representative samples of the filter sand and also a sample of supporting media. One of which will be tested. When the sand is found to be confirming to the above

requirements of the contractor, which he shall submit with his tender, the second sample shall be retained by the Engineer and the contractor will then be given permission to place an order for his supplies.

Prior to packing, all filter sand, shall be washed, heat dried and sieved to conform the specified grading and tested. Separate test certificates (In triplicate) shall be provided to the Engineer for each 20 cubic meters of media so supplied.

Packing shall be in suitable approved double or triple bags to protect the media from spillage or contamination.

Any sand or media delivered losses or found to be split or open bags shall be rejected on site. Storage on site shall be only in an approved. Pre designed area, well drained and free of mud and silt. Following installation and satisfactory testing of all the filter floors and when the Engineer is satisfied that the installations are complete. The contractor will be given written permission to commence filling the filters. The contractor will set out and indicate and the methods of filling the media in his tender submission and specification. Filter media shall be carefully placed and not charged by dropping, dumping, machine handling or any other method which in the opinion of the Engineer will be determined to the floor media, nozzles/drains to or sealants.

In each filter, two adjacent valves shall be charged simultaneously. Following the initial charging the filter shall be washed by the contractor. Filter beds, designed for expansion during, cleaning shall be skimmed prior to disinfections and commissioning of the works.

Item No 2. Painting of WTP/ESR/SUMP:

All items of metal work shall be thoroughly washed dried., cleaned, decreased before application of any paint.

Normally the initial coats shall be applied in the manufacturer' ship. After arrival of the equipment on site, the same shall be inspected and damaged portions shall be cleaned and given the primer and under coat of similar paint.

After erection all metal work shall be painted as follows :

- (a) Surface painted with red oxide of iron primer or with oil based under coats shall received two under coats and one finishing coat of an approved oil based paint.
- (b) Bituminous painted surfaces shall receive two coats approved bituminous paint.
- (c) Galvanized surfaces shall be primed with chromate primer followed by two under coats and one finishing coat of approved oil base paint.
- (d) All indoor parts, instruments and electrical equipment shall be chromium or copper nickel plated.

The following Table gives the nature of surfaces and paints to be used.

The Contractor shall study and follow this property.

Sr no.	Surface	Treatment
1.	All railings, Mild steel ladders, pipesfor water supply, flooring etc.	Galvanization and two coats of approved oil approved shades
2.	Submerged metallic parts and theirprojections above water level	Bituminous paint
3.	Metal parts above water level	Approved oil paint of approved shades.
4.	All indoor fixtures parts, instrumentsetc. Equipment, panels, etc.	Chromium or nickel plating.

The contractor shall clearly indicate the surface treatment for all metallic parts of the plants in the schedule of particulars in details

Paints:

Specification for line, shall be as per specifications of Gujarat Water Supply & Sewerage Board and Roads Hand Book MSPE-24 specification and explanatory notes for building and house drainage.

1. Finishing wall with water proofing cement paint on an undecorated wall surfaces (two coats) to give an approved brand and manufacture and of required shape even shade after thoroughly brushing the surface to remove all dirt and remains of loose powdered materials.

1.0. Materials : 1.1. The water shall conform to M-I. Cement water proofing shall conform to I.S. 5410-1969.

2.0. Workmanship :

2.1. Preparation of surface: White wash colour wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

2.2. Preparation of paint: Portland cement shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, the manufacture's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The tins of cement paint drums shall be kept tightly when not in use.

2.4. Application of Paint:

2.4.1. No painting shall be done when the paint is likely to be exposed to a temperature of below 7°C within 48 hours after application.

2.4.2. When weather conditions are such as to cause damage the work shall be carried out in the shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

2.4.3. To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.

2.4.4. For undercoated surfaces, the surfaces shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the proceeding coat shall be allowed between two coats. Next coat shall not be started until the proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the

proceeding coat shall be slightly moistened before applying the subsequent coat.

2.4.5. The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

2.4.6 The cement paint shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free from excessive heavy brush marks. This lamps shall be well brushed out.

2.4.7. Water proof cement paint shall not be applied on surfaces already treated with white wash colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

2.5. Curing : Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by me sprinkling of water say about 12 hours after the application.

3.0. Mode of measurements & payment:

3.1 The rate shall be for a unit of one sq. metre.

2. Painting one coat (excluding priming coat) on previously painted steel and other metal surfaces with synthetic enamel paint brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials & Workmanship : The painting shall be carried out on previously painted steel and other metal surfaces using synthetic enamel paint in one coat.

2 0. Mode of measurements & payment:

2.1. The rate shall be for a unit of one sq. metre.

Distemping with dry distemper of approved brand and manufacture(Two) coat and of required shade on wall surface (two coats) over and including a primer coat of whitening to give an even shade after thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter

1.0 General :

This specification lay down the requirement of lime to be applied on concrete, or brick masonry surface in cement mortar of specified proportion and thickness. The work shall conform to IS: 1661-1960.

2.0 Materials :

The materials required lime shall conform the I.S. & specifications specified in Specifications for the materials required in the item shall be specified as under.

3.0 Preparatory Work :

Smooth surface of concrete old plaster etc. must suitably roughened to provide necessary bond for the plaster. The exposed materials of concrete shall be removed by using chisel and make plain levelled surface, all dirt, soot oil paint or any other material that might interface with satisfactory bond shall be removed.

While preparation of lime of specified proportion as per Item description, the approved quality lime at the rate of as per manufactures instructions shall be added in water while mixing in dry condition. The contractor shall bring the lime to the site in it's original packing, and shall be got approved by The Engineer-In-Charge.

4.0 Finishing :

In any continuous face of a wall, finishing treatment of any type shall be carried out continuously and day to day breaks made to coincide with architectural breaks in order to avoid unsightly junctions.

5 0. Mode of measurements & payment:

5.1. The rate shall be for a unit of one sq. metre.

DETAILED TECHNICAL SPECIFICATIONS ITEM NO. 6,7& 8: MECHANICAL

5.00 H.P. Mono block Motor. Suitable to Booster 3 Phase 400/440 volt, 50c/s, A.C. supply & 2800 RPM as per IS 9079, MOC: Casing:CI FG260:Impeller Bronze & Shaft:SS:410 Motor. Suitable to Booster Pump.

THREE PHASE HORIZONTAL MONO SUBMERSIBLE PUMP SETS.

The Three Phase Horizontal Mono Submersible Pump Sets for the Water Supply Scheme should be as per IS: 14220 / 1994 with Latest revision.

The standard specifies the technical requirement for Three Phase Horizontal Mono Submersible Pump sets. Commonly used in sump for handling clear cold water for application in water supply etc.

The duty point of the pump set should be located at the optimum efficiency point of the pump rating curves and there should not be steep fall in efficiency in the operating range as

specified in Annexure-VI. The verification of the pump sets performance will be as per relevant latest is at rated voltage. The pump with lesser number of stages will be preferred. R.P.M. of pump set shall be 2900 at 50 Hz.

Company shall be offered the Efficiency within -5 Digit at Pump Operating Head Rang at +10% to -25% (i.e. if company shall be offered 50% Efficiency at Duty Point, 45% Efficiency are maintained at Pump Head Operating Rang +10% to -25%) Three Phase, 50Hz, 415 (+10% - 15%) Volts, 2900 RPM.

Minimum Motor Horse Power Rating, Cable Size, Starting System and Delivery Size shall be as per ANNEXURE - IV attached. In case, if the motor rating exceeds the minimum ratings given in the annexure-IV, then the starting methods as applicable shall have to be given accordingly.

1 PUMP:

The pump Casing should be free from blow holes, sludge inclusion and other detrimental defects. Casing should be provided with renewable wearing rings except in radial flow pump set. Casing should be provided with wearing rings. Casing should be hydraulically tested up to 1.5 times shut off pressure.

The Shut-off Head of the pump shall be 20% OR more than the Maximum Head (Operating Range).

2 IMPELLER:

Impeller should be of closed type, ensuring required performance and free of cavitations. The material of impeller will be as per Annexure – V.

3 SHAFT:

The common shaft of Pump & Motor. Below the impeller shaft assembly, shaft protection sleeve shall be provided. It shall have surface finishing of 0.75 Microns. The material of shaft shall be as per Annexure – V.

4 **MOTOR:**

The submersible motor shall confirm to IS: 9283 / 1994 with Latest revision. It should be totally enclosed squirrel cage induction type water -cooled and water lubricated, Sealed against entry from outside water.

The windings shall be of wet type. The thrust bearing should be of wet type water lubricated and designed to take all untoward load at most unfavourable running conditions. Front and Rear bearing housing and thrust bearing housing should preferably be fixed separate replaceable bolts/studs and (not threaded connections) to the starter to facilitate easy dismantling. Inspection Agency will open the motor base and check the thrust bearing and mark the identification & the word GWSSB with hard punch or with indelible ink. If the fibber thrust bearing is provided then it shall be marked with indelible ink.

Full proof sealing arrangement by sand guard shall be preferred in the Motor inlet body to prevent open well water impurities like sand, silt from entering the motor bearing Stator and Motor should be impregnated with a superior varnish class-B thermal insulation properties by vacuum pressure on stator cold rolled stamping used.

Rotor shall be painted with Polyurethane paint & backed properly under controlled temperature condition and not by manual or gravity flow to remove air pocket so that these are thoroughly filled up by varnish. Motor rotor should be preferably lead shot blasted. Subsequently, rotor body should be baked repeatedly under controlled conditions to ensure long life of paint and hard finish to the surface to avoid corrosion before power coating.

The rotor shaft shall be as per Annexure-V and provided with sleeves having materials as per Annexure-V in the bearing portion. The windings should be accessible to facilitate checking and locating any faults without disturbing all the coils and also to enable replacement of any defective coils. It should be possible to rewind the Stator with ready made protested coils in order to save time during the repair. Kelvin bridge/digital resistance meter shall be treated preferable for measurement of hot and cold resistance of winding for evaluated temperature rise. Full proof arrangement should be made for stopping the rotating of shifting of stampings inside the stator body due to operation of pump sets. Earth leakage current should not be more than 50 mili-ampere at rated voltage.

- 2.1 The quoted H.P. of motor should meet both the following conditions;
- 2.1.1 The minimum power margin over and above the duty points shall be 15%. The Offered motor should not have output rating less than that mentioned in ANNEXURE- IV (under the column Min. H.P) in any case. The Motor rating shall be equal to or Up to 10% higher than that mentioned in the ANNEXURE - IV according to offered Overall Efficiency. However the motor shall not get overloaded during the specified Head Range of +10% to -25% over duty Point Head as per IS.
- 2.1.2 The motor should not get overloaded in the range of + 10% & (-) 25% of the specified pump head. The meaning of overload will be as per IS: 14220

- 2.2 All rotating parts should be individually balanced if applicable on machine for minimum 700 RPM according to the relevant IS (and vibrations of the assembly during the Testing shall not exceed to 80 microns peak to peak.) (As per Relevant IS)
- 2.3 Brass Drain Plug Provided.
- 2.4 SS Suction Strainer Provided.
- 2.5 Compensating device provided.
- 2.6 Rotor painted and baked under controlled Condition or powder coated.
- 2.7 Winding easily assembles.
- 2.8 Winding subjected to 1.5 KV for 30 Seconds.
- 2.9 Matching Grooves for stopping stamping from rotation and shifting.
- 2.10 Stamping treated chemically to recover unwanted Substance and impurities.
- 2.11 Rotor lead/sand shot blasted.
- 2.12 Thrust plate lapping is done on machine and the limit is 0.3 Micron.
- 2.13 Stator end ring shall be of bronze metal or M.S. if applicable. OR S.S.
- 2.14 Stator is rewind able with readymade protested coils in each type of motor offered.
- 2.15 Vendors to submit cross sectional drawing of Pump motor with clear indication of material specification for the major components covered under specification.

3 **METHOD OF STARTING:**

Up to 7.5 HP, D.O.L. starter.

8 HP to 20 HP Star Delta

and 21 HP and Above Auto Transformer Starting.

4 **CABLE:**

SITC of flat PVC cable for sub pump
1X3X4 mm²

Motor shall be provided with Three core Flat PVC Copper water proof and Flexible Cable of 5 mt. length and suitable size. The cross sectional areas should be sufficient so as not to cause voltage drop of more than 2.5% of nominal voltage i.e. 10 volts at 400 volts throughout the length of the cable. Size of the Flat Cable as per ANNEXURE- IV. Cable should be provided with ISI Mark (IS: 694), Manufactured by GWSSB Approved Vender's.

5 **MARKING:**

The method of marking all the pumps to be delivered under scope of contract shall ensure that all the information will remain legible even after transportation, storage in open space etc. In general the legible and marking upon the goods shall indicate the followings.

- 1) Manufacturer's Brand name and/or Trade Mark. / Model Embossed / Engraved. Also stencilPainting / inscribed as "GWSSB" on each Pumps & Motors

- 2) Purchaser's mark as "GWSSB" is hard punched on each pumpset and Year of manufacturing.
- 3) Any other important matter that the manufacturer deemed fit to be inscribed.
- 4) BEE Logo is preferable. Manufacturer may give BEE Logo Voluntarily.

A Name Plate Corrosion Resistant Materials shall be affixed on the Pump Sets with the following details.

a.	Name of Manufacturer	
b.	Model	
c.	Serial number	
d.	Delivery Size (NRV) size in mm	mm
e.	Number of Stage	Nos
f.	Head in meter at Duty Point	Meter
g.	Operating Head range for overloading requirements.	Meter
h.	Discharge at Duty Point	LPM
i.	Overall Efficiency Duty Point	%
j.	Motor rating	KW
k.	Rated Current	Ampere
l.	Rated Voltage (V) with Variation	Volt
m.	Rated Speed	RPM
n.	Frequency (Hz)	Hz
o.	Connection Star / Delta	
p.	Type of Duty (Whether Continuous or Not)	
q.	Minimum submergence.	meter
r.	Year of Manufacture.	

6 TESTING

Pump shall have to be tested as per IS: 14220 / IS: 11346 and Motor will be tested as per I.S: 9283 at manufacturer's works.

- 6.1 Suppliers have to give inspection call with internal test report in specimen sheet shown in IS: 11346 for pump test.
- 6.2 The firm has to maintain and produce proper record such as calibration of instrument etc. for verification by inspecting agency.

- 6.3 The leakage current of pump set shall not exceed 50 milli Ampere at rated voltage. The firm shall furnish their quality assurance plan to the inspecting agency who will review the same to their satisfaction.
- 6.4 Rejection of any kind during inspection will be viewed seriously, cumulative three rejections may be considered as sub standard product of the firm and board will reserve the right to stop giving further order under the rate contract.
- 6.5 "The manufacturer shall have to provide material test certificate for impeller / shaft for Chemical properties carried out at NABL Accredited / Govt. Approved Laboratory for verification.

In case of complaints received from the field, the randomly selected sample of the lot will be sent to NABL Accredited Laboratory for the post purchase inspection and if the sample fails disciplinary action will be taken. the manufacturer will be black listed / banned / debarred up to three years.

7 STRIP TEST:

The inspecting agency shall dismantle the pump set precisely to carry out the strip test which shall also include thorough review of the material used with reference to the relevant tests. If required to ensure, the use of proper material they may also suggest to carry out any of the required tests excluding HT Tests. Not to insist for HT test during strip test, but after interval of 6 month of type test HT should be carried out.

8 TYPE TEST:

The type test certificate as per IS : 9283 from Government Laboratory/ NABL accredited Approved Laboratory for each H.P. range frame size of Submersible Motor shall invariably be submitted with the tender offer.

Further at the time of inspection against supply order under this rate contract, the inspecting agency shall review the type test of each motor for each H.P. rating/frame size of the motor and if required the inspecting agency may suggest fresh type test.

However if such tests are not carried out previously the same shall have to be carried out once at the time of inspection.

9 ROUTINE INSPECTION:

Routine inspection as per pump test record sheet at the time of supply will be carried out by the TPI.

Randomly selected one pump from each category of first order for the particular category lot shall be tested at EQDC / ERDA / NABL Accredited Laboratory and on satisfactory result of the same pumps, other pumps as per sampling plan from each category lot are to be tested at manufacturer's works and on satisfactory result the lot is to be released for dispatch.

Subsequently, if test result / performance are not satisfactory, randomly selected pumps of any category of any order shall be tested at EQDC / ERDA / NABL Accredited Laboratory and necessary action will be taken accordingly at the discretion of GWSSB, which will be binding to the contractor (Manufacturer).

Pump Testing charge for routine inspection will be borne by GWSSB if results are as per tender agreement otherwise it shall have to be borne by the contractor (Manufacturer).

If the pump which has failed in field, one of the pumps of that order may be selected for testing. If that pump also fails in EQDC/ ERDA/ NABL accreditation Laboratory without unreliable reason of its working environment, then it is liable for

- (1) For fitment of Security Deposit of the manufacturer.
- (2) Termination of the contract from department.
- (3) Disciplinary action will taken by GWSSB. The manufacturer will be black listed / banned / debarred up to three years.

10 PACKING:

Pump & motor shall be packed in a suitable wooden box acceptable to buyer.

**DETAILS TO BE FILLED FOR THREE PHASE HORIZONTAL MONO
SUBMERSIBLE PUMP SETS.**

NOTE: Submit at the time of Tender submission. Tenderer shall submit details separately for every category.

	Category No	
I)	PUMP DETAILS	
1	Capacity in LPM	
2	Head in MTR	
3	Type of pump	
4	Pump efficiency at duty point _____ %	
5	Pump input at duty point (KW)	
6	Maximum submergence required in mtr.	
7	Specific speed	
8	Head indicated in Schedule-B are in meters and are inclusive of head losses from all causes.	
9	Characteristic curves should cover completed range of operation i.e. minimum operation head to shut off head	
II)	MOTOR DETAILS :	
1	Motor rating (HP/KW)	
2	Synchronous motor speed(RPM)	
3	Efficiency of motor at full load	
4	Efficiency of motor at duty point	
5	Power factor at full load	
6	Power factor at duty point	
7	Method of Starting(star Delta/ATS/DOL)	
8	(a) Current at duty point	
	(b) RPM at full load	
	(c) RPM at duty point.	
	(d) Starting current as percentage of full load current	
	(e) Starting torque as percentage of full load current	

9	Motor input at duty point	
10	Reserve power of motor. Minimum 15 % margin over duty point condition.	
III)	CABLE :	
1	Size of cable	
2	Make of cable	
3	Maximum current carrying capacity of Cable	
VI)	OVERALL EFFICIENCY OF UNIT :	
	(a) at Full Load	
	(b) at duty Point.	
1	Please confirm materials as per specifications or otherwise state the variation	
2	Performance curves of pump and motors are required as under	
	i) Discharge V/s Head	
	ii) Discharge V/s Power input (KW)	
	iii) Discharge V/s overall efficiency of pump set	
	iv) Submersible motor characteristic curves as under	
	(a) Load V/s power factor	
	(b) Load V/s Speed	
	(c) Load V/s efficiency	
	(d) Load V/s Current	
V)	Cross section drawing for both pump and motor showing clearance at bearing wearing run out and materials specification for major component at the time of supply.	

ANNEXURE – IV

Three Phase Horizontal Mono Submersible Pump Sets.

Cat. No.	Discharge in LPM	Head in Mtrs	Min. H.P.	Cable	Method of Starting	Delivery size in mm dia	Minimum Overall Eff. %
1	2	3	4	5	6	7	8
SM - 2.1	220	22.5	3.0	1.5	D.O.L.	50	31.68
SM - 2.2	360	24	5.0	1.5	D.O.L.	50	35.19
SM - 2.3	438	22.5	5.0	1.5	D.O.L.	50	37.80
SM - 2.4	530	27	7.5	2.5	D.O.L.	50	38.88
SM - 2.5	498	32.5	7.5	2.5	D.O.L.	50	38.16
SM - 2.6	600	40	10.0	2.5	S.D.	50	40.28
SM - 2.7	690	40	12.5	2.5	S.D.	50	41.58
SM - 2.8	600	46	12.5	2.5	S.D.	50	40.81
SM - 2.9	440	52	12.5	2.5	S.D.	50	40.28
SM - 2.10	700	70	25.0	16.0	A.T.S.	50	44.00
SM - 2.5.1	510	16	4.0	1.5	D.O.L.	65	39.33
SM - 2.5.2	440	26	5.0	1.5	D.O.L.	65	37.10
SM - 2.5.3	720	25	7.5	2.5	D.O.L.	65	42.75
SM - 2.5.4	900	37	15.0	4.0	S.D.	65	43.89



SM - 2.5.5	750	42	15.0	4.0	S.D.	65	42.90
SM - 2.5.6	1000	58	30.0	16.0	A.T.S.	65	44.00
SM - 3.1	700	24	7.5	2.5	D.O.L.	80	41.04
SM - 3.2	1000	24	10.0	2.5	S.D.	80	45.60
SM - 3.3	700	27	10.0	2.5	S.D..	80	42.75
SM - 3.4	870	32.5	12.5	2.5	S.D.	80	43.32
SM - 3.5	1300	32	17.5	2.5	S.D.	80	47.58
SM - 3.6	1175	37	20.0	4.0	S.D.	80	46.61
SM - 3.7	1300	50	25.0	16.0	A.T.S.	80	48.80
SM - 4.1	1275	11	6.0	1.5	D.O.L.	100	46.08
SM - 4.2	1450	12.5	7.5	2.5	D.O.L.	100	48.75
SM - 4.3	1160	20	10.0	2.5	S.D.	100	47.12
SM - 4.4	1250	25	12.5	2.5	S.D.	100	47.74
SM - 4.5	1600	26	17.5	4.0	S.D.	100	49.14
SM - 4.6	1500	30	20.0	4.0	S.D.	100	48.98
SM - 4.7	1860	34	25.0	16.0	A.T.S.	100	50.40



Signature of Tenderer.

Executive Engineer,
P.H. Mech. Store Division,
GWSSB, Gandhinagar



2.1.1 ANNEXURE – V

MATERIALS FOR COMPONENTS OF MONOSET HORIZONTAL SUBMERSIBLE PUMP AS PER IS;14220/1994 WITH LATEST REVISION.

Sr.No.	Name of Parts.	Materials of Construction.
1	2	3
1	Shaft sleeve when used	Grade X20 Cr 13 Conforming to IS: 1570 (Part-5) 1985.
2	Motor bearing housing and base	Grade FG 260 of IS: 210/1993.
3	Pump & Motor Shaft (Common)	SS AISI 410.
4	Bearing Bush	Leaded tin bronze Grade LTB4.
5	Rotor	Electrical sheet steel and electro grade copper rods conforming to IS : 613/1984.
6	Stator Core	Electrical sheet steel and PVC insulated winding wire conforming to IS: 8783/1978.
7	Winding Wire	As per relevant IS: 14220 and IS: 9283
8	Breather and diaphragm	Nitrile rubber.
9	Cable	Three Core Flat PVC Copper Cable with IS Mark (IS:694)
10	Cable Gland	Nitrile rubber.
11	Thrust Bearing face combinations.	Carbon-stainless steel
12	Water drain plug.	Bronze.
13	Impeller	Leaded Tin Bronze LTB 2 of IS :318/1981
14	Casing	Cast Iron Grade FG 260 of IS :210/1993.
15	Sand Guard	S.S. 304
16.	Studs	SS AISI 410



ANNEXURE - VI

Quoted Efficiency at Head Rang at +10 to -25 of Three Phase Horizontal Mono Submersible Pumps

NOTE: Submit at the time of Tender submission.

Category.	Discharge in LPM	Head in Mtrs	Minimum H.P.	Minimum Overall Eff. % at Duty Point	+10 % Head	-25 % Head	Minimum Overall Eff. % at Duty Point	Efficiency at +10 % Head	Efficiency at -25 % Head
1	2	3	4	5	6	7			
SM - 2.1	220	22.50	3.0	31.68	24.75	16.88			
SM - 2.2	360	24	5.0	35.19	26.40	18.00			
SM - 2.3	438	22.50	5.0	37.80	24.75	16.88			
SM - 2.4	530	27	7.5	38.88	29.70	20.25			
SM - 2.5	498	32.50	7.5	38.16	35.75	24.38			
SM - 2.6	600	40	10.0	40.28	44.00	30.00			
SM - 2.7	690	40	12.5	41.58	44.00	30.00			
SM - 2.8	600	46	12.5	40.81	50.60	34.50			
SM - 2.9	440	52	12.5	40.28	57.20	39.00			
SM - 2.10	700	70	25.0	44.00	77.00	52.50			
SM - 2.5.1	510	16	4.0	39.33	17.60	12.00			
SM - 2.5.2	440	26	5.0	37.10	28.60	19.50			
SM - 2.5.3	720	25	7.5	42.75	27.50	18.75			
SM - 2.5.4	900	37	15.0	43.89	40.70	27.75			
SM - 2.5.5	750	42	15.0	42.90	46.20	31.50			
SM - 2.5.6	1000	58	30.0	44.00	63.80	43.50			
SM - 3.1	700	24	7.5	41.04	26.40	18.00			
SM - 3.2	1000	24	10.0	45.60	26.40	18.00			
SM - 3.3	700	27	10.0	42.75	29.70	20.25			
SM - 3.4	870	32.50	12.5	43.32	35.75	24.38			
SM - 3.5	1300	32	17.5	47.58	35.20	24.00			
SM - 3.6	1175	37	20.0	46.61	40.70	27.75			
SM - 3.7	1300	50	25.0	48.80	55.00	37.50			
SM - 4.1	1275	11	6.0	46.08	12.10	8.25			
SM - 4.2	1450	12.50	7.5	48.75	13.75	9.38			
SM - 4.3	1160	20	10.0	47.12	22.00	15.00			



SM - 4.4	1250	25	12.5	47.74	27.50	18.75			
SM - 4.5	1600	26	17.5	49.14	28.60	19.50			
SM - 4.6	1500	30	20.0	48.98	33.00	22.50			
SM - 4.7	1860	34	25.0	50.40	37.40	25.50			



2.1.2 (IS:11346:2002 Page No. 23 ANNEX - D (Clause 6)

SPECIMEN SHEET FOR IS ; 8034

PUMP TEST RECORD SHEET

Sheet No;

Refer Graph No.

Name of Test : Performance test as per IS: 8034

Submersible Pump Sets

Pump Type	Pump SI No.....	Motor rating kW/HP	Motor SI No.....
Suctionmm	Delivery mm	Voltage Full Load Current,	Amps
Material of Impeller		Meter constant : Ax kWx.....	Rated Frequency.....
Suction Lift Measured by : Hg Manometer / Vacuum Gauge		Capacity Measured by - Vee-notch / Volumetric tank / Flowmeter.	
Delivery Head Measured by : Hg Manometer / Pressure Gauge		Class of Accuracy of Measuring Instrument - One	

Sr. No.	Frequency, Hz	Delivery Gauge Reading, m	Gauge Distance, %, m	Velocity Head Correction, m	Total Head, m	Head Over Notch, mm (in Case of Vee-notch)	Volume (l) / time(s) (in case of volumetric tank)	Discharge, l/s.	Current, A	Wattmeter Reading		Motor Input (IP), kW	Pump Output (LP), kW	Overall Efficiency, %	Performance converted at rated frequency.....		
										W1	W2				H m	Q l/s.	IP, kW



Pump Certified for	i) Total Head in m	Date	Tested by
	ii) Discharge in l/s Frequency	Remarks	
	iii) Overall Efficiency Percent Motor Input, kW	
	iv) HeadRange in m	
	H Q Guarantee Factor	
	Overall Efficiency at Duty Point, Percent.....	Impeller Diameter mm	
General Requirements - Satisfactory / Unsatisfactory.			

SIGNATURE OF TENDERER



2.0SITC of Control panel board for sub. Pump

DOL / Star Delta starter suitable for local & remote pump control application consisting of MPCB, overload relay and contactors as per Type II coordination including digital voltmeter, analogue ammeter with selector switch, run hour meter, required Protective relays & control accessories. Supply of control panel board 5.0 H.P. HP D.O.L.

Supply of fully automatic air break type panel up to 7.5 H.P. D.O.L. Star Delta from 8 -20 H.P. above 20 H.P. auto transformer Control Panels for Submersible Pumps suitable for operation on 415 (+ 10% -15%) Voltage, 3 Phase, $50 \pm 3\%$ Hz A.C. Supply, Control Panels shall be comprising of MCB/MCCB, Overload relays, Contactors and Accessories. The details of equipment / accessories for each type of panels are given in enclosed data sheet.

1) ENCLOSURES:

The control panel shall be dust and vermin proof as per IP-41 and fabricated out of minimum 1.5 mm CR sheets for all Panels. Control Panel shall be wall-mounting type for DOL / Star Delta and for ATS wall mounting-cum-pedestal type. All items inside the panel shall be mounted on steel base plate. All metal parts shall be thoroughly cleaned, degreased and made free from rust. Control panels shall be powder coated. The color shade of panel shall be RAL 7032 for entire panel and component mounting plate should be Orange only. Size of the enclosure should be as mentioned in the drawing attached.

All bolts, nuts, screws, washers shall be Galvanized Zinc / Cadmium plated and passivity, and full protection from dust rubber lining should be provided. There shall be cable entry for suitable size at the bottom of the control panel for outgoing cable to submersible motor. There should be one suitable entry on bottom of Control Panel for incoming cable. Layout on the door will be as per drawing (attached). For Closing the Door Two Half Turn Door Locks (Top and Bottom) operated by a Screw Driver type key should be provided. One Key is provided by the supplier with each Control Panel.

The cable entries for incoming and outgoing cable shall be provided with rubber grommets, at bottom of panel.

2) WIRING AND TERMINALS:

Power Supply to Control Panel and Internal Control Panel wiring shall be done with P.V.C. insulated copper conductor / Strip having 660/1100 V grade insulation Control wiring shall be done with 1.0 mm² copper conductors and shall be terminated with adequately sized compression type lugs for connections to the equipment terminals and the terminal strips. Each wire shall be identified at both ends by PVC ferrules. Not more than 2 wires to be terminated at one terminal and proper type and size at terminals should be used keeping in view the components for which they are used, so, that sufficient surface contact can be achieved. Screws and Bolts should be used as per corresponding size and hole. That should be done to the satisfaction of inspection authority. Incoming and outgoing connections to be made at terminals only Clip on type terminals shall be used for wiring up to 10mm² and for conductors larger than 10 mm² bolt type terminals shall be provided. Terminal may also be permissible on epoxy insulator with copper strip and Hardware of proper size. The size of incoming cable should be



provided as per table-I here under:

TABLE - I

Sr No	Type of Control Panel	Size of incoming Conductor Terminal	Terminal strip for outgoing Conductor		
1	D.O.L. Up to 3 H.P.PANEL	1 x 3 x 2.5 sq.mm	1 No.	-	2.5 sq.mm
2	D.O.L. Up to 5 H.P.PANEL	1 x 3 x 2.5 sq.mm	1 No.	-	2.5 sq.mm
3	D.O.L. Up to 7.5 H.P.PANEL	1 x 3 x 4.0 sq.mm	1 No.	-	4.0 sq.mm
4	S.D. 8 to 10 H.P.PANEL	1 x 3 x 6.0 sq.mm	2 Nos.	-	4.0 sq.mm
5	S.D. 11 to 15 H.P.PANEL	1 x 3 x 6.0 sq.mm	2 Nos.	-	4.0 sq.mm
6	S.D. 16 to 20 H.P.PANEL	1 x 3 x 10.0 sq.mm	2 Nos.	-	6.0 sq.mm
7	ATS 21 to 30 H.P.PANEL	1 x 3 x 16.0 sq.mm	1 No.	-	16.0 sq.mm
8	ATS 31 to 35 H.P.PANEL	1 x 3 x 16.0 sq.mm	1 No.	-	16.0 sq.mm
9	ATS 36 to 45 H.P.PANEL	1 x 3 x 25.0 sq.mm	1 No.	-	25.0 sq.mm
10	ATS 46 to 50 H.P.PANEL	1 x 3 x 25.0 sq.mm	1 No.	-	25.0 sq.mm
11	ATS 51 to 60 H.P.PANEL	1 x 3 x 35.0 sq.mm	1 No.	-	35.0 sq.mm
12	ATS 61 to 70 H.P.PANEL	1 x 3 x 35.0 sq.mm	1 No.	-	35.0 sq.mm
13	ATS 71 to 80 H.P.PANEL	2 x 3 x 25.0 sq.mm	1 No.	-	50.0 sq.mm
14	ATS 81 to 90 H.P.PANEL	2 x 3 x 25.0 sq.mm	1 No.	-	50.0 sq.mm
15	ATS 91 to 100 H.P.PANEL	2 x 3 x 25.0 sq.mm	1 No.	-	70.0 sq.mm
16	ATS 101 to 110 H.P.PANEL	2 x 3 x 35.0 sq.mm	1 No.	-	70.0 sq.mm
17	ATS 111 to 120 H.P.PANEL	2 x 3 x 35.0 sq.mm	1 No.	-	70.0 sq.mm
18	ATS 121 to 130 H.P.PANEL	3 x 3 x 35.0 sq.mm	1 No.	-	95.0 sq.mm
19	ATS 131 to 140 H.P.PANEL	3 x 3 x 35.0 sq.mm	1 No.	-	95.0 sq.mm
20	ATS 141 to 150 H.P.PANEL	3 x 3 x 35.0 sq.mm	1 No.	-	95.0 sq.mm
21	ATS 151 to 160 H.P.PANEL	3 x 3 x 35.0 sq.mm	1 No.	-	Above 95 sq.mm.

3) NAME PLATE :

Labels shall be provided for each equipment mounted on the panel and all labels shall be engraved in Gujarati Language on 3 ply-laminated sheets or anodized aluminum. These shall be fastened to the panels by screws and not by Adhesive. All mounted equipment shall have identification with paint inside the panels. Instruction for operation of panel shall be engraved in Gujarati language on 3 ply laminate sheet or anodized aluminum. These should be fastened to the front side of panel door by screws and not by Adhesive.



4) ACCESSIBILITY :

Checking and removal of components shall be possible without disturbing adjacent equipment. All auxiliary equipment's shall be easily accessible incoming supply terminals shall be shrouded with plastic covers to prevent accidental contact.

5) INCOMING:

MCCB for ATS and MCB for DOL / Star Delta

MCCB:

- 1) Fixed thermal magnetic type.
- 2) Breaking capacity (ICU) should be minimum 10 KA up to 200 A and Minimum 36KA for 225 A and above (ICU = 50% of Ics).
- 3) All Accessories should be field fit table type.
- 4) Rated Insulation voltage should be minimum 600 V.
- 5) Certified pollution degree for environment for MCCB should be as per IEC-

60947MCB:

- 1) Should be suitable for Isolation function as specified in IEC 60898 / IS:

8828.

- 2) Should have IP-20 protection with positive contact indication.
- 3) Should be of "C" type tripping class suitable for motor application.
- 4) Energy limitation class should be III.
- 5) Average suitable life should greater than 20,000 for 32 A and 10,000 for

more than 32 A rating.

- 6) Breaking capacity should be minimum 10KA.

7) MCCB / MCB

MCCB / MCB for main circuit should be TP and Neutral should be separate. It should be mounted in side the panel on base plate and the operating trigger shall be front of the panel in such a way that only trigger is seen fitted in a Hooper type box as shown in drawings. A separate MCCB / MCB for capacitors should be mounted as suitable place inside the enclosure. The current rating shall be as per Table - II.

TABLE – II

Sr. No.	Type of Control Panel Board	FOR MAIN CIRCUIT	FOR CAPACITOR		Range of CT
		Capacity of MCB / MCCB	Capacity of MCB / MCCB (TP 10 KA)	Capacitor KVA _r	
1	D.O.L. Up to 3 H.P. Panel	16 AMP MCB	-	0	10/5 AMP
2	D.O.L. Up to 5 H.P. Panel	20 AMP MCB	-	0	15/5 AMP
3	D.O.L. Up to 7.5 H.P. Panel	25 AMP MCB	6 AMP MCB	3	20/5 AMP
4	S.D. 8 to 10 H.P. Panel	32 AMP MCB	6 AMP MCB	3	30/5 AMP
5	S.D. 11 to 15 H.P. Panel	50 AMP MCB	10 AMP MCB	4	50/5 AMP



6	S.D. 16 to 20 H.P. Panel	63 AMP MCB	10 AMP MCB	5	60/5 AMP
7	ATS 21 to 30 H.P. Panel	75/80 AMP MCCB	16 AMP MCB	7	75/5 AMP
8	ATS 31 to 35 H.P. Panel	100 AMP MCCB	16 AMP MCB	8	100/5 AMP
9	ATS 36 to 45 H.P. Panel	125 AMP MCCB	20 AMP MCB	10	100/5 AMP
10	ATS 46 to 50 H.P. Panel	150/160 AMP MCCB	25 AMP MCB	11	150/5 AMP
11	ATS 51 to 60 H.P. Panel	200 AMP MCCB	32 AMP MCB	13	150/5 AMP
12	ATS 61 to 70 H.P. Panel	200 AMP MCCB	32 AMP MCB	15	200/5 AMP
13	ATS 71 to 80 H.P. Panel	225/250 AMP MCCB	40 AMP MCB	17	250/5 AMP
14	ATS 81 to 90 H.P. Panel	300/320 AMP MCCB	40 AMP MCB	19	250/5 AMP
15	ATS 91 to 100 H.P. Panel	300/320 AMP MCCB	50 AMP MCB	21	300/5 AMP
16	ATS 101 to 110 H.P. Panel	300/320 AMP MCCB	50 AMP MCB	23	300/5 AMP
17	ATS 111 to 120 H.P. Panel	400 AMP MCCB	50 AMP MCB	25	400/5 AMP
18	ATS 121 to 130 H.P. Panel	400 AMP MCCB	63 AMP MCB	27	400/5 AMP
19	ATS 131 to 140 H.P. Panel	400 AMP MCCB	63 AMP MCB	29	400/5 AMP
20	ATS 141 to 150 H.P. Panel	400 AMP MCCB	63 AMP MCB	31	500/5 AMP
21	ATS 151 to 160 H.P. Panel	500 AMP MCCB	63 AMP MCB	33	500/5 AMP

8) CONTACTORS:

The contactors shall be air break type having AC-3 duty rating. The contactor shall be suitable for operation on 415+10%-15% voltage Current as per Table-III All contactors should be suitable to perform at ambient temperature - 20° C to 45° C. The insulation class of coil is B or higher. Minimum life of operating cycle as under in million

- 1) Mechanical - a) 15 up to 32 A, b) 10-33 A to 80 A and c) 5-81 A to 400 A
- 2) Electrical - a) 1 up to 70 A, b) 0.75 - 71 A to 150 A and c) 0.5-151 A to 400 A

9) OVERLOAD RELAYS: (IN CASE OF DOL / STAR DELTA / ATS)

Overload relays shall be three element positive acting ambient temperature compressed type with in built single phasing prevention mechanism and adjustable setting range to ensure protection against overload and single phasing. Bimetal relays shall be manually and auto reset type. Should have 1 No + 1 NC or 1C/O potential free auxiliary contact. Ratings shall be as per Table-III. Overload relays should be same make as per contactor as far as possible.



TABLE – III
CONTACTORS & MCCB / OVERLOAD RELAYS

Sr. No.	Type of Control Panel board	Rating			
		Main Contactor	Delta/ Step Contactor	Star Contactor	Relay Range in Amp (Approx.)
1	2	3	4	5	6
1	D.O.L. Up to 3 H.P.PANEL	16	-	-	3-5
2	D.O.L. Up to 5 H.P.PANEL	16	-	-	6-10
3	D.O.L. Up to 7.5 H.P.PANEL	22/25	-	-	10-16
4	S.D. 8 to 10 H.P.PANEL	16	16	16	6-10
5	S.D. 11 to 15 H.P.PANEL	22/25	22/25	22/25	10-16
6	S.D. 16 to 20 H.P.PANEL	30/32	30/32	30/32	13-21
7	ATS 21 to 30 H.P.PANEL	63/70	30/32	22/25	30-50
8	ATS 31 to 35 H.P.PANEL	63/70	38/40	30/32	45-70
9	ATS 36 to 45 H.P.PANEL	80/110	38/40	30/32	55-90
10	ATS 46 to 50 H.P.PANEL	95/110	63/70	38/40	60-100
11	ATS 51 to 60 H.P.PANEL	120/130	63/70	38/40	60-100
12	ATS 61 to 70 H.P.PANEL	160/200	63/70	38/40	80-120
13	ATS 71 to 80 H.P.PANEL	160/200	95/100	50	90-150
14	ATS 81 to 90 H.P.PANEL	200	95/100	50	135-225
15	ATS 91 to 100 H.P.PANEL	200	120/125	50	135-225
16	ATS 101 to 110 H.P.PANEL	225	120/125	65/70	135-225
17	ATS 111 to 120 H.P.PANEL	250	140	65/70	135-225
18	ATS 121 to 130 H.P.PANEL	300	150	80/100	135-225
19	ATS 131 to 140 H.P.PANEL	300	150	95/100	180-300
20	ATS 141 to 150 H.P.PANEL	300	160/170	110	180-300
21	ATS 151 to 160 H.P.PANEL	400	160/170	120/125	180-300

Note:

Overload relay should be provided considering

For D.O.L.:- 1.6 times of maximum H.P.

For Star Delta. : - 0.96 times of Maximum H.P.

For ATS up to 80 H.P.:- 1.5 times of Maximum H.P.

For ATS above 80 H.P.:- 1.4 times of Maximum H.P.

It should be within calculation range having margin at upper side for future. It should be manually or auto reset type.

Temperature compensation -20 to +55 Degree C

10) CONTROL SUPPLY:

415 (+10% - 15%) Voltage, 3 Phases, 50 + 3% Hz A.C. Supply

Door push button should be provided for control circuit. Such a way motor supply should



be cut off when door was opened.

415 / 230 V Transformer shall be provided for Supply to MFM.

11) AUTO TRANSFORMER:

Auto transformers shall be air cooled type having 3 tapping of 60%, 70% and 80%. The same should be wound with copper wire. The size of the wire should be determined as per the H.P. of the motor. Stampings of reputed make and winding wire with 'E' Class insulation should be used. This should also be suitable for 6 starts per hour. Maximum temperature rise should not be more than 115⁰ C as per ISS Kordofan Circuits as per ISS should be adopted in ATS Panel. ATS shall be provided with Thermal Overheat Protector (TOP) in each coil of Transformer in such a way to cut the supply of control circuit to save the Transformer from overheating. Thermal Overheat Protector (TOP) rating shall be 90⁰ Centigrade. But add 10% tolerance i.e. 100⁰ Centigrade +/- 10% shall be an Acrylic / Hylem sheet over the transformer. Also to absorb humming Rubber sheet shall be provided below Auto Transformer.

11) ATS

- i) Auto transformer shall be vacuum impregnated.
- ii) Testing of transformers should withstand full load starting current (6 x 1.5 x H.P. x Tapping²) for six starts per hour. Each kick of 15 seconds duration as per relevant IS.
- iii) (%) Percentage regulation of voltage should be within 10%.
- iv) Excitation current at no load at rated voltage should be less than 10% of rated current
- v) Lamination should be preferably CRGO (Cold Rolled Grain Oriented) alternative CRNGO.

12) CONTROL FUSES:

Re-wire able Control Fuse shall be provided for DOL, Star Delta, and ATS Panels 16A 415 Volts. 3 Nos

13) TIMER:

Star Delta - Electronic Star Delta change over time 0 to 30 Sec. ATS -Thermal / Electro - pneumatics / Electronic timer for change over in start to run should be provided. Control wiring may be change as per type of timer and contactors.

14) MULTIFUNCTION METER:

Digital type CT Operated Multifunction meter, 3 lines display i.e. showing any three parameters at a time, of class 1% accuracy shall be provided showing A, V, Hz, Pf, KW, KWH etc. Range of Three no s CT shall be as per Table-II.

15) INDICATING LAMPS:

Light Emitting Diode red color lamp should be used at 230 V and size of lamp holder should be 22.5 mm.

For DOL / STAR DELTA	For ATS
ON	OFF
Over load Trip	Start
SPP	Run
	Over load Trip



	SPP
--	-----

16) PUSH BUTTONS (22.5 MM DIA)

Push button colors shall be as follows:

Stop	Red
Start	Green
Timer Falls (ATS)	Yellow
Overload Reset (ATS)	Black

17) SINGLE PHASING PREVENTOR:

Single phasing preventer with auto switch should be operating on negative phasing sequence components principals and voltage sensing type only. It should be operatesatisfactory from 320 / 480 V.Cut off Voltage should be 320 V and 480 V. Timing range of delay start 0 to 45 Sec. Toggle switch for Auto-SPP-By pass should provided on the front of the unit. There must be an indication when 3 phases are balanced. When one fuse blows, indication light would go off. The wiring diagrams of SPP should be provided on the unit (SPP).

18) INCOMING CABLE:

The length of cable for panels shall be provided with 3 meters suitable size (as per table-I) Flat PVC Copper Submersible Cable of 660/1100 V Grade duly crimped with lugs of both ends. And an additional wire of 2.5 Sq.mm (Black) Single Core shall be provided with 3-phase incoming cable from neutral point to GEB supply. The cable shall be IS Marked.

19) CAPACITOR:

APP 415/440 Volts A.C. GEB approved capacitor with GEB test report should be provided with necessary connections. GEB Test Certificate shall have to provide in duplicate in each respective panel. Capacitor should be inside or outside the panel. Capacity of Capacitor shall be as tabulated as per Table-II. (Different unit of Capacitor is acceptable but total KVAR should be same as per Table-II).

20) TEST AND INSPECTION:

- 1) Tests shall be carried out at manufacturer's works under his care and expenses.
- 2) Following tests as per applicable standard code shall be conducted during inspection.
 - a) H.V. I.R. All panels - 2.0 KV for power test Circuit for 1 Min.

2.1.3 - 1.0 KV FOR CONTROL CIRCUIT
 - b) Meager All panels test as per relevant IS
 - c) Functional test (All panels)
 - d) Temperature rise test for autotransformer only one from each category out of lot of any number of panels offered for inspection.
- 2.1.4** 3) The test report of the concern equipments / components from the concern vendor will have to be provided to inspecting agency vendor of the equipment.

21) EQUIPMENT MAKES:

Unless approved in writing equipment/components of following make approved by CPRI / EARDA Tested shall only be acceptable.



MCB / MCCB	L & T SIEMENS, ELCON, STANDARD, C & S, GE, HAVELLS, SCHNEIDER, HPL, INDO-ASIAN, BChand GWSSB Approved Vendors Make.
Contactors	L&T, SIEMENS, YULE, JSL, C&S, GE, BCH, SCHNEIDER, HAVELLS, PECO, INDO-ASIAN and GWSSB Approved Vendors Make.
Overload Relays	L&T, SIEMENS, SCHNEIDER, GE, YULE, JSL, C&S, BCH, HAVELLS, T/M, GS, PECO, INDO-ASIAN and GWSSB Approved Vendors Make.
Timers	L&T, JSL, ELLICO, C&S, BCH, GELCO, INDO-ASIAN and GWSSB Approved Vendors Make.
Push Buttons (22.5 mm)	L&T, SIEMENS, TEKNIC, VAISHNO, C&S, MATHURA and GWSSB Approved Vendors Make.
CT Coil	Approved by CPRI / ERDA Tested
Door Push Button	REPUTED and GWSSB Approved Vendors Make.
Digital Meters	AE, IMP, MECO, RISHABH (L&T), TRINITY, ELMESURE, HPL, INDOTECH, NIPPEN, SELEC, GELCO, ELLICO and GWSSB Approved Vendors Make.
Terminals	TOSHA, ELMEX, TECHNOPLAST, PI, CONNECT WELL, AIRON, VIRAL and GWSSB Approved Vendors Make.
Single Phase Preventer (Auto Switch)	MINILEC, GELCO, ELLICO, AMBILIN OR Any other make approved by CPRI / ERDA Tested as per GWSSB Specification for each Rating and GWSSB Approved Vendors Make.
Incoming Cable	GWSSB Approved with IS Marked.
Indicating Lamps (LED)	AIRON, ESSEN, IEC, B.C.H., VAISHNO, CONCORD, TEKNIC, ELCOM, MATHURA and GWSSB Approved Vendors Make.
Rewire able Fuse	WILLY, KEW, SUPER and GWSSB Approved Vendors Make.
Auto Transformer	SUN, ELEMBICA, SUECO, ELTECH OR Any other make approved by CPRI/ERDA Tested as per GWSSB Specification for each Rating and GWSSB Approved Vendors Make.
Capacitor	G.E.B. Approved make and GWSSB Approved Vendors Make.

22) I.S. SPECIFICATIONS:

Control Panel and equipment shall conform to following OR relevant I.S. specifications.

a)	IS : 13947 / Part-I	General requirement of switchgear and control gear voltage not exceeding 1000 Volts.
	IS : 13947 Part-II	Degree of protection provided for switchboard.
	IS : 13947 Part-IV	Contractor AC Voltage not exceeding 1000 Volts.
	IS : 13947 (Part- I & IV)	Motor starter for voltage not exceeding 1000 Volts.
b)	IS : 2705	Specifications for Current Transformer.
c)	IS : 5124-1964	Code of practice for installation and maintenance of induction motor starter AC voltage not to exceeding 1000 Volts.



d)	Multi function meter.
----	-----------------------

- 23) Suppliers shall have to supply the Control Panel Boards as per the Approved Wiring Diagrams.
- 24) The Monogram of “GWSSB” should be screen printed on the panel.

DATA SHEET FOR D.O.L. / STAR DELTA & ATS CONTROL PANEL

Sr No	Description	D.O.L. Qty.	S.D. Qty.	A.T.S. Qty.
1	MCB (For Motor)			
	MCCB			
2	Contactor			
3	Overload Relay			
4	Push Buttons			
	Motor Start			
	Motor Stop			
	Timer Bypass			
	Overload Relay Reset			
5	Indicating Lamps			
	Motor on			
	Motor Run			
	Motor Off			
	Overload Trip			
	SPP			
6	Digital Multi Function Meter			
7	CT for Multi Function Meter			
8	Single phasing Preventer (Auto Switch)			
9	Capacitor			
10	MCB / MCCB for Capacitor			
11	Timer			
12	Control Fuse			
13	Auto Transformer			

NOTE: The use of contactors and overload relays in the Control Panel shall be of one make as far as possible.

Junction box

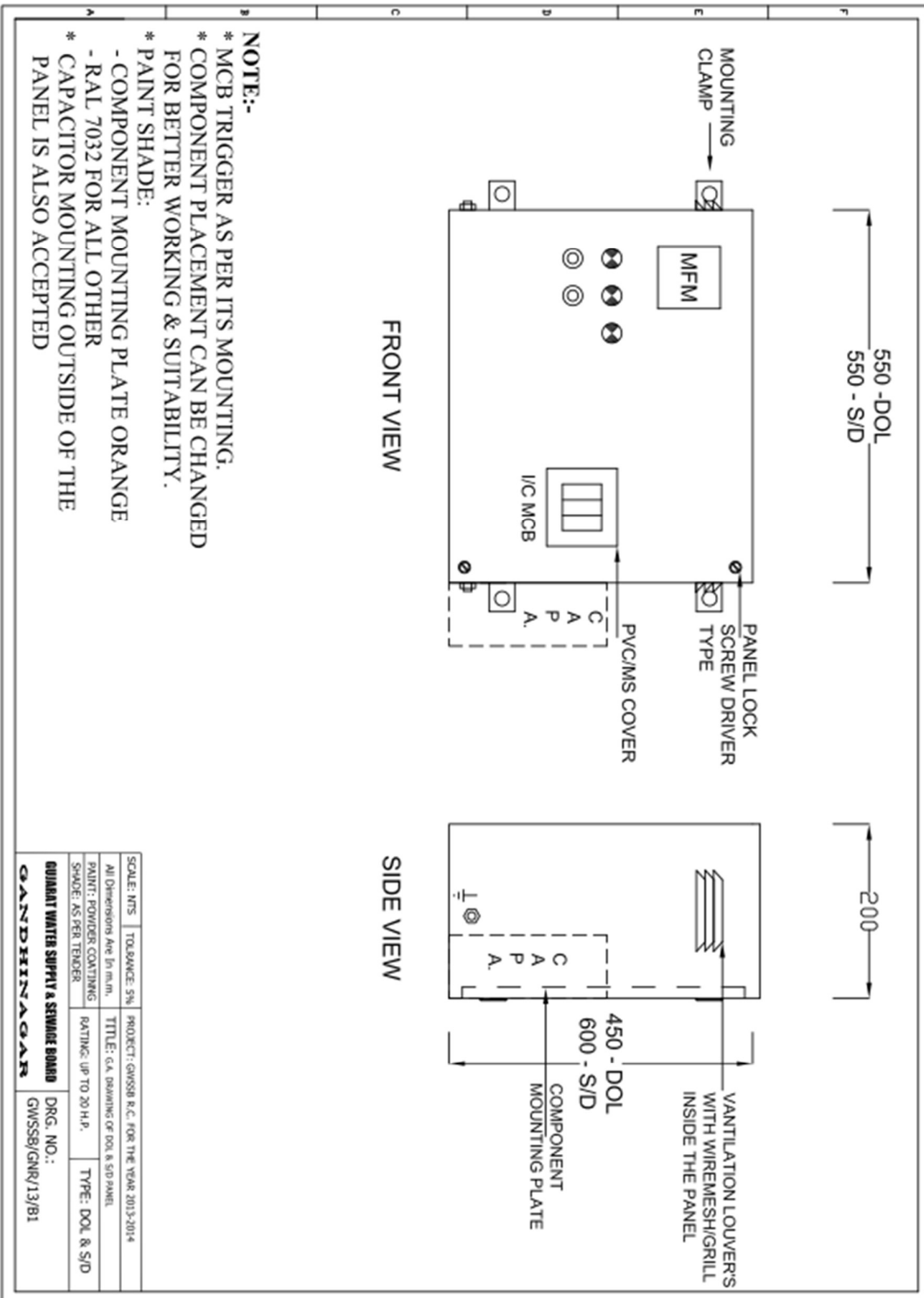
Junction box providing and erecting busbar chamber confirming to is 375 fabricated from 16 gms sheet, dust and vermin proof having hinged door with rubber gasket and necessary busbar supports with aluminum busbar duly wrapped with colour insulation

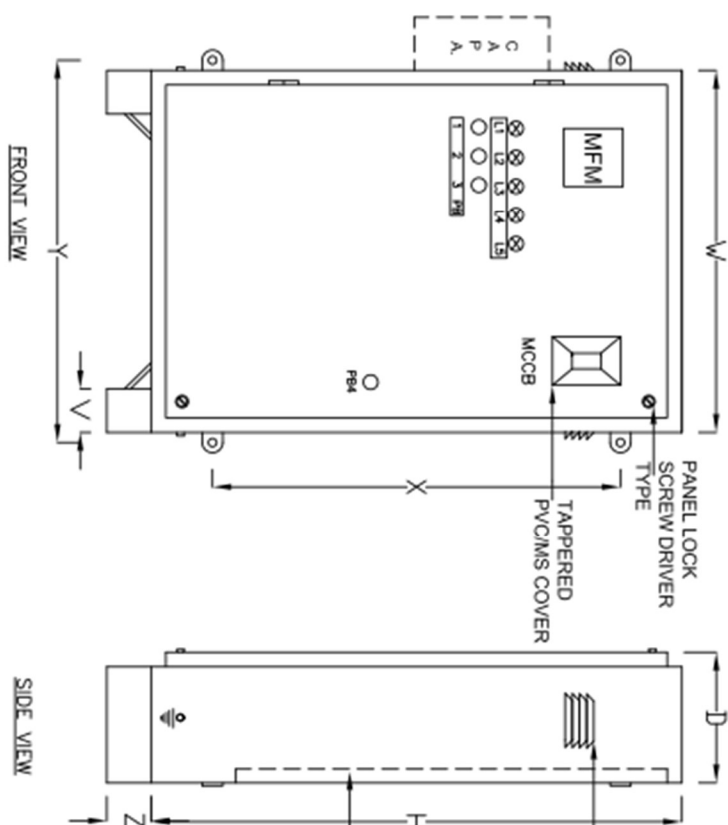


tape for phase sequence, three phase and neutral each on meter long suitable for following current capacity with necessary painting mounted on wall or pedestal frame of required size with necessary connection with proper size of aluminum strip /wire with lugs as directed 100 amp current capacity having cross section area not less than 125 sq.mm.

ALL OTHER ELECTRO - MECHANICAL COMPONENTS AS SHOWN IN PRICE SCHEDULE ARE TO BE PROVIDED ACCORDING TO RELEVANT STANDARD SPECIFICATION AS PER REQUIREMENT OF WORK.







VANTILATION LOUVERS
WITH WIREMESH/GRILL
INSIDE THE PANEL

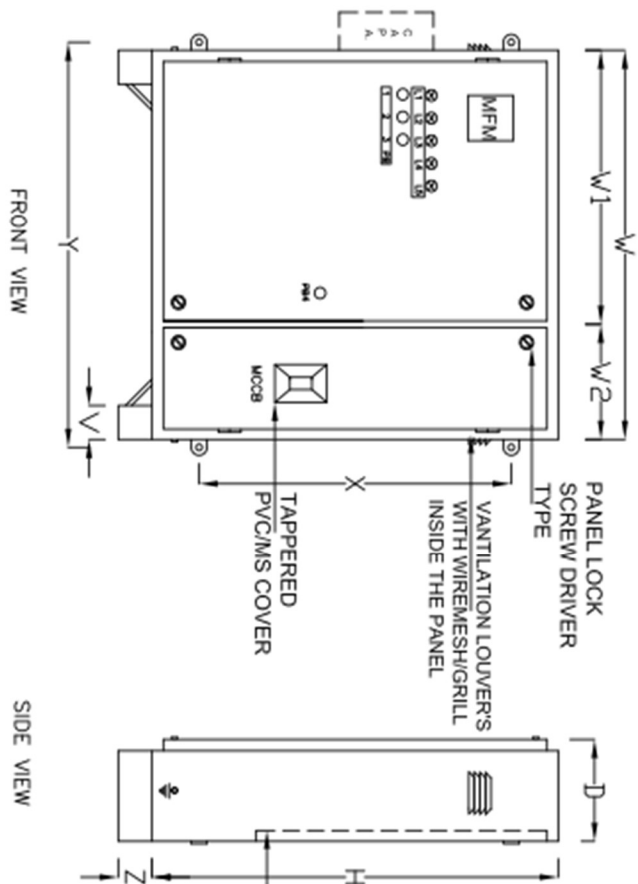
NOTE:-

- * MCCB TRIGGER AS PER ITS MOUNTING.
- * COMPONENT PLACEMENT CAN BE CHANGED FOR BETTER WORKING & SUITABILITY.
- * PB4 LOCATION IS AS PER INSIDE OLR.
- * X & Y DIMENSIONS ARE APPROXIMATE
- * TERMINAL MAY ALSO BE PERMISSIBLE ON INSULATOR WITH COPPER STRIP AND HARDWARE INSTEAD OF BOLTED TYPE TERMINAL.
- * PAINT SHADE:-
- COMPONENT MOUNTING PLATE ORANGE
- RAL 7032 FOR ALL OTHER
- * CAPACITOR MOUNTING OUTSIDE OF THE PANEL IS ALSO ACCEPTED

AUTO-TRANSFORMER			
HP	21-35	36-50	51-70
H	900	1000	1125
W	700	750	850
D	300	300	350
X	700	800	900
Y	750	800	900
Z	150	150	150
V	100	100	100

SCALE: MTS	TOLERANCE: 5%	PROJECT: GWSSB R.C. FOR THE YEAR 2013-2014
ALL DIMENSIONS ARE IN M.M.	TITLE: O.A. DRAWING OF ATS PANEL	
PAINT: POWDER COATING	RATING: 21 to 70 H.P.	TYPE: ATS
SPACE: AS PER TENDER		
GANDRINAGAR		DRG. NO.: GWSSB/GNR/13/B2





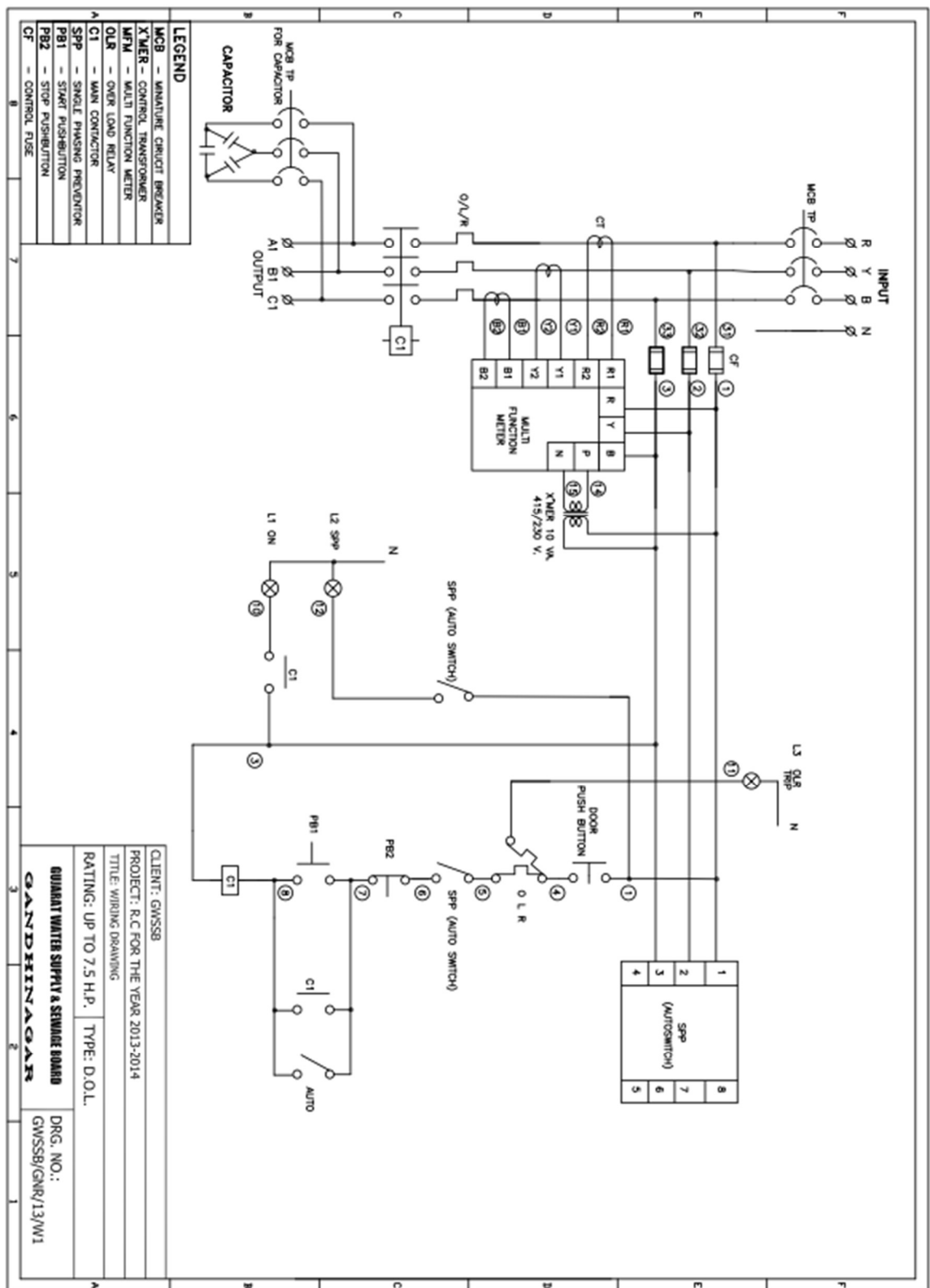
AUTO TRANSFORMER

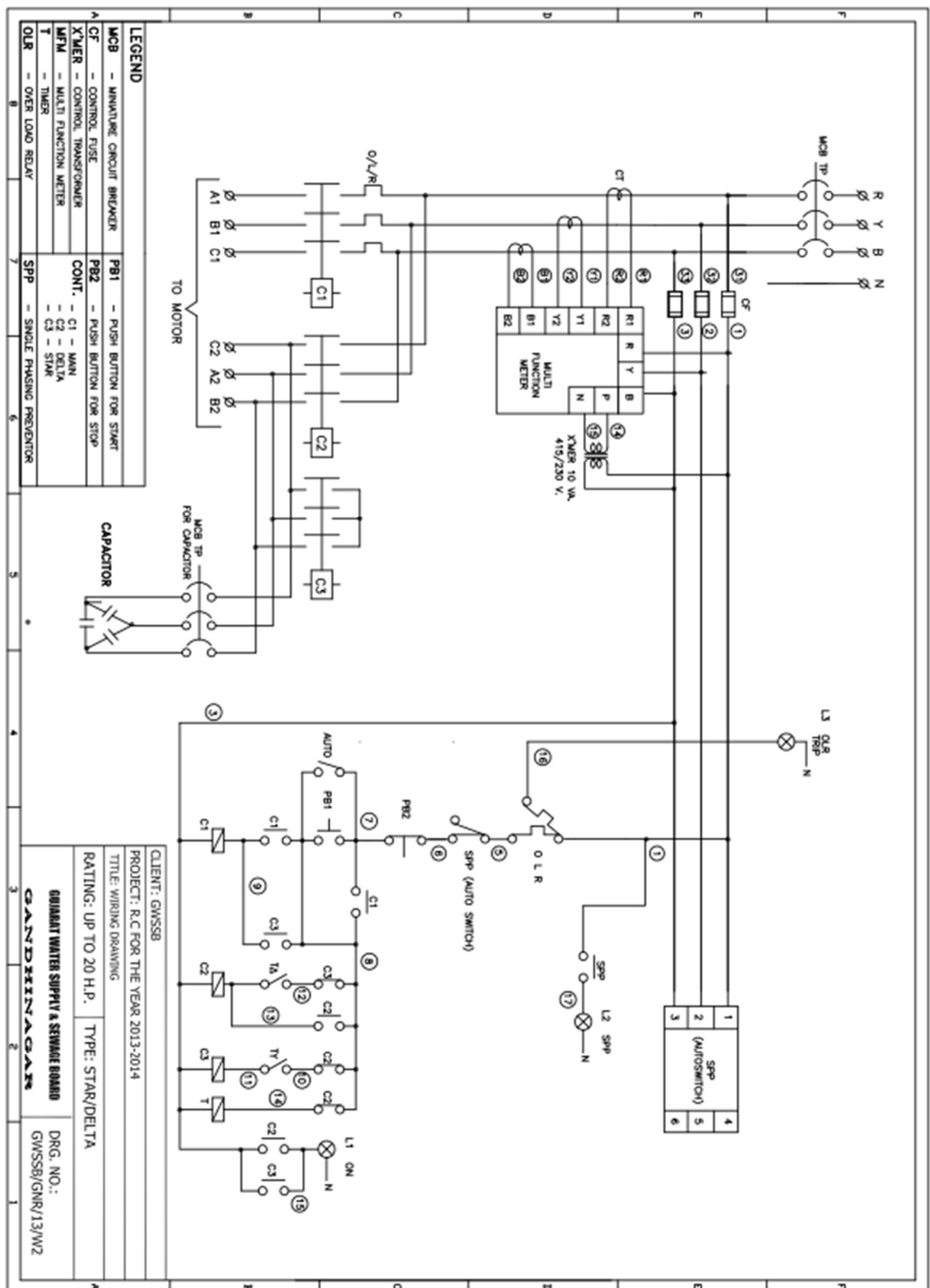
HP	71 TO 80	81 TO 120	121 TO 150	151 TO 160
H	1000	1125	1250	1400
W	1100	1250	1350	1550
W1	750	800	900	1100
W2	350	450	450	450
D	350	350	400	400
X	800	925	1050	1200
Y	1150	1300	1400	1600
Z	150	150	150	150
V	100	100	100	100

- NOTE:-**
- * MCCB TRIGGER AS PER ITS MOUNTING.
 - * COMPONENT PLACEMENT CAN BE CHANGED FOR BETTER WORKING & SUITABILITY.
 - * P/B LOCATION IS AS PER INSIDE OLR.
 - * X & Y DIMENSIONS ARE APPROXIMATE
 - * TERMINAL MAY ALSO BE PERMISSIBLE ON INSULATOR WITH COPPER STRIP AND HARDWARE INSTEAD OF BOLTED TYPE TERMINAL
 - * PAINT SHADE:
 - COMPONENT MOUNTING PLATE ORANGE
 - RAL 7032 FOR ALL OTHER
 - * CAPACITOR MOUNTING OUTSIDE OF THE PANEL IS ALSO ACCEPTED

SCALE: NTS	TOLERANCE: 5%	PROJECT: GWSSB R.C. FOR THE YEAR 2013-2014
All Dimensions Are In mm.	TITLE: G.A. DRAWING OF ATS PANEL	
PAINT: POWDER COATING	RATING: 71 to 160 M.P.	TYPE: ATS
SHADE: AS PER TENDER		
GUANANT WATER SUPPLY & SEWAGE BOARD	DRG. NO.:	
GANDRINAGAR	GWSSB/GNR/13/83	







PVC insulated flat submersible cable as per detailed technical specifications of R/C of GWSSB conforming to IS 694, IEC 60227 /60288 Supply 1 x 3 x 4.0 Sq mm rate cable.

SITC of flat PVC cable for sub pump 1X3X4 mm2

Motor shall be provided with three core Flat PVC Copper water proof and Flexible Cable of suitable length and suitable size. The cross sectional areas should be sufficient so as not to cause voltage drop of more than 2.5% of nominal voltage i.e. 10 volts at 400 volts throughout the length of the cable. Size of the Flat Cable as per ANNEXURE- IV. Cable should be provided with ISI Mark (IS: 694), Manufactured by GWSSB Approved Venders

Conductor Elongation at break of the bare conductor shall be not less than the value specified in table 1. Table 1. Elongation at break of the bare conductor Nominal diameter of wire Minimum elongation Above (mm) Up to (mm) Copper (%) Copper alloy (%) - 0.12 0.2 0.4 0.12 0.2 0.4 - - 8.0 10.0 15.0 6.0 6.0 8.0 - Compliance shall be checked by measuring the elongation at break in accordance with the method specified in 3.3 of IEC 60189-1. If the conductor is tinned, the amount of tin per unit area shall be adequate for soldering the conductor to the terminals without difficulty. Compliance shall be checked by means of the solder test on samples of the conductors in accordance with the method specified in 4.7 of IEC 60189-1. Good tinning shall be evidenced by free flowing of the solder with wetting of the conductor ends.

4.0 G.I. Pipe

Supply of 50 mm dia.G.I. Column pipe

Providing and supplying ISI mark Heavy Duty G.I. pipes with Couplings of following Class and diameter including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete. AND Lowering, laying and jointing G.I. pipes with G.I. specials of following diameters in proper position, grade and alignment as directed by Engineer-in-charge including conveyance from stores to site of work, labour, giving hydraulic testing, etc. complete. Lowering, laying and jointing G. I. pipes with G. I. specials of following diameters in proper position, grade and alignment as directed by Engineer-in-charge including conveyance from stores to site of work, labour, giving hydraulic testing, etc. complet 50 mm Dia. Heavy Duty

1. All pipes, fittings, bolts, nuts, jointing materials and appurtenances for piping to be required for execution of the works shall be manufactured and erected in accordance with the erection plans, specifications and directives of the department. All pipe work and fittings shall be to a class in excess



of the maximum pressure attained in service including any surge pressure.

2. The pipe work installation shall be so arranged to offer ease of dismantling and removal of pumps or other major items of equipment. Expansion bellows with tie rods shall be included in the suction and delivery pipe work of all pumps for easy dismantling as specified in price bid. All loose flanges shall be secured to fixed flanges by suitable tie bolts. All pipe work shall be adequately supported with purpose made fittings. When passing through walls, pipe work shall incorporate a puddle flange. Flange adapters and unions shall be fitted in pipe work runs wherever necessary to permit the simple disconnection of flanges, valves and equipment. The final outlet connection of the pipe work shall match the connecting point of the transmission main.
3. Flanged joints shall be full face, fabric reinforced rubber gaskets, pierced to take the bolts, and the face of all flanges shall be machined to give a true angle of 90° to the centreline of the pipe or fittings. All necessary supports, saddles, slings, fixing bolts and foundation bolts shall be supplied to support the pipe work and its associated equipment in an approved manner. Valves, meters and other devices mounted in the pipe work shall be supported independently of the pipes to which they are connected.
4. The whole of the jointing work and materials necessary to fix and connect the pipes, including adequate and efficient pipe support shall be included in the contract. The bidder shall be responsible for ensuring that the internal surface of all pipe work is thoroughly cleaned before and during erection and before commissioning. Cleaning shall include removal of all dirt, rust, scale and welding slag due to site welding. Before dispatch from the manufacturers' works, the ends of the pipes, branch pipes etc. shall be suitably capped and covered to prevent any accumulation of dirt or damage. This protection shall not be removed until immediately prior to connecting adjacent pipes, valves or pumps. All small bore pipes shall be blown through with compressed air before connection is made to instruments and other equipment. No point of passage of pipes through floors or walls shall be used as a point of support, except with the approval of the department.
5. Material of steel pipes and fittings shall conform to IS: 2062. Fabrication and testing shall be in accordance with IS: 1239 / IS: 3589 for pipes and IS: 6392, ISO 7005 or BS 4504 for flanges. Carbon content & other chemical properties shall be within specified limits of governing IS. Minimum corrosion allowance shall be 2 mm for pipes and fittings which are not mortar lined.
6. All the underground buried mild steel piping shall be protected by the application of hot coal tar enamel and fiber glass wrapping. The coating shall consist of one coal tar primer coat, one coal tar enamel coat, wrapping of fiber glass and one more coat of enamel and then final wrap of enamel impregnated fiber glass.
7. Thickness of pipe for pump house pipe system i. e. suction, delivery, common suction and discharge headers (if any) & header by pass and shall not be less than what is prescribed in relevant IS standards without negative tolerance if specified otherwise in the price bid.



INSTALLATION, TESTING AND COMMISSIONING

5.0 Erection of Sub mono pump set: Lowering of submersible pump set complete with required nos and size of casing pipes erected by means of proper chain pulley block and pipe wrenches after checking of thread of each pipe with coupling to take the load of the pump set and pipe assemble filled up with water. For open well Horizontal submersible pump set for sump well

i. 1 HP to 5 HP

1.1 The Installation work for the Pump set including the foundation work shall have to be carried out as per technical requirement and specification satisfactorily

- 1.2. The Contractor's staff shall include adequate and competent erection engineers with proven, suitable, previous experience on similar contracts to supervise the erection of the works and sufficient skilled, semi skilled and unskilled labour to ensure completion of works in time. The contractor shall not remove any representative, erector or skilled labour from the site without prior approval of the Engineer in charge (EIC) or Engineer in charge's representative.
- 1.3. The Contractor shall ensure that no installation or erection work shall commence until full and unconditionally approved working drawings, signed and stamped by the EIC are available at site.
- 1.4. The Contractor's erection staff shall arrive on the site on dates to be agreed by the EIC. Before they proceed to the site, however, the contractor shall first satisfy himself, as necessary, that sufficient plant of his (or his sub contractor's) supply has arrived on site so that there will be no delay on this account.
- 1.5. One erection engineer who shall be required to be the contractor's representative shall be conversant with the erection and commissioning of the complete works. Should there be more than one erector, one shall be in charge and the contractor shall inform the EIC in writing which erector is designated as his representative and is in charge. Erection engineer is to report to project manager.
- 1.6. The Contractor shall be responsible for setting up and erecting the plant to the line and levels of reference and of the positions, levels dimensions and alignment, appliances and labour in connection therewith. The checking of setting out of any line or level by the EIC or EIC's representative shall not in any way relieve the contractor of his responsibility for the correctness thereof.
- 1.7. Erection of plant shall be phased in such a manner so as not to obstruct the work being done by other contractors or operating staff who may be present at the time. Before commencing any erection work, the contractor shall check the dimension of structures where the various items of Plants are to be installed and shall bring any deviations from the required position, lines or dimensions to the notice of the EIC.



Plant shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the approved drawings. Unless otherwise directed by the EIC, the contractor shall adhere strictly to the aforesaid approved drawings. If any damage is caused by the contractor during the course of erection to new or existing plant or buildings or any part thereof, the contractor shall, at no additional cost to the Employer, make good, repair or replace the damage, promptly and effectively as directed by the EIC and to the EIC's satisfaction.

- 1.8. The contractor shall align all equipment and holding down bolts and shall inform the Employer before proceeding with grouting in the items concerned. The contractor shall ensure that all equipment is securely held and remains in correct alignment before, during and after grouting in.
- 1.9. The approval by the Employer of the contractor's proposals for rigging and hoisting any items of the plant into final positions shall not relieve the contractor from his responsibility for damage to completed structures, parts or members thereof or other installed equipment. He shall at his own cost make good, repair or replace any damaged or injured items, whether structural, electrical, architectural, or of any other description, promptly and effectively to the satisfaction of the Employer.
- 1.10. No plants or other loads shall be moved across the floors of structures without first covering the floors with timber of sufficient size so that applied loads will be transferred to floor beams and girders of steel or concrete. If it is required to reduce bending stresses and deflection, the beams and girders shall be provided with temporary supports.
- 1.11. During erection of the plant the EIC will inspect the installation from time to time in the presence of the contractor's site representative to establish conformity with the requirements of the specifications. Any deviations and deficiencies found or evidence of unsatisfactory workmanship shall be corrected as instructed by the EIC.

2. Leveling and Grouting of Machinery

- 2.1. He shall undertake sufficiently in advance chipping of any unevenness of concrete on foundations, anchor bolt pockets, cutouts etc. to achieve uniform level of reference for erection. All concrete surfaces receiving grout shall be hacked as required to ensure better bonding with grouting.
- 2.2. Contractor shall undertake the inspection of all components to be erected sufficiently in advance to check their soundness and conformity to drawings and the inspection records shall be signed by the Engineer as approval for undertaking the installation of the components. Any damage, shortfalls etc. shall be made good to the satisfaction of the EIC.
- 2.3. All grout for equipment shall be carried out using non shrinkable continuous grout materials with suitable frame work of at least 12 mm thickness. Surfaces to receive the grout shall be hacked and roughened and laitance shall be removed by wire brushing or blast of air. Concrete surface shall be blown off by compressed air before commencing grouting. Grouting shall be done in one continuous operation from one side such that grout flows in a single wave until grout reaches all confined spaces with no air pockets and air from all confined spaces is expelled. A hydro static head of 150 mm shall be maintained during grouting operations. All grouting shall be carried out in the presence of the EIC's representative. All lines and levels shall be checked up after grout is set. Block outs shall be closed



using cement concrete of the same grade as that of the parent structure.

3. Records, Procedures and Reports

- 3.1. The Contractor shall maintain records pertaining to the quality of installation / erection work and inspection, testing, compliance with all technical requirements in respect of all his works as described in the previous paragraphs. The reporting formats shall be in the approved formats. The contractor shall submit such records to the Engineer after the completion of any particular work before submitting the bill of supply / progress of work. Such report shall comprise shop inspection reports, shop testing reports, material test reports, based on which dispatch clearances are provided, all the quality control reports of welding, erection and alignment records.
- 3.2. All the above mentioned records shall be submitted in the final form duly countersigned by the EIC's representative attesting conformity to specifications and his approval of installation, and duly incorporating all the additions, alternations, and information as required by the EIC on the basis of preliminary reports giving the progress of the work. Such records notwithstanding, any records submitted earlier with bill of supply / progress etc. shall be duly bound and submitted to the EIC in six copies by the contractor on his notification of the mechanical completion of erection.

4. General Preparations before Completion of the Plant

- 4.1. The following documents should be completed in accordance with the contract schedule before completion of erection. The Employer and the contractor shall preserve and control these documents in a safe and appropriate place on Site in order the both parties personnel can make use of them at any time.

4.1.1. Technical Documents

- a) Operation and Maintenance manual
- b) Design documents including the contractor's design data, drawings and specifications.
- c) Tools and test equipment list
- d) Spare parts list
- e) Lubricant list

4.1.2. Procedures

- a) Mechanical testing procedure
- b) Electrical testing procedure
- c) Instrumentation testing procedure
- d) Detailed Pre commissioning and commissioning procedure
- e) Detailed Performance Test procedure

4.1.3. General and Coordination Documents.

- a) Detailed organization charts for pre commissioning and commissioning showing lines of authorities and responsibility and functions of all key personnel.



- b) The job description of the members of the team.
- c) The scheduled dates of assignment of each member to pre commissioning and commissioning Organization.
- d) A detailed schedule showing the time sequence which the contractor anticipates to follow for the various steps in completion of erection, pre commissioning and commissioning of each unit and equipment.
- e) The regulations for safety, hygiene and discipline.
- f) The practical organisation of the relationship (meetings, reports, etc.) between the contractor and the Employer at the phases of pre commissioning and commissioning.
- g) Emergency communication route.

4.2. Manpower

- 4.2.1. Required manpower shall be provided as agreed between the contractor and the Employer in a manpower mobilisation plan which shall include the number and qualifications of the operator and maintenance personnel to be furnished by the Employer for the plant.

5. Completion of Erection

- 5.1. The completion of plant under erection by the contractor shall be deemed to occur, if all the units of the plant are structurally and mechanically complete and will include among other such responsibilities the following:

- 5.1.1. Plant in the scope of the contract has been erected, installed and grouted as per specifications.

- 5.1.2. Installation checks are completed and approved by the EIC.

- 5.1.3. The erected plants are totally ready for commissioning checks.

- 5.2. At the stage of completion of erection, the contractor shall ensure that all the physical, aesthetic and workmanship aspects are totally complete and the Plant is fit and sound to undergo tests on completion and subsequent pre commissioning checks.

- 5.3. Upon achieving the completion as described above the contractor shall notify the EIC by a written notice intimating completion of erection and notify the EIC for inspection. The EIC / EIC's representative shall proceed with the inspection of such units within 14 days of such a notice.

- 5.3.1. The EIC shall certify completion when there are no defaults in the works or

- 5.3.2. The EIC shall inform the contractor list of deficiencies for rectification hereinafter referred as Punch list and the contractor shall complete the rectification work within a jointly agreed period before pre commissioning activities and obtain the EIC's acceptance or approval of the same before proceeding with the same.

- 5.3.3. The EIC may inform the contractor that the works are accepted with the 'Punch' list (items which do not hamper operability, safety or maintainability) and allow the Contractors to proceed with the pre commissioning checks when the contractor undertakes to complete such outstanding works within an



agreed time during defects liability period. Taking over shall be based on rectification of all deficiencies as advised by Punch lists.

- 5.4. The erection period indicated by the contractor would be deemed to cover all the activities up to completion as stipulated in previous paragraphs, notice of completion by the contractor, inspection by the EIC for completion and contractor rectification of all deficiencies as noticed by the deficiency / Punch list, and acceptance by the EIC of such rectification's prior to tests on completion.
- 5.5. Minor defects, which in the opinion of EIC which do not hamper operability and maintainability will not be taken into account for deciding mechanical completion. Such defects shall be rectified concurrent to commissioning checks before tests on completion. However, the EIC's decision in this regard is final.
- 5.6. The commissioning period as notified by the contractor shall be deemed to occur beyond the date of completion and shall include all periods of pre commissioning, trials and tests on completion.
- 5.7. It is in the contractor's interest to offer the sections / units / systems progressively under identified milestones within overall erection period, duly completed for rectification of any deficiencies pointed out by the Engineer and to achieve mechanical completion before undertaking the tests on completion within the specified erection period. The EIC also reserves the right to withhold the cost as estimated to be equivalent to the rectification of deficiencies pointed out to the Contractor until such a time such deficiencies are rectified to the satisfaction of the EIC.

6. Pre commissioning

- 6.1. After the completion of erection, pre commissioning activities listed below shall be carried out to make the plant ready for commissioning. All instruments, materials and provisions necessary for conducting site tests shall be provided by the contractor at his own cost.
- 6.2. Upon completion of erection of each piece of equipment, facility or discrete part of the plant, mechanical checks and tests shall be carried out according to the contractor's check list. The mechanical checks and tests shall be to establish that:
 - 6.2.1. The Plant is erected in accordance with the contractor's construction drawings, pipe work drawings, instrument diagrams, etc. issued for the plant.
 - 6.2.2. The materials are installed and mechanically function in accordance with the contract and
 - 6.2.3. Applicable codes as listed in the contract are followed for materials and workmanship.
- 6.3. Items such as painting, thermal insulation and final clean up which do not materially affect the operation or safety of the Plant will be excluded. All these items shall be listed and completed after pre commissioning or commissioning at the discretion of the contractor but before acceptance.
- 6.4. The contractor shall prepare and maintain at site test forms and records which shall include:
 - 6.4.1. Description of type of test or check
 - 6.4.2. Date and times of test or check
 - 6.4.3. Identification of equipment and facilities



- 6.4.4. Test pressure, test data and results, including remarks, if any
- 6.4.5. Signature of the contractor's personnel attesting to data recorded, if any, checks, tests and records thereof shall be carried out by the contractors' construction forces.
- 6.5. Wherever the Employer's witness or attesting of the check or test is required, the Employer's personnel shall attend such check and test. For this purpose, the contractor shall keep the Employer informed of a day to day test plan schedule. The test plan schedule may be revised from time to time to reflect the actual progress of the work and test.
- 6.6. Any items found incomplete or requiring repair or adjustment shall be marked as such on the test records and then reported by the contractor to the Employer and the contractor's personnel in charge of the relevant construction area.
- 6.7. Checking procedures shall be repeated until all the items on the check list are cleared.
- 6.8. A complete set of test records shall be handed over to the Employer on completion.
- 6.9. The tests on the different mechanical and electrical equipment shall include but not limited to:
- 6.9.1. Pumps, Pipe work and Valves
- a) 1.5 times the shut off pressure or twice the working pressure whichever is higher to test the soundness of the joints. Provision of the necessary pumps, gauges, blank flanges, tapping etc. for carrying out these tests shall be included in the contract.
 - b) Leakage tests shall be carried out on all erected pipe work, pumps and valves immediately after erection and where possible before being built in.
 - c) Operating tests shall be conducted on valves.
 - d) The pump set shall be tested for performance. The vibration and noise levels shall be checked to be within the specified.
 - e) The pump shall be tested through the operating range as per BS 5316 Part I Class C / ISO 2548 with all working (excluding stand by) pumps at a time for all the pumps. **However, no negative tolerance shall be permitted on the tested pump efficiency.**
- 6.9.2. Pump motors
- Condition of winding insulation be tested and insulation values shall be restored to required level by suitable heating arrangements locally.
- 6.9.3. Cranes
- The crane and lifting tackle shall be tested to 125 % of the safe working load. The contractor shall arrange the test load. Deflection and speed tests shall also be conducted.
- 6.10. Instrumentation
- The tests on the instrumentation equipment shall include but not be limited to:
- a) All cables shall be tested for polarity, continuity and insulation resistance. The common mode dc voltage at each signal input terminal shall be measured and recorded.



- b) The pre commissioning tests on the various main categories of plant shall be as listed below:
- c) The resistance of each electronic loop shall be measured.
- d) Electronic equipment shall have been energised for at least 24 hours before testing begins.
- e) The zero setting of each display instrument including any local indicator on or associated with a transmitter shall be checked.
- f) The correct calibration of each item in each control or monitoring loop shall be checked by the introduction of appropriate signal at each source, at five cardinal points of the range for increasing and decreasing signals.

6.10.2. The following tests methods shall be used:

- a) Pressure operated devices – dead weight testers or portable calibrators
- b) Level operated devices – actual level variation or simulation thereof. Instrument zero reading shall be checked against a bench mark:
- c) For controlling devices the contractor shall demonstrate the correct operation of the loop including the regulating devices. Each automatic controller shall be set to the appropriate estimated values of the terms which shall be optimised during the plant start up. Each control valve shall be checked during the plant start up. Each control valve shall be checked by operation of the manual control on the associated controller and the correct stroking verified. Valve petitioners, electro pneumatic converters and gauges shall be checked during these tests.
- d) All systems shall be checked for “fail safe” operation.
- e) Initiating devices not covered by the foregoing e.g. plant stop / start controls shall be checked in conjunction with the testing of the associated switchgear and machine.

6.10.3. The contractor shall also demonstrate the data transfer as per data transfer schedule between pumping stations.

7. Commissioning

7.1. After the completion of pre commissioning activities the final checks and preparations necessary for start up of the plant shall be carried out. The contractor shall submit to the Employer a written notice of mechanical completion which shall include:

7.1.1. Identity of a part of the plant considered mechanically complete,

7.1.2. A copy of all relevant completed test reports,

7.1.3. The date on which the completion of the tests was achieved,

7.1.4. Check list and

7.1.5. A request for issuance of a mechanical completion certificate in respect of that part.



- 7.2. Within fourteen (14) days from the date of receipt of the contractor's written notice, the Employer shall:
- 7.2.1. In the case of acceptance, issue a mechanical completion certificate.
- 7.2.2. In the case of objection, submit a rejection statement setting forth remaining items to be completed or defects or deficiencies to be corrected before mechanical completion status can be accepted. When the Employer rejects the contractor's notice the contractor shall take any necessary action to complete or correct the items marked and give the Employer a second notice of mechanical completion.
- 7.3. After the issuance by the Employer of a mechanical completion certificate, commissioning activities listed below shall be carried out to enable the start up and operation of the plant. Procedures are described as below:
- 7.3.1. Commissioning Procedure shall be carried out in a methodical sequence as follows
- a) Warming up
 - b) Start up
 - c) Initial running
 - d) Operability adjustment
 - e) Stable operation
 - f) Final adjustment
- 7.3.2. At all stages of commissioning sequence, the plant shall be operated at optimum plant conditions. To ensure this, the contractor may make minor adjustment to the conditions indicated in the operation and maintenance manual as necessary.
- 7.3.3. The contractor shall check the operating conditions of the plant by constantly monitoring operating data.
- 7.3.4. The contractor shall specify for each discrete part of the plant the operational data to be recorded and the manner in which the data is to be taken.
- 7.3.5. All the operating data shall be recorded by the Employer on the forms to be mutually agreed. A copy of the operating log and analytical data from initial operation through to the completion of performance test shall be made available by the Employer to the contractor for evaluation.



VALVES

6.0 Sluice Valve

Sluice Valve : a) Providing and supplying ISI mark CI D/F Sluice valves of approved makes & confirming to IS 14846 and of following class and diameter; including all taxes, octroi, inspection charges, freight charges, insurance, loading, unloading, conveyance to departmental stores, stacking etc. complete; and

b) Lowering, laying and jointing in position including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete as per instructions of Engineer in charge.

PN-1 with hand wheel /cap operated (PD type short body)

50 mm dia PN 1.0

- 1.3.1 Sluice valve shall conform to IS 14846 - 2000 relevant internationally recognized standards. Ends shall be flanged & drilled as per IS 1538.
- 1.3.2 They shall be of non rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm.
- 1.3.3 The gate face rings shall be securely pegged over the full circumference.
- 1.3.4 Valve of 450 mm and above shall be provided with thrust bearing arrangement for ease of operation. Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15 % in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.
- 1.3.5 All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.
- 1.3.6 All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Specifications & M.O.C. of Sluice valve:

1	General	
---	---------	--



1.1	Type	Both end flanged hand wheel / Gear operated / Actuator Operated
1.2	Rating of valves	PN 1.0 / 1.6
1.3	Manufacturing Standard	IS 14846 - 2000
1.4	Sizes and quantity	As per price bid
2	Materials of construction	
2.1	Non rising Stem	High tensile brass as per IS or high tensile steel AISI - 410
2.2	Body / Bonnet / Wedge / Hand Wheel	CI - IS 210 FG 260
2.3	Stem Nut / Renewable body seat / wedge face ring	Bronze Grade IS: 318 LTB - 2
2.4	Stem packing (renewable valve open on stem)	Jute & Hemp as per IS : 5414
2.5	Bonnet Nuts	Carbon steel as per IS - 1367 CL 4.0
2.6	Bonnet Bolts	Carbon steel as per IS - 1363 CL 4.6
2.7	Bonnet Gasket	Rubber IS : 638 Type - B
2.8	Hydrostatic Test Pressure	
	Body	As per IS 14846
	Seat	As per IS 14846

1.4 Dual Plate Check Valve / NRV

- 1.4.1 The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.
- 1.4.2 Valves shall possess high speed closing characteristics and be designed for minimum slam condition when closing.
- 1.4.3 Dual plate check valves shall conform to API 594 and API 598. They shall have metal to metal sealing. The spring action shall optimize the equal closing rates of each plate especially when the friction coefficients are uneven due to one plate resting upon one another. The plates shall not drag on the seat while opening. The plates shall not vibrate under full or partial flow condition.
- 1.4.4 In case of the nozzle check valve, the disc shall be correctly positioned at all times to achieve fully non slam closure. The spring shall be fully shielded from the flow stream by the central flow diffuser.
- 1.4.5 Tilting disc non return valve shall incorporate a double offset shaft with a variable angle tilt disc configuration. Sealing shall be metal to metal. The disc shall be stable and shall not vibrate under full or partial load conditions.



1.4.6 Valve of diameter greater than 450 mm shall be provided, in addition to others, feet and jacking screws. Hinge pins / shaft shall preferably be square in section to ensure positive location of flaps and provide for secure fixing.

Specifications & M.O.C. of Dual Plate Check Valve:

Sr. No.	General	
1.1	Type	Both end flanged
1.2	Rating of valves	PN 1.0 / 1.6
1.3	Manufacturing Standard	API 594 / 598
1.4	Sizes and quantity	As per price bid
1.5	Maximum pressure drop at design flow rate (mwc)	0.5
1.6	Maximum permissible leakage rate (cc/hr/mm diameter)	7.0
2	Materials of construction	
(a)	Body	Cast Iron IS 210 Gr. FG 260
(b)	Door & Door Face	Cast Steel IS 2062 Gr. B A 216 GR WCB With 13% Cr. Steel overlay (On seating surface only)
(c)	Stop, hinge pin & washer	Stainless Steel AISI 431
(d)	Seat ring (Body)	EPDM Rubber
(e)	Bearings (Body & Plate lug)	PTFE
(f)	Seat ring (Body)	SS AISI - 410
(g)	Spring	Stainless Steel AISI 304
(h)	Hardware	Carbon Steel IS 1367 CL 4.6/4.0
(i)	End Cover	Mild Steel

EXPANSION BELLOWS

The metallic single expansion bellows with all parts shall be manufactured as per EJMA standards. The rating of metallic expansion bellows is PN 1.0 / 1.6 as specified in data sheet & price bid. The bellow shall have both flanged ends of suitable thickness. Material of construction for bellow elements and all other parts are tabulated below. Bellow shall have minimum axial extension of 5 mm & minimum axial compression shall be 15 mm. It shall have adequate capacity to compress and expand



within the limit mentioned in its entire life cycle of minimum 7000 cycles which shall be retained for the entire design period. The period shall have to be specifically mentioned by the bidders. Bellows shall have to be subjected to hydrostatic test at required pressure depending on pressure nomenclature for hold time of minimum 30 minutes.

Materials of Construction:

Sr. No.	Component	Material
(a)	Bellows / Collar / Internal sleeve	SS 240 GR 304
(b)	Limit Rods	CS IS :1367, CL-4.6
(c)	Nut & lock nut	CS IS :1367, CL-4.0
(d)	Lugs / Flanges / Weldend	IS: 2062 Gr. B

PRESSURE GAUGES

Pressure gauges shall be provided on discharge of each pump and on common discharge header of each pump. Pressure gauge shall be bourdon type with a dial size of 150 mm in diameter and calibrated for the required range of duty heads of pumping machinery to be installed as per range available in the market unless specified otherwise in the price bid. The gauge shall be supplied complete with impulse tubing, two valve manifold with drain cock / calibration valve, fittings etc. The pressure gauges shall have an accuracy of $\pm 1\%$ full scale and weather protection class IP 65. All wetted parts material shall be SS 316.

Pressure gauge shall comply with IS 3624 / BS 1780. Pressure gauge shall have siphon & cock arrangement. Glycerine filled dial shall be provided as the gauge is subjected to pressure pulsation and / or vibrations. The internal parts of pressure gauge shall be stainless steel.

The minimum diameter for round pressure gauge shall be 150 mm unless specified otherwise in data sheet.

The zero and span of pressure gauge shall not change by more than $\pm 0.1\%$ of the span per $^{\circ}\text{C}$ changes in ambient temperature.

The pressure gauge shall have to be fitted on individual delivery of pump as well as on the common discharge header.

7.0 Reflux Valve



Providing and supplying ISI mark CS D/F Butterfly Valves as per IS 13095 (Having ISI make embossed on the valve) with Slive of EPDM and disc, shaft & internal part of SS 410 of following class and diameter including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking AND Lowering, laying & jointing in position including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing etc. complete. PN-1 With hand wheel /cap operated (PD type short body)50 mm dia PN 1.0

- 1.2.1 Resilient seated butterfly valve shall be as per IS 13095 – 1991 / BS 5155. Valve shall be suitable for mounting in any position.
- 1.2.2 The valve seat shall be of integrally cast or replaceable design. When the valve is fully closed, the seal shall seat firmly so as to prevent leakage. The seat surfaces shall be machined smooth to provide a long life for the seal.
- 1.2.3 All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve.
- 1.2.4 Valve shall be suitable for throttling purpose.
- 1.2.5 All valve, spindles and hand wheels shall be positioned to give good access for operational personnel.
- 1.2.6 Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.
- 1.2.7 All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Specifications & M.O.C. of Butterfly valve:

1	General	
1.1	Type	Both end flanged hand wheel / Gear operated / Actuator Operated
1.2	Rating of valves	PN 1.0 / 1.6
1.3	Manufacturing Standard	IS 13095 / BS 5155
1.4	Sizes and quantity	As per price bid
2	Materials of construction	
2.1	Internal Hardware	Stainless Steel AISI - 304
2.2	Body/ Disc	CI. IS 210 FG 260



2.3	Body ring (Retainer/seat)	Stainless steel AISI -304
2.4	Shaft	Stainless steel AISI-410
2.5	Disc seat	EPDM rubber/ Nitrile rubber
2.6	Bush & Thrust Pad	G.M. IS :318 LTB-2 / Teflon
2.7	Body seat	Stainless steel AISI -304

Air Valves as per relevant IS Std.

1.0 SCOPE OF CONTRACT:

The contract shall be covering manufacturing, supplying and delivering of;
Air valve double acting (DS2)

GENERAL

The contractor shall be covering manufacturing, supplying and delivery of:
Air valve conforming to IS: 14846 or its latest revision (Specification for Air valves with ISI certification

2.0 CLASSIFICATION

Double acting air valve shall have two ball chambers, on outlet of large capacity shall be provided for admission and release of bulk volume of air during emptying and filling of the main, another of small outlet type for the escape of smaller quantities of air accumulating under pressure. They shall be of flanged type.

3.0 MATERIALS

3.1 CAST IRON

Cast Iron for bodies' pressure covers, splash covers, glands, caps, joints support rings shall be best gray iron of selected grade, 20 of I-S-210-1978 specification for grey iron castings.

3.2 GUN METAL

Gunmetal shall be of mixture of 88% copper, 10% tin 2% Zinc having excellent hard wearing qualities, Ball guides of small orifice units and outlet bushes of large orifice valves shall be of gunmetal.

3.3 FOREGED BROZNE

Nipples, spindles shall be machined from rolled, extruded or forged high tensile brass or aluminum bronze. The produce shall possess much greater strength than ordinary cast product.

3.4 MILD STEEL

Bolts, nuts, flanges etc. shall be of mild steel unless otherwise specified and shall confirm to I.S. 226-1975 specification for structural steel.

3.5 MATERIALS FOR BALLS

The balls shall be of rubber covered and vulcanite covered. The rubber shall have a smooth and hard surface. It shall be as per I.S. 638-1965 specification for rubber and insertion jointing.

3.6 FLANGE JOINTING MATERIALS

The jointing material used between the flanges of components part of the valve shall be compressed fibreboard or rubber of thickness between 1.5 mm to 3 mm. The rubber shall be as per I.S. 683:1965 specifications for rubber and Insertion jointing. The fiberboard shall be impregnated with chemically



natural mineral oil and shall have a smooth and hard surface.

4.0 DIMENSION

Dimension of the Air valves shall be as per relative item mentioned in schedule B of the tender.

5.0 CHARACTERISTICS

- 5.1 Small orifice valves shall have rubber covered balls and nipples of forged bronze or special alloy in to brass plug.
- 5.2 Large orifice valve shall have vulcanite-covered ball closing on rubber sealing backed with leather and gunmetal outlet bushes. They shall be screwed or flanged. The flanged shall be faces and drilled to I.S.S.
- 5.3 For sewage mains, the air valves shall be actuated by mild steel floats bronze spindles and shall be fitted with synthetic rubber seals.
- 5.4 Air valves shall be sound in all respect and uniformly forged so as to have uniform bore. They shall be free from any defects such as unwanted projection, holes or roughness and shall have inner and outer surface perfectly smooth.

6.0 COATING

- 6.1 Immediately after casting and before machining, all cast iron parts shall be thoroughly cleaned and before rusting commences shall be coated by dipping in a bath containing a composition having a tar base.
- 6.2 The coating shall be such that it shall not impose any test of small to water. The coating shall be smooth glossy and sufficiently hard. It shall not chipped when scratched lightly with the point of penknife.

7.0 MANUFACTURERS GUARANTEE

- 7.1 The manufacturers shall guarantee that if any defects chargeable to faulty workmanship, design or materials are found in the valves within a period of one year of dispatch be shall replace any part that prove defective, free of charge at the place of dispatch.

- 8.0 The following information shall be cast on each valve body:

- (a) Manufacturer's name or trademark.
- (b) Size of valve

9.0 MARKING

The marking all the valves are as per relevant standard

10.0 MATERIALS AND WORKMANSHIP:

- 10.1 General requirements of materials and workmanship shall mean any material or article either raw or finished one is required to be used in the manufacturing process of tanks.
- 10.2 All the material shall be new and of high quality.
- 10.3 In case, if material is not specified by relevant ISS for manufacturing part or the whole as item, the supplier shall prepare specifications in concurrence with manufacturer and shall seek an approval of Engineer prior to its use in the manufacturer.

11.0 TEST CERTIFICATE & INSPECTION:

- 11.1 The supplier shall always provide manufacturer's test & inspection certificate as per relevant IS Standard in accordance with every batch/lot of goods so manufactured and supplied.
- 11.2 The supplier shall also produce in addition to manufacturer's test certificate as mentioned in para 7.1 above.

Excavation for jointing headerpipe with rising main pipe refilling thesame after jointing.

1.1 General



- 1.1.1 Valves shall be as per internationally recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504.
- 1.1.2 Valves shall be double flanged type and the face shall be parallel to each other and flange face should be at right angles to the valve centerline. Back side of valve flanges shall be machined or spot faced for proper seating of the head and nut.
- 1.1.3 Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.
- 1.1.4 Valve shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.
- 1.1.5 The valve stem, thrust washers, screws, nuts and all other components exposed to the water shall be of a corrosion resistant grade of stainless steel.
- 1.1.6 Valves shall be free from sharp projections.
- 1.1.7 Butterfly, non return valves and non rising spindle sluice valves size are small hence shall be provided without bypass arrangement. Butterfly shall have a gear mechanism operating arrangements with indicator to see the open close status.
- 1.1.8 Governing standards for butter fly, sluice, dual plate check (non return), reflux valves are tabulated below.

Sr. No.	Description	Standards
1	Sluice valves for water works purposes Class - I	IS: 14846 - 2000
2	Butterfly valve for water works purposes	IS : 13095 - 1991 / BS 5155
3	Dual Plate Check Valve	API 594 / API 598
4	Reflux valve	IS : 5312

- 1.1.8 The tolerance on the valve dimensions shall be as per relevant standard / code but not exceeding the following;

- 1) Face to face ± 3 mm
- 2) CD of flange ± 3 mm
- 3) Bolt circle diameter ± 2 mm
- 4) Thickness of flange ± 2 mm

Dimensional tolerance on casting shall be as indicated in IS : 5519

- 1.1.9 For sluice valves located below floor, suitable floor stands for extension bonnets as required shall be provided. These shall be complete with proper extension stamps, valve stem coupling hand



wheel above offer shall be minimum 600 mm.

1.1.10 Testing for all types of valves

1.1.11 All valves shall be tested, hydraulically as per relevant standards. Body test and test shall be carried out and check for water tightness.

1.1.12 Materials certificate physical & chemical analysis certificates of all component of the valve shall be furnished to GWSSB.

1.1.13 Certified hydraulic test report for all body casting shall be furnished to GWSSB.

8.0 Cable Glands

Providing & fitting heavy duty brass cable glands (nickel-plated) with washers & rubber ring conforming to IS, suitable for 3, 3½ & 4 core cables of following type & sizes:
Single Compression Brass Cable Glands
A. 4 Sq mm Core 3 to 4, size of gland: 28 mm

9.0 EARTHING

Supplying & erecting funnel type earthing having earth plate of following size buried in specifically prepared earth pit 3 mtr. below ground with 40 kg. charcoal and salt with alternate layers of charcoal & salt, 20mm.dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. Cover complete as per para 7.3 of IS 3043 with necessary length of double Galvanised Iron / copper earth wire No 6 SWG bolted with lug to the plate and covered in 12 mm dia. G.I. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to IS (As per drawing) with following specification **With 45 x 45 x 0.35 cms. C.I. earth plate** For electrical body, LT MCC starter panels, APFC Panel, LDB,PDBi.e. independent earthing in normal soil with length of pipe 3.00 mtr.

Provision shall be provided for connecting the earth. All non-current carrying metallic parts of the equipment shall be earthed Two "L" shaped earth bus of aluminum (19 mm x 3 mm) will be connected between base plate and the body of the panel. Also necessary provision of earthing on door shall be made to connect main Earthing.

SITC of funnel type earthing

SITC of funnel type earthing having earth plate of following size buried in specially prepared earth pit 3.0 mtr below ground with 40.0 kg charcoal and salt with alternate layers of charcoal and salt 20 mm diagi pipe with funnel with wire mesh for watering and brick masonry block and c.i. cover complete as per para 7.3 of is 3043 with necessary length of double g.i. / copper earth wire no-6 swg bolted with lug to the patented covered in 12 mm diag.i. pipe 2.5 mtr long complete connected to the nearest switch gear with end socket as per direction and duly tested by earth tester confirming to iss.as per drawing of specifications. Comp. With 30 x 30 x 0.35 cm ci earth plate comp.



1.1. 10.0 TECHNICAL SPECIFICATION FOR REWIRE ABLE PORCELAIN CUT OUT FUSE UNIT

Providing approved make tripple poles cast iron clade switch & rewirable fuse with neutral link 415/500 volt confirming to IS including erection & connection charges for 16 A TP as directed on angle iron frame)

a. 16 A Cat. II (up to 5 HP)

1. The re- wire able fuses shall comply with IS : 2086 as amended from time to time up to date unless otherwise stated elsewhere in this specification.
2. The rated breaking capacity of the fuses up to 16A rating is 2 KA and for above 16A rating the same shall be 4 KA, at a p.f. not exceeding 0.4 (lag).
3. The fuses wire shall conform to IS: 9962:1981 or latest amendment thereof, if any.
4. The fuses wire shall be surrounded by an asbestos/porcelain tube for tending distribution of temperature symmetrically. However, it may not be necessary for rating up to 100Amps.
5. The ends of the tubes shall be baffled by the construction of the body & holder so that flame cannot emit.
6. The length of the fuse wire & mass of the terminals shall be so designed to give desired current- time characteristics of the fuse wire.
7. The continuous rating of tinned-copper fuse wire in semi-enclosed fuses shall not be greater than 60% of their minimum fusing current.
8. The fuse shall glow within 30 minutes when carrying 1.9 times its rated current.
9. The fuse shall carry 1.6 times rated current for at least 30 minutes.
10. The fuses unit shall be capable of withstanding the let through fault current corresponding to prospective fault current.
11. The fuse carrier shall be capable to carry following size of fuse wires(tinned Copper Wire)

Rated Current	Size of Fuse (mm)	Fusing Current
16Amps	0.5 mm	25 Amp
32Amps	0.9 mm	50 Amp
63Amps	1.6 mm	100 Amp
100Amps	2.0 mm	160 Amp
200Amps	2X2.3 mm	300 Amp
300Amps	2X3.2 mm	480 Amp



400Amps	2X3.66 mm	600 Amp
500Amps	2X4.0mm	800 Amp

1.2.

1.3. TECHNICAL SPECIFICATION FOR L.T REWIRE ABLE PORCELAIN FUSE UNIT

1.3.1.

1.3.2. Mounting-of Fuse Unit:

The Fuse Unit can be mounted in an enclosed or open state at any angle on a vertical plain without impairing their performance.

1.3.3. Contacts:

1. The contacts of Fuse Unit shall be robust construction and securely fixed on porcelain fuse base/ carrier and shall conform to the ; provision of IE Rule,1956 with latest amendments.
2. Fixed and Moving Contact materials & other requirements: Annealed Electrolytic Copper duly electroplated with tin or silver to avoid oxidization above 500 C . For fuse up to 100A tin plating shall be used with 8-10 micron thickness of plating.
3. Fixed contacts shall be of spring loaded reversible loop type for base & that for Moving contact (carrier) is knife contact type of 'U'SHAPE.
4. The current density of contact material shall not exceed limit as per IS;2086;1993 or other applicable standard .
5. The resistivity of contact material shall be less than 0.017 micro ohm/meter.
6. The melting point and specific heat of contact shall be 10800C & 375 J/KGK respectively.
7. The magnitude of temperature rise of contacts at maximum ambient temperature of 400C for fixed & for carrier is 550C.
8. The voltage drop cross contacts with carrier fully engaged with contacts shall not exceed the limit as stated in IS; 2086; 1993 or other applicable standards.
9. The spring material of reversible loop base shall be of phosphor bronze.

1.3.4. Terminal Blocks:

1. The terminal blocks shall be made of solid brass/solid copper alloy block of adequate mass to keep down the temperature of the fuse unit. The temperature rise of fuse contacts and terminals need be limited to lower values as far as possible up to 100% rated current for continuous operation to keep down the rate of contacts.
2. Terminal blocks shall be of following sectional area and lengths to take cable connections by means of standard terminal screws up to 100A only. Above termination of Incoming/outgoing cables will be made extended copper strips of thickness not below the size specified as follows and also as stated in Annexure.

Rating	Min Acceptable Section Area(Including area of Hole)	Length (Min)	Dia of hole in Terminal Block and in extended Plate	Size of Extended Terminal Plate
16 Amps	60 mm ²	9 mm.	4.5 mm	Nil



32 Amps	80 mm ²	9 mm.	5.5 mm	Nil
63 Amps	200 mm ²	9 mm.	9.5 mm	Nil
100Amps	300 mm ²	9 mm.	12.6 mm	Nil
200 Amps	700 mm ²	9 mm.	10 mm (In Ex.Plate)	5 x31 mm ²
300 Amps	1000 mm ²	9 mm.	12 mm (In Ex.Plate)	6 x41 mm ²
400 Amps	1100 mm ²	9 mm.	12 mm (In Ex.Plate)	6 x46 mm ²
500 Amps	1200 mm ²	9 mm.	16 mm (In Ex.Plate)	7 x50 mm ²

1. The hole in the Terminal Block shall be of appropriate diameter to receive Aluminium Conductor of rated current carrying capacity.
2. The brass socket of alum cable should have identical current carrying capacity of that of the cable. The extended plates should be adequately electro-tinned and provided with hole/brass bolts and nuts/washer for termination of Incoming/outgoing cable.
3. To eliminate hazards of accidentally touching live parts, the extended terminals may be either provided with protective enclosure (for extended part only) or duly insulated with heat shrinkage PVC Tube.
4. The heat shrinkage PVC covering should be of 1.1 KV Grade.
5. The following are the recommended cable size for different current rating of fuse.

Fuse Rating	Size of Aluminium	Overall Dia of Conductor
16Amp	1X6 mm ²	2.80 mm
16Amp	1X6 mm ²	5.10 mm
32Amp	1X35 mm ²	7.50 mm
100Amp	1X70 mm ²	11.2 mm
200Amp	1X95 mm ²	12.50 mm
300Amp	1X120 mm ² (2 No Parallel)	14.5 mm



400Amp	1X185 mm2 (2 No Parallel)	17.5 mm
500Amp	1X300 mm2 (2 No Parallel)	22.5 mm

1.3.5. **Withdrawal Force:**

Fuse Rating	Withdrawal Force
16Amp	0.5 To 2.5 Kg
32Amp	1.5 To 5.5 Kg
63Amp	3 To 10 Kg
100Amp	4 To 10 Kg
200Amp	15 To 70 Kg
300Amp	15 To 70 Kg
400Amp	20 To 80 Kg
500Amp	20 o 80 Kg

INSTALLATION, TESTING & COMMISSIONING – ELECTRICAL EQUIPMENT

1 Equipment Installation, Testing & Commissioning

Installation of Equipment

- a) In accordance with the specific installation instructions, as shown in contractor's drawings or as directed by the EIC's representative the contractor shall unload, erect, install, wire, test and place into commercial use of all electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square, and properly aligned and oriented.
- b) The contractor shall furnish all supervision, labour, tools, equipment, rigging materials and incidental materials such as bolts, wedges, anchors, concrete inserts etc. required to completely install, test and adjust the equipment.
- c) Drawings, instructions and recommendations shall be correctly followed in handling, settling, testing and commissioning of all equipment and care shall be exercised in handling to avoid distortion to stationary structures, the marring of finish or damaging of delicate instruments or other electrical parts.
- d) The contractor shall erect and commission the equipment as per the instructions of the EIC representative and shall extend all cooperation to him.
- e) In case of any doubt / misunderstanding as to correct interpretation of drawings or instructions, necessary clarification shall be obtained from the EIC's representative. The contractor shall be held responsible for any damage to the equipment consequent to not following instructions



correctly.

- f) The contractor shall move all equipment into the respective buildings through regular doors or floor openings provided specifically for the equipment. The contractor shall make his own arrangement for lifting of equipment.
- g) Where assemblies are supplied in more than one section, the contractor shall make all necessary mechanical and electrical connections between sections including the connections between bus bars / wires. The contractor shall also carry out the adjustments / alignments necessary for proper operation of the circuit breakers. All insulators and bushings shall be protected against damage during installation. Insulators or bushings chipped, cracked or damaged due to negligence or carelessness shall be replaced by the contractor at his own expenses.
- h) The contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments or relays are supplied separately, they shall be mounted only after the associated control panels have been erected and aligned. The blocking material / mechanism employed for the safe transit of the instruments and relays shall be removed after ensuring that the panels have been completely installed and no further movement of the same would be necessary. Any damage to relays and instruments shall be immediately reported to the EIC's representative.
- i) Inspection, storage, installation, testing and commissioning of transformers shall be in accordance with the latest Indian Standards Code of Practice IS: 10028. All commissioning tests as applicable, vide Appendix B of IS: 10028 (Part II) shall be carried out.
- j) Switchgear control panels shall be installed in accordance with the latest Indian Standard Code of Practice 10118. The switchgear panels shall be installed on finished surface or concrete or steel sills. The contractor shall be required to install and align any channel sills which form part of the foundations. Tape or compound shall be applied where called for. The base of outdoor type units shall be sealed in an approved manner to prevent ingress of moisture.
- k) After installation of all power and control wiring, the contractor shall perform operating tests on all switchgear and panels to verify the proper operation of switchgear / panels and the correctness of the interconnections between various items of equipment. This shall be done by applying normal ac or dc voltage to the circuits and operating the equipment. Megger tests for insulation, polarity checks on the instrument transformers, operation tests on equipment, and installation tests shall be carried out by the contractor who shall also make all necessary for proper functioning of the equipment.
- l) Installation and testing of the battery and battery chargers shall be done in strict compliance with the applicable standards. Each cell shall be inspected for breakage and condition of cover seals as soon as received at site. The battery shall be set up on racks as soon as possible after receipt, utilising lifting devices. The cells shall not be lifted by the terminals. Contact surface of the battery terminals and inter cell connectors shall be cleaned, coated with protective grease and assembled. Each connection shall be properly tightened. Each cell shall be tested with a hydrometer and



thermometer and the results logged. A freshening charge, if required, shall be added. When handed over to the Employer, the battery shall be fully charged and the electrolyte shall be at the full level and of the specified specific gravity.

- m) Equipment furnished with finished coats of paint shall be touched up by the contractor if their surface is spoiled or marred while handling.
- r) Foundation work and grouting in of fixing bolts or channels for all transformers, switchgear, motor control panels will be carried out by the contractor.

2 Installation Work for Earthing and Lightning Protection System

- a) The Contractor shall install copper /steel conductors, braids, etc. required for the system and individual equipment earthing. All work such as cutting, bending, supporting, painting / coating, drilling, brazing /soldering / welding, clamping, bolting and connecting onto structures, equipment frames, terminals, rails or other devices shall be in the contractor's scope of work. All incidental hardware and consumables such as fixing cleats / clamps, anchor fasteners, lugs, bolts, nuts, washers, bituminous compound, welding rods, anti corrosive paint as required for the complete work shall be deemed to be included by the contractor as part of the installation work.
- b) The quantities, sizes, material of earthing conductors and electrodes to be installed as per requirement. Routes of the conductors and locations of electrodes shall be as shown on the project drawings.
- c) The work of embedment of earthing conductor in RCC floors / walls along with provision of earth plate inserts / pads / earth risers shall be done by the civil contractor when the floors are cast or during construction of walls. However when required to do so in those areas where flooring will be done after the Contractor is at site, the Contractor shall coordinate with civil contractor and shall install the earthing conductors before the commencement of the concrete work. In such cases the contractor's scope of installation shall include laying the conductors in position with 50 mm concrete cover, making welded connections to inserts / pads / risers above the floor near the equipments. The embedded conductors shall be connected to reinforcing rods wherever necessary.
- d) If the tap connections (earthing leads) from the floor embedded main earthing grid to the equipment are more than 500 mm long then the same shall be embedded in floor by the Contractor where required, together with associated civil work such as excavation / chipping, concreting and surfacing, if not already done by the civil contractor. The concrete cover over the conductor shall not be less than 50 mm.
- e) Installation of earth conductors in outdoor areas, buried in ground, shall include excavation of earth up to 600 mm deep 450 mm wide, laying of conductors at 600 mm depth, brazing / welding as required, of main grid conductor joints as well as risers of length 500 mm above ground at required locations and then backfilling material to be placed over buried conductor shall be free from stones and other harmful mixtures. Back fill shall be placed in layers of 150 mm, uniformly spread along the ditch, and tampered utilising pneumatic tampers or other approved means. If the excavated soil



is found unsuitable for backfilling, the contractor shall arrange for suitable material from outside.

- f) Installation of earth connection leads to equipment and risers on steel structures / walls shall include laying the conductors, welding / cleating at specified intervals, welding / brazing to the main earth grids risers, bolting at equipment terminals and coating welded / brazed joints by bituminous paint. Galvanized conductors shall be touched up with zinc rich paint where holes are drilled at site for bolting to equipment / structure.
- g) Electrodes shall be installed (a) directly in earth or (b) in constructed earth pits, and connected to main buried earth grid, The scope of work shall include excavation, construction of the earth pits including all materials required for construction of earth pits, placing the rod and fixing test links on those pipe / rod / plate electrodes in test pits and connecting to main earth conductors.
- h) Installation of lightning conductors on the roofs of buildings shall include laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods wherever necessary, laying fastening / cleating / welding of the down comers on the walls/columns of the building and connection to the test links to be provided above ground level.
- i) Installation of the test links shall include mounting of the same at specified height on wall/column by suitable brackets and connections of the test link to the earth electrode.
- j) Whenever main earthing conductor crosses cable trenches, they shall be buried below the trench floor.
- k) Suitable earth risers shall be provided above finished floor/ground level. If the equipment is not available at time of laying of the main earth conductors. The minimum length of such riser inside the building shall be 200 mm and outdoors shall be 500 mm above ground level. The risers to be provided will be marked in project drawings.
- l) Earth leads and risers between equipment earthing terminals and the earthing grid shall follow as direct and short a path as possible.
- m) An earthing mat shall be provided under each operating handle of the isolator and operating mechanism of H.V. breakers. Operating handle of the isolator and supporting structure shall be bonded together by a flexible connection and connected to the earthing grid.
- n) A separate earth electrode bed shall be provided adjacent to structure supporting lightning arrestors. Each connection shall be as short and as straight as practicable. For arrestors mounted near transformers, earth conductors shall be located clear off the tank and coolers.
- o) Wherever earthing conductors passes through walls galvanized iron sleeves shall be provided for the passage of earthing conductor. The pipe ends shall be sealed by the contractor by suitable water proof compound.

3 Earthing Connections

- a) All connections in the main earth conductors buried in earth / concrete and connection between main earthing conductor and earth leads shall be of welded type.



- b) Connection between earth leads and earthing terminal provided on the equipment shall be bolted type.
- c) All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- d) Metallic conduits and pipes shall be connected to the earthing system.
- e) Lightning protection system down conductors shall not be connected to other earthing conductors above ground level. Also no intermediate earthing connection shall be made to lightning arrester and transformer earthing leads which shall be directly connected to pipe electrode.

4 Earth Electrodes

- a) Electrodes shall as far as practicable be embedded below permanent moisture level.
- b) Test pits with concrete covers shall be provided for periodic testing of earth resistance. Installation of pipe electrodes in test pits shall be suitable for watering. The necessary materials required for installation of test pits shall be supplied and installed by contractor. The installation work shall also include civil work such as excavation and connection to main earth grid.
- c) Earth pits shall be treated with salt and charcoal if average resistivity of soil is more than 20 ohm metre.
- d) Soil, salt and charcoal placed around the electrode shall be finely graded, free from stones and other harmful mixtures. Back fill shall be placed in layers of 250 mm thick uniformly spread and compacted. If excavated soil is found unsuitable for backfilling, the contractor shall arrange for a suitable soil from outside.

5 Lightning Protection System

- a) The lightning protection air termination rods and/or horizontal air termination conductors shall be fixed in such a way that they remain in their installed position even during severe weather conditions. The necessary accessories such as cleats, clamps, welding materials, bolts, nuts, shall be supplied by contractor.
- b) Air termination systems shall be connected to earthing system by down conductors as shown in project drawings. The down conductors shall follow a direct path to earth. There shall not be any sharp bends, turns and kinks in the down conductors.
- c) All joints in the down conductors shall be of welded type. All metallic structure within 2 metres of down conductors shall be bonded to lightning protection system.
- d) Every down conductor shall be provided with a 'test link' at about 1000 mm above ground level housed in a suitable GI enclosure made of adequate thickness steel sheet and hot dip galvanised. The test joint shall be directly connected to the earthing system electrode.
- e) The lightning protection system shall not be in direct contact with underground metallic service ducts, cables, cable conduits and metal enclosures of electrical equipment. However, all metal projections, railings, vents, tanks, etc. above the roof shall be bonded together to form a part of roof grid.



6 Installation of Cable Racks And Trays

- a) Lines and grade for trays may be measured from building steel and finished floor elevations. Change in line or grade, or the addition of offsets by means of cutting standard tray sections and inserting additional tray fittings to match with the existing arrangement shall be considered as a normal part of the work.
- b) Where embedded steel inserts in concrete floors / walls for welding the supports for cable racks / trays are not available, Contractor shall provide suitable anchor fasteners at no extra cost.
- c) Cable shall be clamped to the cable trays at regular intervals.
- d) Flexible metallic conduits shall be used for termination of connection to equipment such as motors, limit switches and other apparatus.

7 Installation of Cables

- a) The installation of cable shall be on tray and other support as per standard engineering practice.
- b) The contractor shall install, test and commission the cables specified in the specification in accordance with drawings and instructions issued by the EIC's representative. Cables shall be laid directly buried in earth, on cable racks, in built up trenches, on cable trays and supports, in conduits and ducts or bare on walls, ceiling etc. as per drawings. Contractor's scope of work includes unloading, laying, fixing, jointing, bending, and termination of the cables. The contractor shall also supply the necessary materials and equipment required for jointing and termination of the cables.
- c) All apparatus, connections and cable work shall be designed and arranged to minimise risk of fire and any damage which might be caused in the event of fire. Wherever cables pass through floor or wall openings or other partitions, suitable bushes of an approved type shall be supplied and put into position by the contractor.
- d) Standard cable grips and reels shall be utilised for cable pulling. If unduly difficult pulling occurs, the contractor shall check the pull required and suspend pulling until further procedure has been approved by the EIC's representative. The maximum pull tension shall not exceed the recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering and does not set up undesirable conditions of electrostatic stress or electrostatic charge may be used to assist in the pulling of insulated cables in conduits and ducts.
- e) After pulling the cable, the contractor shall record cable identification with date pulled neatly with waterproof ink in linen tags. Identification tags shall be attached securely to each end of each cable with non corrosive wire. The said wire must be non ferrous material on single conductor power cable. Tags shall further be attached at intervals on long runs of cables on cable trays and in pull boxes. Cable and joint markers and RCC warning covers shall be provided wherever required.

All cables shall be allocated a unique number which shall be fixed to each end of the cable using a corrosion resistant label. Cables of different categories shall be tagged with the following subscripts and three digit numbers.



HV power	HV-P
LV power	P
Control	C
Instrumentation	I
Protection	PR
Telecommunication	T

- f) Sharp bending and kinking of cables shall be avoided. The bending radii for various types of cables shall not be less than those specified below:

6.6 kV XLPE multi core	15 times the overall armoured cable dia of the cable
650 / 1100 V PVC insulated	12 times the overall armoured cables dia of the cable

If shorter radius appears necessary, no bend shall be made until clearance and instructions have been received from the EIC's representative.

- g) Power, control and instrumentation cables shall be laid in separate cable racks / trays.
- h) Where groups of HV, LV and control cables are to be laid along the same route, suitable barriers to segregate them physically shall be provided.
- i) Cables of different categories shall be installed so as to maintain satisfactory clearances for safety and in order to reduce the possibility of electrical interference. The following table gives the distances in mm that shall be maintained between the different categories of cable.

Cable Category	HV Power	LV Power	C & I Protection	Telecommunication
HV Power	N/A	275	550	550
LV Power	275	N/A	275	275
C & I / Protection	550	275	N/A	275
Telecommunication	550	275	275	N/A

- j) Where cables cross roads and water, oil, gas or sewage pipes, the cables shall be laid in reinforced spun concrete or steel pipes. For road crossings the pipe for the cables shall be buried at no less than one metre depth.
- k) Cables laid in ground shall be laid on a 50 mm riddled earth bed. The cables shall then be covered



on top and at their sides with riddled earth of depth of about 150 mm. This is then gently filled up to a depth of about 100 mm above the top of uppermost cable to provide bedding for the protective cable covers which are placed centrally over the cables. The protective cable covers for LV cables may be of earthenware and for HV cables of reinforced concrete. The RCC covers shall have one hole at each end, to tie them to each other with GI wires to prevent displacement. The trench is then backfilled with the excavated soil and well rammed in successive layer of not more than 300 mm in depth, with the trenches being watered to improve consolidation wherever necessary. To allow for subsidence, it is advisable to allow a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench.

- l) In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop a fault at a later date.
- m) Cables on cable racks, on cable trays and conduits shall be formed to avoid bearing against edges of trays, racks, conduits or their supports upon entering or leaving trays, racks or conduits. Cables shall be racked or laid directly into cantilevered cable trays where practicable, but in some cases it may be necessary that cables are pulled or threaded into trays. To facilitate visual tracing, cables in trays shall be laid only in single layers and unnecessary crossing of cables shall be avoided. Cables on trays shall finally be clamped in an approved manner.
- n) Cable splices will not be permitted except where permitted by the EIC's representative. Splices shall be made by contractor for each type of wire or cable in accordance with the instructions issued by cable manufacturer's and the EIC's representative. Before splicing, insulated cables shall have conductor insulation stepped and bound or pencilled for recommended distance back from splices to provide a long leakage path. After splicing, insulation equal to that on the spliced conductors shall be applied at each splice.
- o) Jointing of cables shall be in accordance with relevant Indian Standards Codes of Practice. Materials and tools required for cable jointing work, including cold setting bituminous compound shall be supplied by the contractor. Cables shall be firmly clamped on either side of a straight through joint at a distance of not more than 300 mm away from the joints. Identification tags shall be provided at each joint at all cable terminations.
- p) At cable terminal points where the conductor and cable insulation will be terminated, terminations shall be made in a neat, workmanlike and approved manner by men specialised in this class of work.
- q) Control cable termination shall be made in accordance with wiring diagrams, using colour codes established by the EIC's representative for the various control circuit, by code marked wiring diagram.
- r) When control cables are to be fanned out and cabled together with cord, the contractor shall make connections to terminal blocks, and test the equipment for proper operation before cables are corded together. If there is any question as to the proper connection, the contractor shall make a temporary connection with sufficient length of cable so that the cable can be switched to another terminal without splicing. After correct connections are established through operating the equipment, cables shall be cut to their correct lengths, connected to terminals in the specified manner, and corded together



where necessary to hold them in place in a workmanlike manner.

- s) Cable seals shall be examined to ascertain if they are intact and that cable ends are not damaged. If the seals are found to be broken the cable ends shall not be jointed until after due examination and testing by the EIC's representative. Before jointing is commenced, insulation resistance of both sections of cables to be jointed shall be checked by megger.
- t) After installation and alignment of motors, the contractor shall complete the conduit installation, including a section of flexible conduit between motor terminal box and trench / tray. The contractor shall install and connect the power, control and heater supply cables as per equipment manufacturer's drawings, if any.
- u) Metal sheath and armour of the cable shall be bonded to the earthing system of the station. The size of conductor for bonding shall be appropriate with the system fault current.

9 Applicable Standards

a)	Electrical wiring installations (system voltage exceeding 650 V)	IS:732
b)	Code of practice for interior illumination (Part-1)	IS:3646/BS:8206
c)	Code of practice for street lighting installation	IS:1944
d)	Code of practice for industrial lighting	IS:6666
e)	Code of practice for fire safety of building	IS:1646
f)	Boxes for enclosure of electrical accessories	S:5133 (Part-1)
g)	Guide for safety procedures and practices in electrical work	IS:5216
h)	Ceiling roses	IS:371

10 General Practices

- a) All receptacles and switches to be installed in offices and control rooms shall be flush mounted within the wall and those in other areas shall be wall or column mounted.
- b) Ceiling roses shall not embody fuse terminals as an integral part. For voltages exceeding 250 volts a ceiling rose or any similar attachment shall not be used.
- c) A socket outlet shall not embody fuse terminals as integral part of it. The switch controlling the socket outlet shall be on the live side of the line.
- d) All exposed metal parts of the plug, when the plug is in complete engagement with the socket outlet, shall be in effective electrical connection with the earthing pin.

11 Earthing

- a) Conduits and fittings shall be earthed by 12 SWG GI wires run along the length of the conduit and secured by means of suitable clamps efficiently fastened to conduit tip. To achieve perfect electrical continuity, the conduits shall be bonded effectively on either end of a coupling and other



joints.

- b) Conduits shall be earthed at the ends adjacent to switch boards at which they originate or otherwise at the earth clip, clamp or gland, in effective electrical contact with the conduit.
- c) For outdoor lighting poles the earthing conductor shall be terminated up to the junction box on the pole and 12 SWG wire shall be taken up to the pole fitting.

Deputy Executive Engineer

P.H.S. Sub Division

Ahwa



GENERAL TECHNICAL

SPECIFICATIONS

FOR

BUILDING WORKS



SECTION-18

DETAILED SPECIFICATIONS FOR WHITE WASHING & DISTEMPERING AS PER "SCHEDULE OF RATES"

18.11. White washing with lime on undecorated wall surfaces (two coats) to give an even shade including thoroughly brooming to remove all dirt, dust, mortar drops and other foreign matter.

1.0. Materials:

1.1. The charcoal shall be made from glue and boiling water by Mixing 1 kg. mixture shall be suitably tinted where required use under coloured distemper if directed. Glue shall conform to I.S. 852-1969 (Specifications for Animal glue). 1.2 Lime used shall be freshly burnt class 'C' Lime (fat lime) and white in colour conforming to I.S. 712-1973/ Water shall conform to M-I Best quality of gum shall be used in the preparation of white wash. Ultramarine blue or Indigo: This shall conform to I.S. 55-1970 for points, and shall be used for preparation of white wash. Pigments : Mineral colours, not affected by lime shall be used in preparing colour wash.

2.0. Workmanship : 2.1. Preparation of white wash solution :

Surface already white or colour. The fat lime shall be slaked at site and shall be mixed and stirred with about five litres of water for 1 kg. of unslaked lime to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth, 4 Kg. of gum dissolved in hot water shall be added to each cubic metre of lime cream. Small quantity of ultramarine but (Up to 3 gms. per kg. of lime) shall also be added to the last two coats of white wash solution and the whole solution shall be stirred thoroughly before use.

2.1. Preparation of surface:

2.2.1. The surface shall be thoroughly cleaned of all dust, dirt, mortar cropping's and other foreign matter before white wash is to be applied.

2.2.2. The surface spoiled by smoke soot shall be scraped with steel wire brushes or steel scrapers or shall be rubbed with over-burnt Sukhi or brick bats. The surface shall be then broomed to remove all dust, dirt and shall be washed with clean water.

2.1.3. Oil or grease spots shall be removed by suitable chemical and smooth surface shall be rubbed with wire brushes.

2.2.4. All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly. Such portion shall be wetted and allowed to dry. They shall then be given one coat of white wash.

2.2.5. All unnecessary nails shall be removed, the holes cracks patches etc. shall be made good with materials similar in imposition to the surface to be prepared.



2.3. Scaffolding : Wherever scaffolding is necessary it shall be erected in such a way that as far as possible on part of scaffolding shall rest against the surface to be white or colour washed. A properly secured strong and well tied suspended platform (Zoola) may be used for white washing. Where ladders are used, pieces of old gunny bag shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings proper stage scaffolding shall be erected where necessary.

2.4. Application of white wash:

2.4.1 On the surface prepared the white wash shall be applied with 'Moon' brush. The first stroke of the brush shall be from top downwards another, from bottom upwards over the first stroke and similarly one stroke from the right another from the left, over the first stroke brush before it dries. This will form one coat. Each coat shall be allowed to dry before next coat applied. Number of coats as specified in item shall be applied. It shall present smooth and uniform finish free from brush marks and it should not come off easily when rubbed with finger.

2.4.2. Splashing and dropping if any on the doors and windows, ventilators etc. shall be removed and the surface cleaned.

2.4.3. Priming and Alkali resistant treatments, scraping of surface washing etc. surface spoiled by smoke soot removed of oil and grease spots treatment for infection with efflorescence moulds moss, fungi, algae and latches and patch repairs to plaster wherever done shall not be paid extra.



3.0. Mode of measurements & payment :

3.1. All the work shall be measured in the decimal system as under :

- (a) Dimensions shall be measured to the nearest 0.01 M.
- (b) Area in individual items shall be worked out to the nearest 0.01 Sq. M.

All the work shall be measured in sq. mt. Deductions for jambs, soffits, sills etc. for opening not exceeding 0.5 sq. mt. each in area for ends of joints, posts, beams, girders, steps etc. not exceeding 0.5 sq. mt. each in area and for opening exceeding 0.3 sq. mt. and not exceeding 3.0 sq. mt. each in area deductions and additions shall be made as under :

3.2. No deductions shall be made for ends of joints beams, posts etc. and openings not exceeding 0.5 sq. mt. each. No addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish arounds ends of joints, beams, posts etc.

3.3. Deductions for openings exceeding 0.5 sq. mt. but not exceeding 3 sq. mt. each shall be made as follows and no addition shall be made for reveals, jambs, soffits etc. of these openings:

- (a) When both the faces or walls are provided with finish, deduction shall be made for one face only.
- (b) When each face of wall is provided with different finish deduction shall be made for that side of frame for door, windows etc. on which width of reveals is less than that of the other side, where width of reveals on both faces of wall are equal, deduction of 50% of area of opening on each face shall be made from total area of finish.
- (c) When only one face of wall is treated and the other face is not treated, full deduction shall be made if the width of reveal on the treated side is less than that on the untreated side, but if the width of the reveal is equal or more than on the untreated side neither deductions nor additions be made for reveals, jambs, soffits, sills etc.

3.4. In case of area of opening exceeding 3 sq. mt. each, deduction shall be made for openings but jambs, soffits, shall be measured.

3.5. No deduction shall be made for attachment such as casing, conducts, pipe, electric wiring and the like.

3.6. Corrugated surfaces shall be measured flat as fixed and not girth. The quantities so measured shall be increased by the following percentage and the resultant shall be included with the general areas.

- (a) Corrugated steel sheets 14%
- (b) Corrugated A. C. Sheets 20%
- (c) semi corrugated A. C. Sheets 10%
- (d) Nainital pattern roof (Plain sheeting with rolls) 10%
- (e) Nainital pattern roof (with corrugated sheets) 25%

3.7. Cornices and other wall features, when they are not picked out in a different finish/colour shall be girthed and included in the general area

1.8. The rate shall include the cost of all materials, labour, scaffolding, protective measures etc. involved in all



the operations described above.

3.9. The rate shall be for a unit of one sq. metre.

18.12. White washing with lime on decorated wall surface-(One coat) to give an even shade including thoroughly brooming

the surface to remove dirt, dust mortar drops and loose scales of lime wash and other foreign matter.

1.0. Materials & Workmanship : 1.1. -The relevant specifications of item No. 18.11 shall be followed except that the white washing work shall be carried out on decorated wall surface in single coat.

2.0.Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.11 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

18.13. Extra over item 18.11 and 18.12 for every subsequent coat of white washing with lime on wall surfaces.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.11 shall be followed except that this work is for extra coat over and above two coats on wall surface.

2.0.Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.11 shall be followed except that the payment of subsequent coat shall be made extra over and above the item No. 18.11 for every subsequent coat applied.

2.2. The rate shall be for a unit of one sq. mt

18.14. Extra over item 18.11 for white washing with the lime on ceiling and/or sloping roof.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.11 above shall be followed except that this work is for ceiling and/or sloping roof.

2.0.Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.11 shall be followed except that extra payment for white washing on ceiling and/or sloping roof shall be made over and above the payment of item No. 18.11.

2.2. The rate shall be for a unit of one sq. metre.

18.15. Extra over 18.12 for white washing with lime on ceilings and sloping roofs.

1.0. Material Workmanship: 1.1 The relevant specifications of item No. 18.12 shall be followed except that the white washing work shall be carried out on decorated ceilings and/or sloping roofs.

2.0.Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.12 shall be followed except that the extra payment for white washing on ceiling and/or sloping roof shall be made over and above the payment of item No. 18.12.

2.2. The rate shall be for a unit of one sq. metre.

18.16. Extra over the item No. 18.13 for every subsequent coat of white washing with lime on ceiling and/or sloping roofs.



1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.11 and 18.13 shall be followed except that this work is for extra coat over and above two coats of ceiling and/or sloping roofs.

2.0 Mode of measurement & Payment:

2.1. Relevant specifications of item No. 18.11 and 18.13 shall be followed except that the extra payment for white washing shall be made for sloping roof or/and ceiling for every subsequent coat applied over and above item 18.13.

2.2. The rate shall be for a unit of one sq. metre.

18.17. Colour washing with lime on undecorated wall surfaces (Two coats) over and including priming coat of white washing to give even shade including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter. The relevant specifications for the materials and workmanship of item No. 18.11 shall be followed except that it shall be for colour wash.

1.0. Materials:

1.1. Clear-Colle: This shall be made from glue and boiling water by mixing 1 Kg. of glue to every 15 litres of water. The mixing shall be suitable tinted to match with colour of washing as directed. Glue shall conform to I.S. 852-1969.

1.2. Lime : Lime used shall be freshly burnt class 'C' lime (Fat lime) and white in colour conforming to I.S. 712-1973.

1.3. Water : Water shall conform to M-I.

1.4. Gum : Best quality of gum shall be used in the preparation of white or colour wash. The colour pigment of required tint and shade shall be mixed in lime cream. The mineral colour not affected by lime shall be used in preparing the colour wash.

2.0. Workmanship : 2.1. Sufficient quantity of colour wash enough for the complete job shall be prepared in one operation to avoid any difference in shade. The basic white wash solution shall be prepared in accordance with item 18.11. Mineral colours not affected by lime shall be added to the white wash solution. No colour wash shall be done until a sample of the colour has been approved. It shall be noted that small samples of colour appears lighter in shade than when the same shades are applied precisely to large surface. The colour shall be of even tint, over the whole surface. If it is patchy or otherwise badly applied, it shall be rejected. Preparation of the colour wash with pigment shall be as under :

(a) With Yellow and Red Ochre: Solid Lumps if any in the powder shall be crushed to powder and solution in water prepared and then added to white wash sieving it through a coarse cloth, mixed evenly and thoroughly to white wash in small quantities till the required shade is obtained.

(b) With Blue Vitriol: Fresh crystals of hydrous copper sulphate (i.e. blue vitriol) shall be ground to fine powder and dissolved in small quantity of water. Sufficient quantity of solution enough to produce the colour wash of required shade shall be strained through a clean cloth, the filtrate being mixed evenly and thoroughly to the white wash.

(c) Colour wash from other colouring pigment shall be prepared in accordance with the instructions of the manufacturer.



2.2. Preparation of Surface : The surface shall be prepared by removing mortar toppings and foreign matter and thoroughly clean with wire or fibre brush or any suitable means as greeted by the Engineer-charge. All loose pieces and scales shall be scrapped off notes holes filled with mortar.

2.2.1. For scaffolding and application of colour wash, relevant specification of item No. 18.11 above shall be followed. The colour wash shall be applied as under: The colour wash shall be applied in accordance with the procedure given in item No. 18.11. Application of white wash for colour washing on undecorated surface after the surface has been prepared. The first primary coat shall be of white wash and subsequent (minimum two) shall be colour wash and the entire surface shall represent a smooth and uniform finish. To start with, patch of 0.1 sq.mt. on prepared surface shaft be colour washed with first coat of white wash and subsequent coat of colour wash solution in full numbers of coats as described in the item and the shade so obtained shall be examined before the entire work of colourwashing is taken up in hand. It shall be noted that small areas of colour wash win appear lighter in shade then when the same shade is applied to the large surface.

2.2.2. For colour washing on decorated surfaces, after the surface has been prepared, a coat of white wash shall be applied for the patches and repairs. Then one coat or more of colour wash shall be applied over the entire surface, such that the colour of washed surface shall present a. uniform colour shade. No primary coat is needed for a decorated surface bearing colour of same shade on surface requiring change of colour after the surface has been prepared as described above. Two coats of white wash shall be applied before application of specified number (minimum two) of coals of colour wash of the new shade.

2.3. Protective measure: The surface of doors, windows, floors, articles of furniture etc, and such other parts of the building not to be white washed shall be protected from being splashed upon. Such surfaces shall be cleaned of white wash splashed if any.

3.0. Mode of measurements & payment:

3.1. The relevant specification of item No.18.11 shall be followed.

3.2. The rate shall be for it unit of one sq. metre.

18.18. Colour washing, with lime on decorated wall surfaces (one coat) to give an even shade including thoroughly brooming the surface remove all dirt dust, mortar drops and loose scales of, lime wash and other foreign matter.

1.0. Materials & Workmanship: The relevant specifications of item No. 18.17 shall be followed except that the colour washing shall be carried but on decorated wall surfaces in one coat.

2.0. Mode of measurements payment:

2.1. The relevant specification of item No.18.17 shall be followed.

2.1. The rate shall be for it unit of one sq. metre.

18.19. Extra over item No. 18.17 and 18.18 for every subsequent coat of colour wash with lime on wall surface.

1.0. Materials &Workmanship :1.1. The relevant specifications of item No. 18.17 shall be followed except that this work is for extra cost of colour wash overhand above two coals on wall surface.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No; 1JL17 shall be followed except that the extra payment for every



subsequent coat of white wash shall be made over and above the rate of item 18.17 and 18.18.

2.2. The rate shall be for a unit of one sq. metre.

18.20. Extra over item 18.17 for colour washing on ceilings and/or sloping roofs.

1.0. Materials & Workmanship : The relevant specifications of item No.18.17 shall be followed except that this work is for colour washing on ceiling and/or sloping roofs.

2.2. The rate shall be for a unit of one sq. metre.

18.29. Cement washing with Portland cement slurry on undecorated wall surfaces, (one coat) to give a smooth finish including thoroughly brooming the surface to remove all dirt dust, mortar drops and other foreign matter.

1.0. Materials: 1. Water shall conform to M-1. Portland cement shall conform to M-3.

2.0. Materials & Workmanship : 2.1. The relevant specifications of item No. 18.11 for preparation of surface, scaffolding, application of wash etc. shall be followed except that the cement wash shall be applied instead of white wash. Cement shall be mixed to water to form slurry to the consistency of good ready mix oil paint. The slurry shall be applied with brushes to form a smooth bodies opaque surface.

3.0. Mode of measurements & payment:

3.1. The relevant specifications of item No. 18.11 shall be followed.

3.2. The rate shall be for a unit of one sq. metre.

18.30. Extra over item No. 18.29 for every subsequent coat of cement washing with Portland cement slurry.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.29 shall be followed except that the work of cement slurry wash shall be provided for every, subsequent coats above item No. 18.29 to be applied.

2.0. Mode of measurements payment:

The relevant specifications of item No. 18.29. shall be followed except that the extra rate shall be paid for every subsequent coat applied over and above the rate of item No.18.29.

2.1. The rate shall be for a unit of one sq. metre.

18.33. Removing dry or oil bound distemper by washing and scraping and sand papering the wall surface smooth including necessary repairs to scratches complete.

1.0. Materials & Workmanship : 1.1. All loose pieces and scales shall be removed by sand papering and surface shall be cleared of all greasy, dust, dirt, etc. on decorated wall surface. Where heavy scaling has taken place, the entire surface shall, be scrapped by means of steel scrapers so as to remove all accumulated distemper, leaving clean surfaces. Necessary repairs to the scratches shall be made as directed.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.11 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

18.34. Extra over item No. 18.33 for removing dry oil bound distemper on ceiling and sloping roofs!



1.0. Workmanship: 1.1. The relevant specifications of item No. 18.33 shall be followed except that removing dry oil bound distemper from sipping roof, ceiling is to be carried out.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.33 shall be followed except that the payment shall be made for removing dry/oil bound distemper from ceiling/sloping roof over and above the rate-of item No. 18.33.

2.2. The rate shall be for a unit of one sq. metre.

18.38. Distempering with dry (water bound) Distemper of approved brand and manufacture (two coats) and of required shade on undecorated wall surfaces to give an even shade, over and including a priming coat of white washing, after thoroughly brooming the surface free from mortar droppings and other foreign matter.

1.0. Materials: 1.1. The dry distemper and primer shall be of approved brand and manufacture. The dry distemper shall be of required colour and shade and the same shall conform to I.S. 427-1965. Whiting shall conform to I. S. 63-1964.

2.0. Workmanship:

2.1. Scaffolding: Where scaffolding is required it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured strong and well tied suspended platform (Jools) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be laid at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

2.2. Preparation of Surface : 2.2.1 The undecorated surface to be distempered shall be thoroughly brushed free from dust, dirt, grease, mortar, droppings and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry at least 2 months, before application of distemper.

2.2.2. All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster of paris mixed with distemper of the colour to be used. The surface shall then be rubbed down again with a/me grades and paper and made smooth.

The surface affected by moulds, moss, fungi, algealichem, efflorescence etc. shall be treated in accordance with I.S.: 2395 (Part-I)-1966 before applying distemper. Any unevenness shall be made good by applying putty made of plaster of paris mixed with water on entire surface including filling up the undulations & then papering the same after it is dry



2..3. Priming coat:

23.1. A priming coat of whiting shall be applied as per item No. 18.11. over the prepared surface in case of new work on undecorated surface; No coat of white washing with lime shall be used as a priming coat for distemper.

2.3.2. Application of plaster shall be done as under:

The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

2.3.3. Distemper is not recommended to be applied within six months of the completion of wall plaster.

2.4. Proportion of Distemper : The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufactures only. Sufficient quantity of distemper required-for one day's work shall be prepared.

2.5. Application of Distemper coat:

2.5.1. For undecorated surfaces, after the primer coat is dried for at least 48 hours, the surfaces shall be lightly sand papered to make them smooth for receiving the distemper, taking care not to rub cut the priming coat, All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after time interval of at least 24 hours between consecutive coats to permit proper drying, of the preceding coat. The finished surfaces shall be even and uniform without patches, brush marks; distemper drops etc.

2.5.2. Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which cannot be completed on the same day.

2.5.3. 15 cm. double bristled distemper brush shall be used. After the days work, brushes shall be thoroughly washed in hot water with a soap solution and hang down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

2.6. Protective Measure: 2.6.1. The surfaces of door, windows, floors, articles of furniture etc. and such other parts of the building as are not to be distempered shall be protected from being a plashed upon. Such surfaces shall be cleaned of distemper a plashes if any.

3.0.Mode of measurements & payment:

3.1. Priming coat of distemper, Primer scraping of surface spoiled by smoke soot, removal of oil and greast spots, treatment for infection of effloresces, mould moss, fungi, algae and litoben and patch repairs to plaster shall be included in this item forwhich nothing extra shall be paid.

3.2. All the work shall be measured net in the decimal system as in places subject to the following limits unless otherwise stated hereinafter.



(a) Dimension shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out the nearest 0.01 sq. m. all work shall be measured in sq. metre. No deductions

shall be made for ends of joints beams, posts etc. and openings not exceeding 0.5 sq. m. each and no addition shall be made for reveals jambs, soffits, sills etc. of these openings nor finish alround the ends of joints, beams, posts etc.

3.3. Deductions of openings exceeding 0-5 sq. m. but not exceeding 3 sq. m. each shall be made as follows and no addition shall be made for reveals, jambs, soffits sills etc. of these openings:

(a) When both the faces of wall is provided with the same finish deductions shall be made for one face only.

(b) When each face of wall is provided with different finish, deduction shall be made for that of frame for doors, windows

etc. on which width of reveal is less than that of the other side but no deductions shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveals is equal or more than that of untreated side neither deductions nor additions to be made for reveals; jambs, soffits, sills etc.

3.4. In case of area exceeding 3 sq. m. each, openings of deduction shall be made for openings, bat jambs, si
ll and Soffits Shall be measured.



3.5. No deductions shall be made for attachments such as casing, conduits, pipes, electric wiring and the like.

3.6. Item includes removing nails, making good holes, cracks, patches with materials similar in composition to the distemper.

3.7. The rate includes cost of all materials, labour, scaffolding, protective measures etc. involved in all the operations described above. This shall also include conveyance, delivery, handling, unloading storing etc.

3.8. The rate shall be for a unit of one sq. metre.

18.39. Distemping with dry (water bound) distemper of approved brand and manufacture (one coat) and of required shade on decorative wall surface to give an even shade after thoroughly brushing the surface clean of all grease dirt, loose pieces of scales including preparing the surfaces and even sand papered smooth.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.38 shall be followed except that the dry distemper shall be applied on decorative wall surface in one coat.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.38 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

18.40. Extra over item 38 & 39 for every subsequent coat of distemper with dry distemper of approved brand and manufacture.

1.0. Material & Workmanship : The relevant specifications of item No. 18.38 shall be followed same except that the extra work for applying subsequent coat of dry distemper is to be carried out over and above the work of item No. 18.38 and 18.39.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.38 shall be followed except that extra rate shall be paid for every subsequent coat applied over and above the rate item No. 18.38 and 18.39.

2.2. The rate shall be for a unit of one sq. metre.

18.41. Extra over item 38 for distemping with dry distemper on ceiling and sloping roofs.

1.0. Materials & Workmanship : The relevant specifications of item No. 18.38 shall be followed except that the dry distemping shall be carried out on ceiling and sloping roofs on undecorated surface.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.38 shall be followed except that extra rate shall be paid for carrying out work on ceiling/sloping roof on undecorated surface over and above of item 18.38.

2.2. The rate shall be for a unit of one sq. metre.

18.42. Extra over item 18.40 for distemping with dry distemper on ceiling/sloping roofs.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.39 shall be followed except that the work shall be carried out on ceiling/sloping roofs on decorated surfaces.



2.0.Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.39 shall be followed except that the extra rate shall be paid for

the distempering work carried out by dry distemper on ceiling/sloping roofs with decorated surface over and above the rate of item No. 18.39.

2.2. The rate shall be for a unit of one sq. metre.

18.44.Distempering (two coats) with oil bound distemper of approved brand and manufacture and of required shade on undecorated wall surfaces to give an even shade, over and including a priming coat with distemper primer of approved brand and manufacture after thoroughly brushing the surface free from mortar dropping and other foreign matter also including preparing the surface even and sand papered smooth.

1.0. Materials : 1.1. Oil bound washable distemper and primer shall be of approved brand and manufacture. The distemper shall be required colour and shade and the same shall conform to I.S. 428-1969.

2.0. Workmanship: 2.1. Scaffolding: Where scaffolding is required, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured strong and well tied suspended platform (Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

2.2. Preparation of surface :2.2.1. The undecorated surface to be distempered shall be thoroughly brushed off from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for atleast 2 months before applications of distemper.

2.2.2. All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster of paris mixed with drydistemper of colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of distemper is allowed. The surface affected by moulds, moss, fungi algae lichens, efflorescence etc. shall be treated in accordance with I.S. 2395 (Part-I) 1966. Before applying distempering, any unevenness shall be made good by applying putty made of plaster of paris mixed with water on entire surface including filling up the undulation and then sand papering the same after it is dry.

2.3. Priming coat:

2.3.1. A priming coat or distemper prime of approved manufacture and shade shall be applied over the papered surface in case of new work on undecorated surface. If the distemper priming is done after the wall surface dries completely, the distemper primer shall be applied.

2.3.2. Application of Primer shall be done as under:

The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for atleast 48 hours before oil bound distemper or Paint is applied.

2.3.3. Oil bound distemper is not recommended to be applied within six months of the completion of wall



plaster.

2.4. Preparation of oil bound distemper : 2.4.1. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacture only. Sufficient quantity of distemper required for a day's work shall be prepared.

2.5. Application of Distemper coat:

2.5.1. For undecorated surfaces, after the primer coat is dried for atleast 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of atleast 24 hours between consecutive coats to permit proper drying of the proceeding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

2.5.2. Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which cannot be completed on the same day.

2.5.3. 15 cm. double bristled distemper brush shall be used. After day's work brushes shall be thoroughly washed in hot water soap solution and hung down to dry. Old brushes which are dirty and caked! with distemper shall not be used on the work.

2.6. Protective measurements : The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the buildings as are not to be distempered shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes if any.

3.0.Mode of measurements & payment:

3.1. Priming coat of distemper primer, scraping of surface spoiled by stunk soots removal of oil and grease spots, treatment for infection of effloresces mould moss, fungi, algae and lichen and patch repairs to plaster shall be included in this item for which nothing extra shall be paid.

3.2. All the work shall be measured net in the decimal system as in place subject to the following limits unless otherwise stated hereinafter:

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out to the nearest 0.01 sq. m. All work shall be measured in sq. metre. No deductions shall be made for ends of joints, beams, posts etc., and openings, not exceeding 0.5 sq. m. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish around ends of joints, beams, posts etc.

3.3 . Deductions of opening exceeding 0.5 sq. m. but not exceeding 3 m. in each shall be made as follows and net addition shall be made for reveals, jambs, soffits etc. of these openings:

(a) When both the faces of walls are provided with same finish deductions shall be made on one face only.



(b) When each face of wall is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveal is less than that of the other side but no deduction shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening of each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deduction shall be made if the width of the reveal on treated side is less than that on untreated sides but if the width of the reveal is equal or more than that on untreated side neither deductions not addition to be made for reveals, jambs, soffits, sills etc.

3.4. In case opening of area exceeding 3 sq. m. each, deduction shall be made for openings but jambs, sills and soffits shall be measured.

3.5. No deductions shall be made for attachments such as casings, conduits, pipes, electric wiring and the like.

3.6. Item includes removing nails, making good holes, cracks, patches with material similar in composition of distemper.

3.7. The rate includes cost of all materials, labours, scaffolding, protective measures etc. involved in all the operations described above. This shall also include conveyance, delivery, handing, unloading, storing work etc.

3.8. The rate shall be for a unit of one sq. metre.

18.45. Distempering (two coats) with oil bound washable distemper of approved brand and manufacture and of shade required on undecorated wall surfaces to give an even shade, over and including a priming coat with alkali resistance primer of approved brand and manufacture after thoroughly brushing the surface free from mortar droppings, and other foreign matter and also including preparing the surface even and sand-papered smooth.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.44 shall be followed except that the primer of alkali resistance primer of approved brand and manufacture shall be used instead of distemper primer.

2.0. Mode of measurements & payment:

2.1. The mode of measurements and payment shall be the same as for item No. 18.44 above.

2.2. The rate shall be for a unit of one sq. metre

18.46 Distempering (one coat) with oil bound washable distemper of approved brand of required shade on decorated wall surfaces to give an even shade after thoroughly brushing the surfaces clean of all grease, dirt, loose pieces of scales and also including distempering with oil bound washable distemper of preparing the surface even and smooth.

1.0. Materials & Workmanship : The relevant specifications of item No. 18.44 shall be followed except that distempering with oil bound washable distemper shall be carried out on decorated wall surfaces in one coat.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.44 shall be followed.



2.2. The rate shall be for a unit of one sq. metre.

18.47. Extra over items 18.44 to 18.46 for every subsequent coat of distempering with oil bound washable distemper of approved brand and manufacture.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.44 shall be followed except that this work is for providing extra coat of oil bound distempering over and above two coats of distempering.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.44 shall be followed except that the extra rate shall be paid over and above the rate for every subsequent coats over two coats of item 18.44 and 18.46.

2.2. The rate shall be for a unit of one sq. metre.

18.48. Extra over item 18.44, 18.45 for distempering with oil bound washable distemper on ceiling and sloping roofs.

1.0. Materials & Workmanship: The relevant specifications of item No. 18.44 shall be followed except that the distemperings shall be carried out on ceiling/sloping roofs.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.44 shall be followed except that the extra rate shall be paid for earning of distempering work on ceiling/sloping roofs over and above the rate of item No. 18.44 and 18.45.

2.2. The rate shall be for a unit of one sq. metre.

18.49. Extra over item 18.46, 18.47, for every subsequent coat of distempering on ceiling and sloping roofs.

1.0. Materials & Workmanship : 1.1, The relevant specifications of item No. 18.44 shall be followed except that the distempering work shall be carried out for subsequent coats over item No. 18.46 and 18.47.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.46 shall be followed except that the extra rate shall be paid for every subsequent coat of distemper applied over and above the rate of item No. 18.46 and 18.47.

2.2. The rate shall be for a unit of one sq. metre.

18.51. Finishing wall with water proofing cement paint on an undecorated wall surfaces (two coats) to give an approved brand and manufacture and of required shape even shade after thoroughly brushing the surface to remove all dirt and remains of loose powdered materials.

1.0. Materials : 1.1. The water shall conform to M-I. Cement water proofing shall conform to I.S. 5410-1969.

2.0. Workmanship :

2.1. Scaffolding: The relevant specifications of item No. 18.11 shall be followed.

2.2. Preparation of surface: The relevant specifications of item No. 18.11 shall be followed except that the word white wash colour wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.



2.3. Preparation of paint: Portland cement shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, the manufacture's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The lids of cement paint drums shall be kept tightly when not in use.

2.4.Application of Paint:

2.4.1. No painting shall be done when the paint is likely to be exposed to a temperature of below 7°C within 48 hours after application.

2.4.2. When weather conditions are such as to cause damage the work shall be carried out in the shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

2.4.3. To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.

2.4.4. For undercoated surfaces, the surfaces shall be treated with minimum two coats of water proof cement

paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be slightly moistened before applying the subsequent coat.

2.4.5. The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

2.4.6 The cement paint shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free from excessive heavy brush marks. This shall be well brushed out.

2.4.7. Water proof cement paint shall not be applied on surfaces already treated with white wash colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

2.5. Curing : Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after the application.

2.6. Protection measures shall be taken as per item No. 18.11 para 2.6.

3.0. Mode of measurements & payment:

3.1.The relevant specifications of item No. 18.11 shall be followed.

3.2. The rate shall be for a unit of one sq. metre.

18.53. Extra over item 18.51 for every subsequent coat of water proofing cement paint of approved brand and manufacture.



1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.51 shall be followed except that the work is for applying subsequent coat of cement water proofing paint.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.51 shall be followed except that the extra rate shall be paid for applying every subsequent coat of cement water proofing paint over and above the rate of item No. 18.51.

2.2. The rate shall be for a unit of one sq. metre.

18.54. Extra over item 18.51 for finishing with cement paint on ceiling/sloping roofs.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.51 shall be followed except that the cement water proofing paint shall applied on ceiling and sloping roofs.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.51 shall be followed except that the extra shall be paid for applying cement water proofing paint on ceiling and sloping roofs, over and above the rate of item No. 18.51.

2.2. The rate shall be for a unit of one sq. metre.

18.56. Extra over item 18.53 for every subsequent coat of finishing with cement paint on ceiling and sloping roofs.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.51 shall be followed except that the work shall be carried out for subsequent coat on ceiling and sloping roofs.

2.0. Mode of measurements & payment: 2.1. The relevant specifications of item No. 18.53 shall be followed except that extra rate shall be paid for every subsequent coat applied with cement water proofing paint over and above the rate of item No. 18.53.

18.57. Wall painting (two coats) with plastic emulsion paint of approved brand and manufacture on undecorated wall surfaces to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand paper smooth.

1.0. Materials : Water shall be conform to M-I. The plastic emulsion shall conform to I.S. 5411-1969 (part-I).

2.0. Workmanship:

2.1. Scaffolding: The relevant specifications of item No. 18.11 para 2.1. shall be followed.

2.2. Preparation of surface: The relevant specifications of item No. 18.44 para 2.2. shall be followed.

2.3. Preparation of Mix : This shall be done as per manufacturer's instructions. The thinning of emulsion is to be done with water and not with turpentine. The quantity of thinner to be added shall be as per manufacturer instructions.

2.4. Applications:

2.4.1. Before pouring into small containers for use, the paint shall be stirred thoroughly in its container. When



applying also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

2.4.2. The paint shall be laid on evenly and smoothly by means of crossing and laying off the crossing and laying off consist of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of mouldings, etc. shall be left on the work. The full process of crossing and laying off will constitute one coat.

2.4.3. The paint shall be applied with brush or rollers. For undecorated surfaces, the surface shall be treated with minimum coats of cement water proofing paint. The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking by brush being used.

2.4.4. The surface on finishing shall present a flat velvety smooth finish. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

2.5. Precautions:

(a) Old brushes if they are to be used with emulsion paints, shall be completely dried of turpentine oil paint by washing in warm soap water.

Brushes shall be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

(b) In the preparation of wall for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

(c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

(d) Washing of surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application.

2.6. Protective measures: 2.6.1. The relevant specifications of item No. 18.17. para 2.3. shall be followed:

3.0. Mode of measurements & payment:

3.1. The relevant specifications of item No. 18.11 shall be followed.

3.2. The rate shall be for a unit of one sq. metre.

18.59 Extra over item No. 18.57 for every subsequent coat of wall painting with plastic emulsion paint of approved brand.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 18.57 shall be followed except that the painting

work shall be for subsequent coat of plastic emulsion paint.

2.0. Mode of measurements & payment: 2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra shall be paid for every subsequent coat of plastic emulsion paint applied over and above



the rate of item No. 18.57. 2.2. The rate shall be for a unit of one sq. metre.

18.60 Extra over item 18.57 for painting with plastic emulsion paint of approved brand on ceiling and slopping roofs.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.57 shall be followed except that the painting shall be done on ceiling and sloping roofs.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra payment shall be made for applying plastic emulsion paint on ceiling and sloping roofs over and above the rate of item No. 18.57.

2.2. The rate shall be for a unit of one sq. metre.

18.62. Extra over item 18.59 for paint on ceiling and sloping roofs.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 18.5.7 shall be followed except that the work for subsequent coat of plastic emulsion paint will be carried out on ceiling and sloping.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra rate shall be paid for carrying out painting on sloping roofs and ceiling with plastic emulsion paint over and above the rate of item No. 18.59.

2.2. The rate shall be for a unit of one sq. metre.

SECTION-19

DETAILED SPECIFICATIONS OF ITEMS - PAINTINGS & POLISHING

AS PER "SCHEDULE OF RATES"

19.11. Painting one coat (excluding priming coat) on previously painted steel and other metal surface with enamel paint, brushing to given and even shade including cleaning the surface of all dirt, dust and other foreign matter.



1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 19.7 shall be followed except that painting shall be carried out in one coat with enamel paint on previously painted steel and metal surface.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 19.7 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

19.12. Applying priming coat over new steel and other metal surfaces after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and secured with brushes, fine steel, wood scrapes and sand paper, with ready mixed priming paint, brushing red lead.

1.0 Materials:

1.1. The ready mixed primer, brushing red lead shall conform to I, G. 102-1962.

1.2. The thinner (linsed oil) shall conform to I.S. 75-1973. If for any reason, thinning is necessary in case of ready mix paint, the brand of thinner recommended by manufacturer shall be used.



2.0.Workmanship:

2.1. Preparation of surfaces : The surfaces to be painted shall be cleaned of all rust, scale, dirt and other foreign matter sticking to it with wire brushes, steel wool, scrapers, sand paper etc. This surface shall then be wiped finally with mineral turpentine which shall also removed grease and perspiration of hand marks. The surface shall then be allowed to dry.

2.2. Application of primer : 2.2.1. After the preparation of the surface, the priming coat shall be applied immediately. The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer of the particular primer. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing alternately in opposite directions, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2. During painting, every time after the priming coat has been worked out of the brush bristles or after the brush has been unloaded of the bristles of the brush shall be opened up by striking the brush against portion of the unpainted surface with the end of the bristles, held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again into a paint container. The priming coat shall be allowed to dry completely before painting is started.

2.2.3. No hair marks from the brush or clogging at paint puddles in the corner or panels angles of mouldings etc. shall be left on the work.

2.2.4. Special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

2.2.5. The container when not in use shall be kept close and free from air so that paint does not thicken and also shall be kept guarded from dust.

3.0.Mode of measurements & payment:

3.1. The new steel and other metal surface shall be measured under this item.

3.2. All the work shall be measured net in the decimal system as executed subject to the following limits unless otherwise stated hereinafter:

(a) Dimensions shall be measured to the nearest 0.01 metre.

(b) Areas shall be worked out to the nearest 0.01 Sq. metre.

3.3. No deductions shall be made for openings not exceeding 0.5 sq. mt. each and no addition shall be made for painting theadings, mouldings, edges, jambs, soffits, etc. of such opening.

3.4. In case of fabricated structural steel and iron work, priming coat of paint shall be included with fabrication. In case of trusses if measured in sq. m. compound girders, stanchions, lattices, girder and similar work, actual area shall be measured in sq. M. and no extra shall be paid for painting on bolts, heads, nuts, washers etc. No addition shall be made to the weight calculated for the purpose of measurements of steel and iron works for paint applied on shop or at site.

3.5. The different surfaces shall be grouped into one general item, areas of uneven surface being converted into equivalent plain areas in accordance with the table given as per Annexure II for payment.

3.6. The rate shall be for a unit of one sq. metre.



19.7. Painting two coats (excluding priming coat) on new steel and other metal surfaces with enamel paint, brushing, interior to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials : The enamel paint shall conform to M-44 B.

2.0 Workmanship : 2.1. General:

2.1.1. The materials required for work of painting work shall be obtained directly from approved manufacturers or approved

dealer and brought to the site in maker's drums, kege etc. with seal unbroken.

2 1.2. All materials not in actual use, shall be kept properly protected, lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials which have become stale or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins. When not in use, the containers shall be kept properly closed.

2.1.3. If for any seasons, thinning is necessary, the brand of thinner recommended by the manufacturer shall be used.

2.1.4. The surface to be painted shall be thoroughly cleaned am.' dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavourable weather and all the surfaces shall be thoroughly dry before painting work is started.



2.2. Application:

2.2.1. Brushing operations are to be adjusted to the spreading capacity advised by the manufacture of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brushmarks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2. Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from Engineer-in-charge before next coat is started.

2.2.3. Each coat except the last coat shall be lightly rubbed down with sand paper of fine pumice stone and cleaned of dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corners of panels angles of mouldings etc. shall be left on the work.

2.2.4. Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc. Approved best quality brushes shall be used.

3.0. Mode of measurements & payment:

3.1. The relevant specifications of item No. 19.12 shall be followed for mode of measurements and payment. The rate is excluding priming coat.

3.2. The rate shall be for a unit of one sq. metre.

19.15. Extra over item No. 19.7 and 19.11 for every subsequent coat of paint.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 19.7 shall be followed except that the work of painting shall be carried out for subsequent coat.

2.0. Mode of measurements & payment:

2.1. The relevant specifications of item No. 19.7 shall be followed except that the extra rate shall be paid for every subsequent coat of paints applied over and above the rate of item No. 19.7 and 19.11.

2.2. The rate shall be for a unit of one sq. metre.

19.19. Painting two coats (excluding priming coat) on new steel and other metal surface with synthetic enamel paint, brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials : Synthetic enamel paint shall conform to I. S. 1932-1964.

2.0. Workmanship : 2.1. The relevant specifications of item No. 19.7 shall be followed except that the painting shall be carried out with synthetic enamel paint.

3.0. Mode of measurements & payment:

3.1. The relevant specifications of item No. 19.7 shall be followed.

3.2. The rate shall be for a unit of one sq. metre.



19.21. Painting one coat (excluding priming coat) on previously painted steel and other metal surfaces with synthetic enamel paint brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 19.19. shall be followed except that the painting shall be carried out on previously painted steel and other metal surfaces using synthetic enamel paint in one coat.

2 0. Mode of measurements & payment:

2.1 The relevant specifications of item No. 19.19 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

19.23. Extra over item No. 19.19 and 19.21 for every subsequent coat of paint.

1.0. Materials & Workmanship: 1.1. The relevant specifications of item No. 19.19. shall be followed except that the work shall be carried out for subsequent coat of paint.

2.0. Mode of measurements & payment: 2.1. The relevant specifications of item No. 19.19 shall be followed except that the extra rate shall be paid for applying subsequent coat of oil paint over and-above the item No. 19.19.and 19.21



Electromechanical Specifications

1.0 GENERAL

These General Mechanical Electrical Technical Specifications are meant to amplify the specifications General Conditions of Contract. If any discrepancy is noticed between these conditions, General Conditions of contract, specifications, Bills of Quantities Drawings the most stringent of the above shall apply.

All electrical and mechanical installations shall be of high quality, safe, durable, complete fully operational including all necessary items, spares accessories whether or not specified in detail. All electrical and mechanical work shall be completed in accordance with the regulations standards to the satisfaction of the inspection agency authorized by owners. The general provisions, special provisions general requirements apply to all sections of this specification.

The contractor shall be fully responsible for the maintenance of electrical, mechanical and other installations till the entire work covered by this contract is satisfactorily completed by him handed over to the owner.

2. ACCOMPANIMENT TO BID

The Contractor will attach to the bid, at the time of submission technical schedules provided by BID documents.

3. INTENT

4.

It is the intention of the specification drawings to design, supply, installation, testing commissioning ready for use for continuous dependable satisfactory operation.

5. INTERPRETATION OF PROJECT DOCUMENTS

The specifications price schedule shall be considered as part of this contract any work or material shown on price schedule not called for in the specification or vice versa shall be executed as if specifically called in for both. The drawings indicate the extent general arrangement of the machineries, equipment's, apparatus, fixtures, controlling switches, wiring system etc. are essentially diagrammatic. The drawings indicate the points of termination of conduit runs broadly suggest the routes to be followed.

Machinery equipment shall be installed as indicated on the drawings. However any minor changes found essential to coordinate the installations of this work with other services shall be made without any additional cost to the owner. The drawings are for the guidance of the contractor. Exact locations distances levels will be governed by the building. The contractor shall examine all civil, structural, mechanical electrical drawings before starting the work report to the Department any discrepancies which in his opinion appear on them get them clarified.

6. SCOPE OF SPECIFICATION

These specifications covers Design, manufacture, factory testing, supply, delivery to site, unloading and storage to site, complete installation including cement concrete foundation wherever necessary, final checkup, painting, performance testing commissioning of pumping machinery related electrical equipment 'accessories to be supplied under these specifications on turnkey basis, to achieve a guaranteed co-ordinate commercial operation of the same to the entire satisfaction of the department.

Any item of work, either supply /or erection of material/machinery which have not been specifically mentioned in this specification drawing but are necessary to complete the work for trouble free, efficient operation guaranteed performance of the entire plant offered shall be deemed as included within the scope of this specification shall be provided by contractor without any extra cost to the client.

The following mechanical electrical equipment's are to be covered under this contract.

- a) Vertical Turbine (VT) Pumps and Motors
- b) Pipes Fittings
- c) Valves - (i) Sluice / Gate / Butterfly valves (b) Non Return Valves (c) Air Valves / velocity valve
- d) E.O.T. Crane of required capacity
- e) Expansion Bellows
- f) De-watering Pumps
- g) Trash Racks / Screens at in-let to the water sump
- h) Low voltage switch gear control-gear
- i) Distribution board

- j) Powercontrol cables
- k) Lighting system
- l) Earthing

7. AMBIENTCONDITION

The equipment's are to be operated in tropical climate with high ambient temperature up to 50° C. So the equipment shall be so designed that it will be suitable to operate under tropical climate with high humidity, dust fungus condition.

8. RATING

Rating of all items shall be appropriate for the condition on the particular site on which the items will be used.

The rating of all electrical equipment/ components shall be for three phase 415 V, 50 Hz AC supply with the following variations:

- a. Voltage variation +/-10%
- b. Frequency variation +/-5%
- c. Combined variation +/-10%

The rating shall be as per manufacture's printed literature drawings as per latest Indian Standards, IE rules Power supply authority conditions for power supply prevailing at the location.

9. REGULATIONS STANDARDS

The installation shall conform in all respects to Indian Standard Code of Practice for pumping machinery electrical equipment installations. It shall also be in conformity with the current Indian Electricity rules, Indian Electricity Act, National Electrical code Regulations of the local Electrical Supply Authority in so far as these become applicable to the installation. Wherever these specifications call for a higher standard of material /or workmanship than those required by act of the above regulations, then these specifications shall take precedence over the said regulationsstandard. In general, the material, equipment workmanship not covered by the above shall conform to the relevant Indian Standards.

The electrical installation work shall follow codes of the Indian standard specifications Rules (within the best meaning of the same) under this contract.

The machinery, equipment, component material shall conform to the latest revision of the following standards:

10. LIST OF APPLICABLE INDIAN STANDARD CODE OF PRACTICE

Sr. No.	Standard No.	Title
1.	IS - 5	Colors for ready mixed paints enamels.
2.	IS - 104	Ready mixed paint, brushing, zinc chrome, priming.
3.	IS - 158	Ready mixed paint, brushing, bituminous, black, lead Free, acid, alkali head resisting.
4.	IS - 325	Three phase induction motors.
5.	IS - 335	New insulating oils.
6.	IS - 375	Marking arrangement for switch gear, Bus bars main Connection auxiliary wiring.
7.	IS - 613	Specification for copper rods bars for electrical purpose
8.	IS - 694	PVC insulated cables for working voltage up to including 1100 V.
9.	IS - 722	AC Electricity meters
10.	IS - 732 (part I)	Code of practice for electrical wiring installations
11.	IS - 807	Code of practice for design, manufacture, erection testing (structural portion) of cranes hoists
12.	IS - 816	Code of practice for use of metal arc welding for general construction in mild steel
13.	IS - 900	Code of practice for installation maintenance of Induction motors.
14.	IS - 1239	Mild steel tubes, tubular other wrought steel fittings
15.	IS - 1248 (Part I and II)	Direct acting indicating analogue electrical measuring Instrument their accessories.
16.	IS - 1271	Electrical insulation classifies by thermal stability
17.	IS - 1520	Horizontal split casing centrifugal pump for clear, cold fresh water
18.	IS - 1554 (Part I and II)	PVC insulated electrical cables (heavy duty)
19.	IS - 1651	Stationary cells batteries, lead acid type (with tubular positive plates)
20.	IS - 1710	Vertical turbine pumps for clear, cold, freshwater.
21.	IS - 1866	Insulating oil in service, code of practice for maintenance supervision of.
22.	IS - 2026 (Part I to V)	Power Transformers
23.	IS - 2062	Steel for general structural purposes.

24.	IS - 2071 (Part I to III)	High voltage testing method
25.	IS - 2099	Bushings for alternating voltage above 1000 V.
26.	IS - 2121 (Part I to IV)	Conductors and earth wire accessories for overhead Power lines.
27.	IS - 2147	Degrees of protection provided by enclosures for low voltage switchgear control gear
28.	IS - 2253	Designation for types of construction mounting Arrangements of rotating electrical machines.
29.	IS - 2309	Code of practice for the protection of buildings allied Structures against lightning.
30.	IS - 2486 (Part I)	Metal fittings for overhead power lines with a nominal Voltage greater than 1000 volts.
31.	IS - 2544	Porcelain post insulators for systems with nominal voltage greater than 1000 volts.
32.	IS - 2551	Danger notice plates.
33.	IS - 2629	Recommended practice for hot dip galvanizing on iron steel.
34.	IS - 2633	Hot dip galvanizing
35.	IS - 2667	Fittings for rigid steel conduits for electrical wiring.
36.	IS - 2675	Enclosed distribution fuse boards cutouts for voltage not exceeding 1000 volts.
37.	IS - 2705 (Part I to IV)	Current transformers
38.	IS - 2834	Shunt capacitors for power systems.
39.	IS - 3043	Code of practice for Earthing
40.	IS - 3070 (Part I and III)	Lightning Arrestors for AC system.
41.	IS - 3156 (Part I and IV)	Voltage transformers
42.	IS - 3177	Code of practice for electric overhead traveling cranes gantry cranes other than steel work cranes
43.	IS - 3427	Metal enclosed switch gear control gear for voltage above 1000 v but not exceeding 11000 v.
44.	IS - 3452	Toggle switches
45.	IS - 3589	Seamless or Electrically welded steel pipe
46.	IS - 3624	Vacuum pressure gauges
47.	IS - 3637	Buchholz relay
48.	IS - 3639	Fittings accessories
49.	IS - 3835	Aluminized steel core wire for Aluminum conductors (ACSR)
50.	IS - 3938	Electric wire rope hoists

51.	IS - 3961 (Part II)	Recommended current ratings for cables
52.	IS - 4029	Guide for testing three phase induction motors
53.	IS - 4064	Switch fuse unit
54.	IS - 4137	Code of practice for heavy duty electric overhead traveling cranes including special service machines for use in steel work
55.	IS - 4237	General requirements for switch gear control for voltage not exceeding 1000 volts.
56.	IS - 4691	Degree of protection provided by enclosures for rotating electrical machinery.
57.	IS - 4722	Rotating electrical machines.
58.	IS - 4728	Terminal marking direction of rotation for rotating electrical machinery.
59.	IS - 4759	Hot dip galvanizing
60.	IS - 4889	Method of determination of efficiency of rotating electrical machines.
61.	IS - 5504	Spiral welded pipe
62.	IS - 5039	Distributions pillars for voltage not exceeding 1000 v.
63.	IS - 5082	Wrought aluminum alloy bars, rods, tubes sections for electrical purposes.
64.	IS - 5216	Guide for safety procedures practices in electrical work.
65.	IS - 5312	Swing type Non return valve
66.	IS - 5578	Guide for marking of insulated conductor.
67.	IS - 5831	PVC insulation sheath of electric cables.
68.	IS - 6005	Code of practice for phosphate of iron steel.
69.	IS - 6346	Specification for PVC insulated cables for electricity supply
70.	IS - 6362	Designation of methods of cooling of rotating electrical machine.
71.	IS - 6474	Polyethylene insulation sheath for electric cables
72.	IS - 6511	Range of preferred safe working loads for cranes, lifting appliances related excavators equipment.
73.	IS - 6595	Horizontal centrifugal pump for clear, cold fresh water
74.	IS - 6600	Loading of oil immersed transformer
75.	IS - 6792	Method for determination of Electric strength of insulating oils
76.	IS - 6875	Control switches for voltage up to (part I to III) including 1000 V AC 1200 VDC
77.	IS - 7098 (Part I and II)	Cross linked polyethylene insulated PVC Sheathed cables for working voltages from 3.KV up to including 33 KV
78.	IS - 7421	Bushings for ≤ 1000 V
79.	IS - 7538	Three Phase squirrel cage induction motor for Centrifugal pumps for agricultural application.

80.	IS - 8061	Code of practice for design, installation maintenance of service lines up to including 650 v.
81.	IS - 8084	Inter connecting Bus bars for A.C. voltage above 1KV Up to including 36 KV.
82.	IS - 8130	Conductors for insulated electric cables fixable cords.
83.	IS - 8197	Terminal marking for electrical measuring instruments their accessories
84.	IS - 8309	Compression type tubular terminal ends for aluminum conductors of insulated cables.
85.	IS - 8923	Warning symbol for dangerous voltage
86.	IS - 9046	AC contractors of voltage above 1000 V up to including 11 KV.
87.	IS - 9137	Code of acceptance test for CF pumps
88.	IS - 9224	Low voltage fuses.
89.	IS - 10001	Performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 KW)
90.	IS - 10028	Code of practice for selection installation (Part I to III) maintenance of transformers.
91.	IS - 10234	Pipeline Welding
92.	IS - 10418	Specification for drums of electric cables
93.	IS - 10748	Hot-Rolled steel strip
94.	IS - 10810	Methods for test for cables
95.	IS - 11346	Testing of agricultural pump
96.	IS - 12661	High voltage motor starter (D.O.L)
97.	IS - 12672	Internal fuses internal overpressure disconnections for shunt capacitors
98.	IS - 12776	Galvanized str for Earthling
99.	IS - 13095	Wafer type butterfly valve size from 40 mm to 2000 mm
100.	IS - 13118	High Voltage AC circuit Breakers.
101.	IS - 13349	Cast iron single faced thimble mounted sluice gates
102.	IS - 13947 (Part to V)	Low voltage switchgear control gear
103.	IS - 14845	Air Relief Valves
104.	IS - 14846	Non rising stem type sluice valve size from 50 mm to 1200 mm
105.	IS - SP: 30-1984	National Electrical code.
106.	ASME (Section - ix)	Non Destructive Test
107.	API 1104	Pipeline Works
108.	AWWA C 512	Air Relief Valves

MATERIAL EQUIPMENT

All material equipment shall conform to the relevant Indian standards shall be of the approved make design. The contractor shall be responsible for the safe custody of all the materials shall insure them against theft, damage by fire, earthquake etc. A list of items of materials equipment together with sample of each shall be submitted to the Engineer-In-Charge within 15 days of the award of the contract. Any item which is proposed as a substitute shall be accompanied by all technical detail giving sizes, particulars of materials the manufacturer's name shall be submitted along with the bid offer. At the time of the submission of proposed substitute the contractor shall state the credit, if any due to the client's. In the event, the substitution is approved all changes substitutions shall be requested in with detail justifications approvals obtained in writing from the Engineer-In-Charge. Decision of Engineer-In-Charge in the matter shall be final.

All materials of the same kind of service shall be identical made by the same manufactures. Any deviation to this rule shall be got approved from the Engineer-In-Charge. Top priority shall be given to the products that have a permanent agent providing spare parts maintenance facilities in the same city where the project is situated.

11.MANUFACTURERS

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

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

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

The list of vendors is furnished in Volume – II of Condition of Contract of Tender Document.

12.INSPECTION TESTING

The Engineer-In-Charge reserves the right to inspect test at manufacturer's works at all reasonable times during manufacture of items included in this contract. Tests on site of completed works shall demonstrate among other things.

- m) That all items operate efficiently quietly to meet the specified requirements.
- n) That all circuits are correctly fused protected that all protective devices are properly coordinated.
- o) That all non-current carrying metal work is properly safely grounded in accordance with the specifications.
- p) While testing any machineries/equipment's at manufacturers/contractor's place the Engineer-In-Charge shall reserve the right to check/calibrate all the measuring devices.

The contractor shall provide all necessary instruments labor for testing shall make adequate records of test procedures readings shall repeat any tests requested by the Engineer-In-Charge shall provide test certificates signed by a properly authorized person. Such test certificates shall cover all works.

If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or retesting will be considered.

The Engineer-In-Charge decision as to what constitutes a satisfactory test shall be final.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

- q) All materials, components equipment's covered in this specification shall be procured, manufactured, erected, commissioned tested at all the stage as per comprehensive quality assurance programmed drawn in with IS -9000A.

This is however, not intended to form a comprehensive programmed as it is the contractor's responsibility to draw up implement such programmed duly approved by the Engineer-In-Charge. The detailed quality plans for manufacture field activities should be drawn up by the Contractors separately in the prescribed format signed by TPI will be submitted to Engineer-In-Charge for his approval.

- r) Manufacturing quality plan will detail out for all components equipment's, various test/inspection be carried out as per the requirements of specification standard mentioned there in quality practices procedures followed. Contractor's quality control organization, the relevant reference documents standards, acceptance norms, inspection documents raised etc. during all stages of material procurement, manufacture, assembly final testing / performance testing.
- s) Field quality plans will detail out for all the equipment's the quality practices procedure etc. to be followed by contractor's site quality control organization, during various stages of site activities from receipt of materials / equipment's at site.
- t) The Contractors shall also furnish along with the quality plan copies of the reference documents/ plant standards / acceptance norms/test inspection procedure etc. as referred in them. These quality plans reference documents / standards etc. shall be subject to Engineer-In-Charge approval, without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, owner shall identify customer hold points(CHP), test/checks which shall be carried out in presence of TPI the Engineer-In-Charge or his representative beyond which work shall not proceed without approval of Engineer-In- Charge in writing.

All deviations to these specifications, approved quality plan applicable standards must be documented referred to Engineer-In-Charge or his representative along with technical justification for approval.

- u) No materials/ equipment's shall be dispatched from the manufacturer's works before the

same is either accepted subsequent to pre-dispatch final inspection (including verification records of all previous test/inspection) by Engineer-In-Charge or his representative or such pre-dispatch final inspection is waived by the Engineer-In-Charge.

All material used or supplied shall be backed up by valid material certificate test reports. These certificates reports shall indicate the hit numbers or other such acceptable identification numbers of the material they purport to certify. The material certified shall also have the identification details stamped on it.

- v) All material used for equipment construction including casting forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the test conducted to determine the main properties, chemical analysis details of treatment procedure recommended actually it shall be recorded on certificates. Tests shall be carried out as per applicable materials standard agreed details.
- w) No welding shall be carried out on iron component for repair or whatsoever purposes. All the sub vendors proposed by the contractor for procurement of major bought out items including castings, forging, semi-finished, finished components/equipment- (list of which shall be drawn by the contractor, submitted to finalize by the Engineer-In-Charge shall be subject to Engineer-In-Charge's approval.
- x) The contractor shall undertake an inspection, testing programming during manufacture in his work that of his sub contractor's to ensure the mechanical accuracy of components, compliance with drawing conformance to functional performance requirements acceptability of all materials, parts equipment's correlation of its identity with test certificate shall carry out all test/inspection required establish that the items/equipment's conform requirements of this specification the relay codes/standards specified in this specification in addition to carrying out tests as per the approval.

13. RECTIFICATION TAKING OVER

The contractor shall carry out all rectifications, repairs or adjustment work found necessary during performance testing, commissioning trial run.

On successful commissioning trial run on carrying out the rectification work, the Engineer-In-Charge will take over the installation either wholly or in part as the case may be. Unless otherwise specified, the work, material accessories shall conform to the latest applicable Indian standard.

14. COMPLETION CERTIFICATE

On completion of the electrical mechanical installation (or an extension to an installation) a certificate shall be furnished by the contractor countersigned by the licensed supervisor,

under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority. The contractor shall be responsible for getting the installation inspected approved by the local concerned authorities.

15. PRICEDetails

At any time at the request of the Engineer-In-Charge, the contractor shall provide details or break up of costs prices of any part or parts of the work.

16. TESTCERTIFICATES

The contractor shall submit valid test certificates for all the electrical mechanical plant, equipment material/system. These shall be issued by a Government recognized inspection office certifying that all equipment's, materials, construction functions are in agreement with the requirements of these specifications acceptedstarts.

17. INSTRUCTIONMANUAL

The contractor shall prepare instruction manuals in English, on operation, preventive maintenance repairs of pumping machinery, mechanical electrical equipment's supplied submit 5 copies of the same to the Engineer-In-Charge at the time of hing over.

18. AS BUILTDRAWINGS

At the completion of work before issue of certificate of virtual completion the contractor shall submit to the Engineer-In-Charge layout drawing drawn at appropriate scale indicating the complete electrical mechanical system "As Installed" These drawings mustprovide:

- y) Run, location size of conduits. Inspection, junction pull boxes.
- z) Number size of conductors in each conduit.
- aa) Location rating of sockets switches containing the light power outlets.
- bb) Location details of distribution boards switch gear other particulars.
- cc) A complete wiring diagram as installed scheduled drawings showing all connections in the complete electrical system.
- dd) Location of outlets, junction boxes, sizes of various conduits for telephone, clock system, fire alarm, sound system all other extra low voltage system.
- ee) Location of all Earthing stations, route size of all Earthing conductors, manholes etc.
- ff) Route particulars of all cables.
- gg) Pumping machinery dimensional layout drawings in pumphouse.
- hh) EOT EOHwith electrical hoist drawings.

- ii) Pumps dimensional drawings, cross sectional drawings, foundation drawings, supply location, Valves dimensional cross sectional drawings complete with details.

19. SPAREPARTS

The Contractor shall indicate include, in the supply all the necessary commissioning spares, motor spares recommended spares in the schedule of spare parts. The Engineer-In-Charge reserves the right to finalize the exact quantities of the spare parts effect price adjustment on the basis of the rates quoted by the Contractor. The spare ordered by Engineer-In-Charge shall be delivered at the site at agreed delivery schedule.

20. COMMISSIONINGSPARES

- jj) It will be the responsibility of the Contractor to draw furnish a list of all commissioning spares required for successful commissioning of the equipment covered under the contract. Such list shall be furnished by the contractor within four months of the date of LOA, separately for all equipment's shall be reviewed by Engineer-In-Charge discussed for mutual agreement. The commissioning spares will be so identified as to allow the trial operation not to suffer for want of commissioning spares. The identification of commissioning spare will not in any way relieve the vendor any of its responsibilities of satisfactory performance under the provisions of other condition of contract. All the commissioning spares shall be deemed to be included in scope of the contractor as a part of the respective equipment package at no extra cost to owner.
- kk) All such identified spares shall be supplied by contractor at least two months before the schedule date of commencement of trial operation of the respective package. Such spare shall be received stored.

21. PACKING PRESERVATION

- ll) Each spares shall be clearly marked or labelled on the outside of the packing with its description. When, more than one spare-part is packed in a single case, a general Description of the contents shall be shown on the outside of such case a detailed list enclosed. All cases, containers other packages must be suitably marked numbered for the purposes of identification.
- mm) All cases, containers or packages are liable to be opened for such examination as may be reasonable by the engineer.
- nn) In case of equipment supplied with grease/lubricants from imported origin, the supplier shall clearly indicate the indigenous equivalent of the grease/ lubricant source of supply so as to enable to owner to procure these items from indigenous sources. Necessary initial filling of lubricating oil, grease etc. shall be arranged by the contractor with no extra cost to

client.

22. PAINTING

All metallic surfaces equipment components shall first be thoroughly cleaned, degreased phosphate then be given two coats of zinc primer in then the surface shall be coated, painted with approved shade of paint. The resulting coating shall be uniform smooth shall adhere perfectly to the surface.

2.0 HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS (HSCF)

GENERAL

The Pump shall be Centrifugal, Horizontal shaft, Horizontal split case type designed manufactured for pumping liquid like raw / potable water. Pump shall be directly coupled to motor through coupling, mounted on common base plate with foundation bolts all other required accessories.

The pump shall be designed to operate satisfactorily without detrimental surges, vibration, noise or dynamic imbalance over the required Head-Capacity range. The head-capacity curve of the pump shall have continuously rising head characteristics with decreasing capacity over the whole performance range of pump. The shut off head of the pump shall be at least 120% of the total head.

The pump shall be selected in such a way so that operating point shall lie on best efficiency point (BEP) or within 15 % of BEP flow on either side meeting NPSH requirement. Pump selected with duty point lying on right side of BEP beyond 15 % limit shall not be accepted.

The pump shall be selected with intermediate diameter of Impeller. The rated impeller diameter shall be at least 10 mm smaller than the maximum Impeller dia. possible for the offered pump model. The pump selected for rated performance below minimum Impeller diameter shall not be accepted.

The manufacturer shall ensure while selecting pump that required Net Positive Suction Head (NPSH) is less than available NPSH to ensure pump's operation without cavitation under the worst operating condition. The required NPSH at duty point throughout the range shall be at least 1.0 m 0.5 m, less than the available NPSH respectively at the lowest water level in the sump.

Each pump must be capable of running satisfactorily in parallel with other sets in the system without throttling by itself, without cavitation or overload under all operating conditions within the system resistance indicated. All pump shall have identical performance with job motor.

The pump shall be designed to start with delivery valve fully open.

The unit shall be designed to operate safely at the maximum speed attainable in the reverse direction of rotation due to water returning through the pump at times when the power supply to the motor is interrupted the discharge valve fails to close.

Pump's rotating assembly shall be statically dynamically balanced as per ISO standards shall run smooth without undue noise vibration. The velocity of vibration shall be within the 4.5 mm/sec. Noise level shall be limited to 85 dB A at a distance of 1.0 m

The power rating of motors to drive pumps shall be suitable to meet maximum requirement of power for the rated impeller throughout its' performance range.

Selection of pump shall be towards downward side

FEATURES OF CONSTRUCTION PUMP:

Pump shall be horizontal centrifugal, single / double stage; Horizontal split case Type suitable for dry-pit installation with wearing rings. The pump shall have side suction side discharge nozzle located in lower part of delivery casing.

CASING:

Pump casing shall be of robust construction. Liquid passages shall be designed to allow free passage finished smooth. The tongue shall be straight across filed to a smooth rounded edge. Casing shall be provided with wearing rings. Casing drain connection with collar plug shall be provided at lowest part of casing. Tapping shall be provided at side center of suction discharge nozzles for pressure gauge connection. These tapping shall be plugged by collar plugs.

IMPELLER:

Impeller shall be enclosed, single or double suction type with smooth large ways so as to allow free passage to the fluid being pumped. It shall be free from sharp corners projections likely to catch hold rags stringy materials. Impeller shall be statically dynamically balanced at rated speed as per applicable standard so as to avoid vibration.

SHAFT SLEEVE:

Replaceable shaft sleeves shall be provided shall be securely locked or keyed to the shaft to prevent loosening. Necessary rubber 'O' ring or CAF / Teflon gaskets shall be provided between impeller shaft sleeve to prevent liquid passage between shafts sleeve. In no case shaft shall be in contact with liquid. The surface hardness of the shaft sleeve shall be minimum 250 BHN.

STUFFING BOX:

Pump shall be provided with stuffing box arrangement as mentioned in specific requirement for shaft sealing.

Pump when required with gl packed Stuffing box; same shall be of such design that they can be repacked without removal of any part other than gl lantern ring. Stuffing box drain with pipe connection shall be provided at the lowest point so that no leakage accumulates in it. Lantern ring shall be switched between packing shall be easily removable. Lantern ring shall be of axially split type shall be sealed with self-liquid being pumped or as recommended by the pump manufacturer. Necessary pipe connections piping for this shall be provided by pump manufacturer. GI shall be of split type. GI bolts nuts shall be of SS.

Pumps required with Mechanical Seals shall be provided with necessary piping for cooling, flushing lubrication of seal faces as recommended by seal manufacturer. Seal shall be designed selected for the specified application in order to perform the equipment trouble free working life not less than 40,000 hours of operation. Seals shall be covered with SS 304 mechanical seal cover shall be tightened with SS fasteners as per the specifications.

Pumps shall be supplied with Rubber liquid deflector to prevent liquid entry to bearings, in case of failure of mechanical seal / leakage through stuffing box.

BEARINGS:

Pump shall be provided with anti-friction grease lubricated bearings. The whole rotating assembly of pump shall rest between minimum two bearings for smooth operation. Bearings shall be easily accessible for inspection maintenance. Bearings shall be of SKF / FAG make only.

COUPLING:

The pump shall be coupled with electric motor mounted on a common base plate using pin bush type of KTR / Rathi / Fenner make only. Coupling shall be statically dynamically balanced at rated speed.

COUPLING GUARD:

A stationary coupling guard shall be provided for the coupling conforming to all relevant safety codes regulations. Coupling guard design shall be such that coupling is covered from both the sides as well apart from top cover. Guard shall be designed for easy installation removal, complete with necessary support, accessories SS fasteners.

BASE PLATE:

The pumping unit shall be provided with a common drain rim type base plate with 25mm dia. drain pipe, terminated to nearest drain pit/trench. The base plate shall be of sufficient size rigid sufficient to maintain the pump motor in proper alignment position. Base plate shall be supplied by pump manufacturer only. The base plate shall be grouted on the RCC foundation with the help of "J" type foundation bolts of manufacturer's recommended / approved size.

MATERIAL OF CONSTRUCTION:

The specific requirement shall be considered as under:

Casing	CI IS210 Gr. FG 260
Shaft	AISI 410
Shaft sleeve	AISI 410 H
Impeller	CF8M
Impeller wear ring	SS 316
Casing wear ring(if apply.)	SS316
Shaft Seal	GI Packed Stuffing Box
Liquid Deflector	Natural Rubber
Suction Strainer	SS 304

5 mm bar having 25 mm x 25 mm opening Base Plate (Drain Rim type) CI

NAME PLATE

Each pump shall be provided with a stainless steel name plate indicating the following details.

- Model
- Manufacturer's special number
- Rated capacity in LPS / M³/HR
- Total head in MWC
- Speed in RPM
- Weight of equipment
- Material of impeller

DATA SHEET OF HORIZONTAL SPLIT CASE CF PUMP (HSCF)

SR. NO.	PARTICULAR	DESCRIPTION	DATA TO FILL BY BIDDER
1.0	LIQUID DATA		
1.1	Liquid hled	Treated Water	
1.2	Specific gravity	1.0	
1.3	Residual chlorine in ppm	2 to 3	
1.4	Temperature	Ambient temp.	
2.0	PUMP DATA		
2.1	Make	Pl. Furnish detail	
2.2	Pump type	Horizon. Split Case	
2.3	Pump Model	Pl furnish	
2.4	Number of pumps - Nos.	As per price bid	
2.5	Type of duty	Continuous	
2.6	Design capacity-m ³ /hr.	As per price bid	
2.7	Total Rated Head-mlc	As per price bid	
2.8	Guaranteed min. Pump efficiency at rated capacity. w/o coating	80% Min. w/o -ve tolerance	

2.9	Guaranteed Overall Pump set efficiency at rated capacity-%	Min. w/o -ve tolerance	
2.10	Pump input at rated duty-KW	Pl furnish	
2.11	Rated Speed of pump- RPM	(Synchro.)-max. (FLS of Ele. Motor)	
2.12	Max. BkW @ Rated Impeller.	Pl furnish	
2.13	Reco. Drive motor rating- KW	Pl furnish (Min.as per SOQ)	
2.13.1	Guaranteed min. Motor efficiency at rated capacity. w/o coating-%	92% Min. w/o -ve tolerance	
2.14	Full load speed of motor-RPM	Pl furnish	
2.15	N.P.S.H. required-m	Pl. furnish	
2.16	Shut off head-m	Pl. furnish	
2.17	Location	Indoor	
2.18	Pump Speed	As Per BOQ	
2.19	Minimum Efficiency	As per BOQ	
3.0	Constructional Feature		
3.1	No. of stage	Single	
3.2	Casing	Volute type	
3.3	Impeller	Double suction Enclosed	
3.4	Impeller dia.- mm	Max. / Rated / Min.	
3.5	Shaft / Drive Transmission	Direct Coupled	
3.6	Shaft sealing	Gl packed Stuffing Box sealed	
3.7	Mounting Orientation	Horizontal	
3.8	Nozzle orientation and size-mm		
	Suction	mm / Side	
	Discharge	mm / Side	
3.9	Flange drilling	As per IS 1538, FF	
3.10	Direction of rotation	Pl. furnish	
3.11	Type of Starter	Soft Starter	
4.0	MATERIAL OF CONSTRUCTION		
4.1	Pump Casing (M)	CI, IS 210 Graf 260	
4.2	Impeller (M)	CF 8 M	
4.3	Shaft (M)	AISI 410	
4.4	Shaft Sleeve (M)	AISI 410-H	
4.5	Casing /Impeller Wearing Ring (M)	SS 316	
4.6	Strainer (M)	SS 304 of 5 mm bar	
4.7	Gl Bolt and Nuts	SS 316	
4.8	Hardware in contact with liquid / Non-wetted	Wetted: SS 304 Non Wetted : G.I.	
4.9	Liquid deflector	Natural Rubber	
4.10	Gl	CI-IS 210 Gr FG260	
4.11	Painting	Pl furnish	
4.12	Base plate (Drain rim type)	CI	
5.0	ACCESSORIES and SERVICES REQUIRED		

5.1	Pin Bush Type Coupling	YES	
5.2	Coupling guard	YES	
5.3	Set of foundation bolts and Nuts	YES	
5.4	Base Plate	YES	
6.0	WEIGHT		
6.1	Weight of pump-kg	Pl furnish	
6.2	Weight of motor-kg	Pl furnish	
6.3	Reco. Crane capacity-Ton	Pl furnish	
7.0	DRAWINGS		
7.1	ISO efficiency Perform. curve	Pl furnish	
7.2	GAD Drg. of Pump set	Pl furnish	
7.3	C/S drg.of pump with part list	Pl furnish	
7.4	Catalogue of products	Pl furnish	
7.5	QAP of products	Pl furnish	

Note: 01. Manufacturer / supplier shall submit separate data sheet for each duty.

02. For components (marked-M) material certificates shall be furnished

03. Bidder shall refer electrical specifications for motor requirement shall offer accordingly.

2.0 Horizontal Mono Submersible Pump Set / Drain Pump set:

Horizontal mono submersible pump set shall be as per IS: 14220 / 1994 with latest amendments. The standard specifies the technical requirement for three phase mono submersible pump sets commonly used in sump for lifting clear cold water for application in water supply etc. The duty point of the set should be located at the optimum efficiency point of the pump rating curves there should not be steep fall in efficiency in the operating range. The pump with single stage RPM of shall be 2900 operating on $415 \pm 10\%$ volts, 3 phase and 50 Hz frequency.

Minimum motor horse power rating, cable size, starting system delivery size shall be as specified in the data sheet.

Features of construction shall be as follows.

A. PUMP:

The pump casing should be free from blow holes, sludge inclusion other detrimental defects. Casing should be provided with renewable wearing rings excepting radial flow pump set. Casing should be provided with wearing rings. Casing should be hydraulically tested up to 1.5 times shut off pressure. Shut off head shall be at least 105 % of maximum head range.

B. IMPELLER:

Impeller should be of closed type, ensuring required performance free of capitations. The material of impeller will be as per MOC shown in data sheet.

C. **SHAFT:**

The pump and motor shall be unbuilt on common shaft. Below the impeller shaft assembly, shaft protection sleeve shall be provided. It shall have surface finishing of 0.75 Microns. The material of shaft shall be as per Annexure - III.

D. **MOTOR:**

The submersible motor shall confirm to IS: 9283 / 1994 with latest revision. It should be totally enclosed squirrel cage induction type water cooled water lubricated sealed against entry from outside water.

The windings shall be of wet type. The thrust bearing should be of wet type water lubricated designed to take all untoward load at most unfavorable running conditions. Front rear bearing housing thrust bearing housing should preferably be fixed separate replaceable bolts / studs (not threaded connections) to the stator to facilitate easy dismantling. Full proof sealing arrangement by a gasket shall be preferred in the motor inlet body to prevent open well water impurities like, silt from entering the motor bearing stator motor should be impregnated with a superior varnish class B thermal insulation properties by vacuum pressure or epoxy paints on stator cold rolled stamping used rotor shall be painted with Polyurethane paint and baked properly under controlled temperature condition not by manual or gravity flow to remove air pocket so that these are thoroughly filled up by varnish. Motor rotor should be preferably lead shot blasted. Subsequently rotor body should be baked repeatedly under controlled conditions to ensure long life of paint hard finish to the surface to avoid corrosion before power coating.

The material of construction of rotor shaft shall be as specified in data sheet provided with sleeves having materials as per detailed material of construction in the bearing portion. The windings should be accessible to facilitate checking locating any faults without disturbing all the coils also to enable replacement of any defective coils. It should be possible to rewind the Stator with readymade protected coils in order to save time during the repair. Kelvin Bridge / digital resistance meter shall be treated preferable for measurement of hot cold resistance of winding for evaluated temperature rise. Full proof arrangement should be made for stopping the rotating of shifting of stampings inside the stator body due to operation of pump sets. Earth leakage current should not be more than 50 Milli amperes at rated voltage.

The HP rating of motor shall be decided on minimum power margin over above the power required on duty point shall be 25 % bidder has to supply motor of minimum HP rating considering 25 % reserve power margin.

Starting method shall be direct on line.

E. **CABLE:**

Motor shall be provided with three core flat PVC water proof flexible copper submersible cable in single length (approx. 15 meters) of suitable size as per actual requirement. The cross sectional areas should be sufficient so as not to cause voltage drop of more than 2.5% of nominal voltage i.e. 10 volts at 400 volts throughout the length of the cable size of the Following points shall be applicable for the manufacture of the pump set:

- (1) Casing individually tested to hydraulic test pressure 1.5 times of shut off pressure.
- (2) All rotating parts should be individually balanced on machine for rated RPM according to the relevant IS (vibrations of the assembly during the testing shall not exceed to 80 micron peak to peak).Impeller closed type
- (3) Motor Wet type
- (4) Brass / Carbon steel drain plugprovided.
- (5) Compensating deviceprovided
- (6) Stator varnished by vacuum pressure method or EPOXY painted (if cold rolled stamping used).
- (7) Rotor varnished by vacuum pressure method or Epoxy Paint methane paint duty properly backed.
- (8) Rotor painted baked under controlled condition or powder coated.
- (9) Winding easily assembled.
- (10) Winding subjected to 1.5 KV for 30seconds
- (11) Matching grooves for stopping from rotation shifting
- (12) SS / Brass suction strainer preferred.
- (13) Stud nuts shall be of alloy steel nut shall be Locknut.
- (14) Stator end ring shall be of bronze metal or MS.
- (15) Stator is rewind able with readymade protested coils in each type of motor offered
- (16) Cable confirming to IS:694.

F. TESTING PERFORMANCE AS PER IS: 14220 WITH LATEST REVISION:

Pump shall be tested as per IS: 14220 motor shall be tested as per IS: 9283 at manufacturers works. Bidder shall have to give internal test report.

G. MATERIALS OF CONSTRUCTION

Sr. No.	Description	Material (s)
1	Shaft sleeve when used	Grade X04 Cr. 12, X12 Cr 12 or X 20 Cr 13 Conforming to IS: 1570 (part-5) 1985

2	Motor bearing housing base	Grade FG 200 of IS: 210/1993
3	Pump and Motor Shaft (Common)	Grade X04 Cr 12, X12 Cr 12 or X20 Cr 13 Conforming to IS: 1570 (Part-5) 1985 or Grade 40C8 or 45C8 Conforming to IS: 1570 (Part-2/ Sec.1) 1979
4	Bearing Bush	Leaded tin bronze Grade LTB3, LTB4 or LTB5 of IS: 318 / 1981 or resin bonded carbon or PTFE bonded carbon
5	Rotor	Electrical sheet steel electro grade copper rods conforming to IS: 613 / 1984 or Aluminum dia cast rotor conforming to IS: 617 / 1984
6	Stator Core	Electrical sheet steel PVC insulated winding wire/polymer insulated winding wires or with any suitable plastic covered wires conforming to IS: 8783 / 1978
7	Winding Wire	<p>i) For motors other than water filled motor: Enameled copper conductor conforming to IS: 4800 (Part-7) 1970</p> <p>ii) For water filled motors: (a) Enameled copper conductor to IS: 4800 (Part-7) / 1970or (b) PVC insulated winding wire conforming to IS: 8783 / 1978or (c) With polymer insulated such that the test of insulated resistance satisfied</p>
8	Breather diaphragm	Nitrile rubber
9	Cable	PVC insulated PVC sheathed 3 core flat type conforming to IS: 694/1990 or PVC insulated polymer sheathed 3 core flat type (approx. 15 meters)
10	Cable GI	Nitrile rubber
11	Thrust Bearing combinations	Bronze- ferrobestos, Brass - Ferro tests, Carbon-Stainless steel, Bronze suitable elastomer or any other suitable combinations
12	Water drain plug	Bronze / Brass / Stainless steel / Suitable Plastic
13	Impeller	High tensile brass conforming to IS: 304 / 1981or leaded tin Bronze LTB 2 of IS: 31 8/ 1981
14	Casing	Cast iron Grade FG 200 of IS: 210 / 1993, Allow steel casing conforming to IS: 3444/1987
15	S Guard	Bronze Or S.S.

4.1 Horizontal Multi-stage Pump set (If Applicable):

Pump should be suitable for helingRaw/ Clear water. The speed of the pumpshall not be more than 1500 and number of stages shall be limited to six. The complete pump rotor shall be balanced statically and dynamically to provide vibration free operation. All the pumps will also be tested hydraulically at two times the working head pressure or 1.5 times shut off head pressure whichever is higher.

The materials of construction of these pumps shall be as below: -

Casing/bowl	Cast Steel ASTM A276 Grade 316
Shaft	ASTM A276 Gr 410
Impellers	ASTM A743 Gr CF8M
Sleeves	ASTM A276 Gr 410
Neck rings and Neck bushes	Cast Steel ASTM A276 Grade 316
Packing	GI Packing
Bush bearing	Oil Lubricated

1.1 DESIGN CONSTRUCTIONREQUIREMENTS

- 1.1.1 Design construction features of the pump shall be as per relevantstards.
- 1.1.2 Pumps shall be of indoor installed, horizontal multi stage centrifugal type, all identical pumps shall beinterchangeable.
- 1.1.3 Design datasuchasCapacity,TotalHead,duty, typeofpumpconstruction,suction condition type of coupling shall be as specified in 'Procurement Datasheet'.
- 1.1.4 $NPSHA > NPSHR$ by at least 0.5m

21 PUMPCASING:-

- 2.1.1 Pumpcasing shall be provided with adequate number of vents primingconnections with valves unless the pump is made self-venting priming.
- 2.1.2 Casing shall be robust construction.

3.1 IMPELLER:-

- 3.1.1 The rotor assembly shall be dynamically balanced designed with critical speed substantially above the operating speed. The impellers should be double entry to eliminate thrusts itshall be statically dynamically balanced as per grade per ISO 1940 Gr. 6.3 to ensure vibration free operation. It shall be positively locked on shaft shall not loosen under reverse rotation.

41 SHAFT:-

- 4.1.1 Shaft size shall be selected considering that the critical speed shall be away from the operatingspeed as recommended in applicable code/stard. The critical speed shall also be at least 10% away from runaway speed.

5.1 SHAFTSLEEVES:-

- 5.1.1 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes.
- 5.1.2 Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening.

6.1 BEARINGS:-

- 6.1.1 Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing.
- 6.1.2 Bush bearing with oil lubrication to be provided to take care of high radial load to provide better flexibility for misalignment resulting in longer service life for journal bearing.

Thrust balancing device with balance valve and seating bush designed to take care of all axial thrust should be provided in pump design.
- 6.1.3 Bearings hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.
- 6.1.4 The bearings shall be oil lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete all accessories like pump, filters, piping's, fittings, valves, interlocking supervising instruments etc., as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.

7.1 STUFFINGBOXES:-

- 7.1.1 Stuffing box design shall permit replacement of packing without removing any part other than the G.I.
- 7.1.2 Stuffing boxes shall be sealed/cooled by the fluid being pumped/external clear water. All necessary pumps, piping, fittings, valves, etc., as required for safe trouble-free operation of the pumps shall be included in the scope of supply.

H. NOTE:

- a) Impeller shall be of fully enclosed type of suitable shape shall be statically and dynamically balanced for smooth-running.
- b) The impeller shall be of single entry type with all inlet eye/suction in the same direction.
- c) The motor shall be directly coupled to pump through well-designed pin bush type couplings alternatively any other suitable flexible/hydraulic coupling of adequate rating.
- d) The motor pump set along with coupling shall be supplied mounted on a common base plate of adequate strength.
- e) Technical supervision by the firm should be provided at the site for installation of the pump.

I. 8.1 OPERATING CONDITIONS

- a. Pump shall be designed to have the best efficiency at the specified duty point. Further, the pump(s) shall be suitable for continuous operation at any point within its specified "range of operation".
- b. The pumps shall be designed to operate under discharge valve fully open condition.
- c. The pump shall operate satisfactorily in isolation in parallel with all other working pumps without cavitations, any deleterious effects, undue vibrations, noise leaking at all water levels, from minimum to maximum.

9.1 DRIVE UNIT

The horizontal solid shaft squirrel cage induction motors coupled to the pump sets shall be suitable for available power supply. The motors shall be energy efficient (IE3) generally conforming to latest revision of IS 12615 / 325 4722 / IEC 60034 with latest national and international code of practices.

The pump shall be directly driven by a constant speed, air cooled motor. A heavy duty coupling along with coupling guard shall be provided between the pump drive unit.

Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously under the following supply conditions:

- a. Variation in supply voltage +10%
- b. Variation in supply frequency +5%
- c. Combined voltage frequency variation 10%
- Drive motors shall be suitable for DOL/ star- delta starter panel as the case may be. Motors shall be suitable of starting 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.
- Drive motors shall be suitable for DOL/ star- delta starter panel as the case may be. The locked rotor current of the motor shall not exceed 600% of full load current (subject to tolerance as per the applicable standard).
- Motors shall be designed to withstand 120% of rated speed for two minutes without any mechanical damage, in either direction of rotation.
- Stator leads shall be brought to the terminal box as insulated cable through a suitable barrier terminated in clamp type terminals.
- The Power rating of the motor shall be the larger of the following:
 - 1. 115% of the power input to the pump at duty point at a speed corresponding to the frequency of 48.5 Hz.
- Maximum power input while operating solo or in parallel within maximum minimum system

resistances corresponding to the speed at 50Hz.

J. **10.1 INSULATION**

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

K. **11.1 CONSTRUCTIONAL FEATURES**

The motor construction shall be suitable for easy disassembly reassembly. The enclosure shall be sturdy shall permit easy removal of any part of the motor for inspection repair.

Motors weighing more than 25 kg shall be provided with eyebolts, lugs or other means to facilitate safe lifting.

The rotor bars shall not be insulated in the slot portion between the iron core laminations for squirrel cage motors.

L. **12.1 TERMINAL BOX**

Terminal boxes shall be of weather proof construction designed for outdoor service. To eliminate entry to dust water, gaskets of neoprene or approved equivalent shall be provided at cover joints between box motor frame. It shall be suitable for bottom entry of cables. It shall be capable of being turned through 360 degrees in steps of 90 degrees.

The terminals shall be of the stud type with necessary plain washers, spring washers check-nuts. They shall be designed for the current carrying capacity shall ensure ample phase to phase phase to ground clearances. Suitable cable GIs cable lugs shall be supplied to match specified cables.

M. **13.1 PAINT FINISH**

All motor parts exposed directly to atmosphere shall be finished painted to produce a neat durable surface which would prevent rusting corrosion. The equipment shall be thoroughly degreased, all rust, sharp edges scale removed treated with one coat of primer finished with two coats of grey enamel paint.

N. **14.1 HEATING DURING IDLE PERIODS**

Motors rated above 30 kW shall have space heaters suitable for 240V, single phase, 50 Hz, AC supply. Space heaters shall have adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation during idle period. The space heaters shall be placed in easily accessible positions in the lowest part of the motor frame.

O. **15.1 ACCESSORIES**

Two independent earthing points shall be provided on opposite sides of the motor, for bolted connections. These earthing points shall be in addition to earthing stud provided in the terminal box.

Motor shall have Resistance Temperature Detectors embedded in stator windings, DE/ NDE bearings (2 nos. per winding and 1 no. per bearing) to detect overheating and trip the motor from control panel in the event of the temperature exceeding safe operating limit. A Temperature Scanner, having minimum 12 channels with necessary relay outputs, for each motor shall be provided.

Note: Bidders has to enclose confirmation as regards to motor efficiency quoted, from original manufacturing along with tender documents.

16.1 NAMEPLATE

Each pump shall be provided with a stainless steel name plate indicating the following details.

- Model
- Manufacturer's special number
- Rated capacity in LPS /M³/HR
- Total head inMWC
- Speed inRPM
- Weight of equipment
- Material of impeller

17.1 DRAWINGS AND DOCUMENTS REQUIRED

The Following drawings/ documents shall be submitted by Manufacturer/ Bidder.

- a. Motor Technical Datasheet
- b. Motor General Arrangement and Dimension Drawing
- c. Terminal Box Drawing
- d. Performance Curves
- e. Quality Assurance Plan

18.1 VIBRATION AND NOISE LEVEL

The vibration limit measured at motor end for the pumps shall not exceed the limit specified in Hydraulic Institute Standards or specified in Owner's Technical Specification whichever is stringent. The noise level shall not exceed 85 dBA measured at 1m from the outline of pump set as defined in Technical Specification.

19.1 TESTS

Motor shall be subjected to all the routine tests as per applicable standard in the presence of the PURCHASERS representative. Copies of test certificates of type routine tests (as per IS 325, IS 12065, IS 12075 and IEC 60034) shall be furnished for the PURCHASERS approval. The VENDOR shall ensure to use calibrated test equipment/ instruments having valid calibration test certificates from standard laboratories traceable to national/ international standards.

If type tests have not been carried out on similar Motors, or if the type test reports submitted are not found in order, then VENDOR shall carry out these tests without any extra cost to the Purchaser.

All the type, routine acceptance tests of motors shall be carried out as per applicable standard in the presence of the Purchaser/Purchaser's representative.

20.1 ROUTINE TESTS:

The following routine tests shall be carried out on 100% quantity of motors.

- a. Insulation Resistance Test
- b. High Voltage Test
- c. No load running of the motor and measurement of current voltage on all three phases
- d. Locked rotor test at suitable voltage
- e. Testing of accessories / auxiliaries for correct functioning
- f. Vibration test
- g. Noise level test

21.1 TYPE TESTS:

The following type test shall be carried out on 1 no. Of each type and rating of motor.

- a. Measurement of stator resistance
 - b. No load running of motor reading of voltage, current, power speed
 - c. Reduced voltage running up test at no load to check the ability of motor run up to full speed on no load in each direction of rotation with 1/3 of the line voltage applied to the motor
 - d. Locked rotor reading of voltage, current, power input torque value of the motor
 - e. Full load readings of voltage, current, power input slip
 - f. Temperature rise test
 - g. Momentary overload test
 - h. Insulation resistance test before after high voltage test
 - i. High voltage test
- Type test reports to be submitted shall not be older than five (5) years. In case type tests have not been carried out on similar Motors, or if the type test reports submitted are not

found in order, then VENDOR shall carry out these tests at accredited test house like CPRI/ ERDA etc. without any extra cost to the PURCHASER.

22.1 PUMP INSPECTION:

Department engineer shall witness following tests at the manufacturer's test laboratory.

Performance Testing	IS 9137/ISO 9906 Gr 2
Hydro Test Pressure Testing	1.5 times of Shut off Head or 2 times of Duty point head whichever is higher

Pump manufacturer shall submit material test certificates (Physical and Chemical Testing) of Pump Casing, Impeller, Shaft, Shaft Sleeve, Impeller, Casing wear ring and Impeller Wear ring at the time of performance inspection of the pump for necessary review purpose.

Pump manufacturer shall submit dynamic balancing report of Impeller as per ISO 1940 Gr. 6.3 at the time of performance inspection of the pump for necessary review purpose.

Vibration and Noise levels of the pump set shall be recorded during performance testing should be within acceptable limit as per HIS.

Pump set shall be offered for performance test with tested and inspected job motor only. Lab motor testing is not acceptable.

2.4.2 SUBMERSIBLE PUMP SET:

SITC of board approved make complete set of submersible pump and wet type electrically operated motor with all standard accessories, fittings, mountings etc. including cable of suitable size. Pump confirming to I.S. 8034 motor confirms to IS-9283 (Or its latest revision and amendment) working at 3 phase 415V, 50 C/S, A.C. Supply and 2900 R.P.M. including suitable diameter delivery pipe.

The Submersible pump set should be of sturdy construction to facilitate manual loading unloading requirements. It should be repaired in workshop with ease at minimum cost shall have fast wearing parts of replaceable. Feature easy rewind-ability of electric motors of economy in repairs are overriding consideration after meeting the basic. Hydraulic, electric mechanical requirements needed.

The duty point of the pump set shall be located at the optimum efficiency point of the pump rating curves there should not be steep fall in efficiency in the operating range. The verification of the pump sets performance will be as per relevant latest IS at rated voltage.

The Company shall offer the Efficiency within (-) 5 digit at Pump Operating Head Range at +10% to -25% (i.e. if the company offers 50% Efficiency at Duty Point, in that case 45% Efficiency is maintained at Pump Head Operating Range +10% to -25%). Minimum Motor Horsepower Rating, Cable Size, Starting System, Minimum Overall Efficiency DeliverySize shall be as per relevant stand.

PUMP:BOWL:

The pump shall conform to IS: 8034. Bowls should be free from Blow Holes, Stages inclusion other detrimental defects.

Bowls shall be provided with renewable wearing rings except in radial flow pump set. Bowls should be provided with renewable wearing rings should be suitable for lubricating by water shall be of superior quality. The fitment of wearing rings with interface fir OR locking compounds is to be done. Stage casing/ Stage Bowl shall be hydraulically tested upto 1.5 times Shut-Off Pressure or maximum upto 25 kg/cm² whichever is higher.

IMPELLERS:

be of closed type (Not Fabricated) ensuring required performance free of cavitation.

Shaft

The pump shaft will be guided by bush bearings provided in each bowl wherever required. Shaft protection sleeve is to be provided below impellershaft assembly. The material of shaft and shaft protection sleeve should be Stainless steel - AISI - 410 shaft shall have 0.75 Microns surface finish.

Suction casing with strainer

Opening of the Suction casing should be of proper size shape to minimize, eddy current. In order to check entry of foreign materials strainer/Screen shall be of minimum thickness for SS-0.5 mm.

The pump-motor is fitted directly with a Suction Bell mouth to which is compulsorily fitted a Heavy duty Strainer (to avoid pick up of gravel, pebbles, vegetation, etc.).

Entrance velocity of water in the pump should not be more than 3.6 m/sec.

Bearing Bush

The materials of bearing sleeve shall be conforming to IS: 318/ 1962 or as per latest revision.

INSTALLATION

- (a) The pump is to be coupled with motor lowered into the bore well required column pipes. So.
- (b) The pumps shall be suitable for vertical, portable installation and be interchangeable between

these modes throughout their working life time. The pump will be of suspended type design by column pipes.

- (c) The pump shall be offered with vertical, suspended by column /discharge without any bottom supporting arrangement.

Note:-The pump set to be offered shall have mixed flow type impeller bowls (stage casing) mounted with nut bolt (spigot connection). The contractor shall have to give performance test of submersible pump set at manufacture

Works at his cost before dispatch. The incidental expenditure shall be borne by the contractor.

Motor:

- The submersible motor shall confirm to IS: 9283 / 1994 with latest revisions. It should be totally enclosed squirrel cage induction type water cooled water lubricated sealed against entry from outside water.
- The windings shall be of wet type. The thrust bearing should be of wet type water lubricated designed to take all untoward load at most unfavorable running conditions. Front rear bearing housing thrust bearing housing should preferably be fixed separate replaceable bolts / studs (not threaded connections) to the starter to facilitate easy dismantling. Full proof sealing arrangement by s guard shall be preferred in the motor inlet body to prevent open well water impurities like s, silt from entering the motor bearing stator motor should be impregnated with a superior varnish class B thermal insulation properties by vacuum pressure or epoxy paints on stator cold rolled stamping used rotor shall be painted with Polyurethane paint and backed properly under controlled temperature condition not by manual or gravity flow to remove air pocket so that these are thoroughly filled up by varnish. Motor rotor should be preferably lead shot blasted. Subsequently rotor body should be baked repeatedly under controlled conditions to ensure long life of paint hardfinish to the surface to avoid corrosion before power coating.

DATA SHEET FOR Horizontal Mono Submersible Pump Set			
Name of RWSS:			
Name of Pumping Station:			
Sr. No.	Particulars	Departmental Requirement	Bidders' Data
1	Capacity	As per price bid	
2	Head	As per price bid	
3	Type of pump	Horizontal mono submersible	

4	Minimum submergence required in meter	Manufacturers' Standard	
5	Motor Details		
5.1	Type of motor	Submersible	
5.2	Rated Voltage	415 Volts	
5.3	No. of phases frequency	3 Phase, 50 Hz	
5.4	Method of Starting	Direct On Line	
5.5	Class of insulation		
5.6	Fill of motor	water	
5.7	Ambient reference temperature	45 °	
5.8	Motor HP rating	Manufacturers' Stard	
5.9	Synchronous motor speed	2900 RPM	
5.1	Method of Starting	Direct on line	
5.1	Motor input at duty point		
5.1	Reserve power of motor	Minimum 25 % margin over duty point condition	
6	Cable	PVC flat submersible copper	
6.1	Size		
6.2	Maximum current carrying capacity of		
	Cable		
7	Overall efficiency of pump set		
7.1	at Full Load		
7.2	at duty Point		
8	Materials of construction		
8.1	Confirm materials of construction for	Yes / No	
	various pump and motor parts with		
	accessories as per detailed technical		
	specifications		
8.2	State any variation in any of above explicitly	* To be stated by the pump manufacturer / agency	
9.0	Required accessories		
4.2	Delivery Pipe	Required	
4.4	Direct on line starter panel	Required	
4.6	Cable required for pump motor	Required	
4.7	Suction Strainer	Required	

- The material of construction of rotor shaft shall be as specified in data sheet provided with sleeves having materials as per detailed material of construction in the bearing portion. The windings should be accessible to facilitate checking locating any faults without disturbing all the coils also to enable replacement of any defective coils. It should be

possible to rewind the Stator with readymade protested coils in order to save time during the repair. Kelvin Bridge / digital resistance meter shall be treated preferable for measurement of hot cold resistance of winding for evaluated temperature rise. Fullproof arrangement should be made for stopping the rotating of shifting of stampings inside the stator body due to operation of pump sets. Earth leakage current should not be more than 50 milli amperes at rated voltage.

- The HP rating of motor shall be decided on minimum power margin over above the power required on duty point shall be 25 % bidder has to supply motor of minimum HP rating considering 25 % reserve power margin.
- Starting method Up to 7.5 HP. D.O.L. Starter, 8 to 20 HP Star Delta 21 HP and above Auto transformer starter type.

Submersible Pump-Set

Sr. No.	Particulars	Departmental Requirement	Bidder's Data
.A	PUMP		
1	Name of the manufacturer		
2	Pump Type	Submersible Pump-Mix Flow Type	
3	Model		
4	Sr. No.		
5	Number of Stage(Nos.)	Minimum Nos. of stage as per design	
6	Location	As per price bid	
7	Head at Nominal Duty Point.(mtr)	As per price bid	
8	Discharge at Nominal Duty Point.(LPM)	As per price bid	
9	Pump Efficiency at dutypoint (%)	As per relevant IS / HIS stard	
9	Delivery Size(NRV)(mm)	As per manufacturer stard	
10	Max. Outside dia. Of pump set including cable thickness(mm)	As per manufacturer stard	
12	Min.O.D.of bowl(mm)	As per manufacturer stard	
13	Pump Input at dutypoint(KW)		
14	Min.Submergence required(mtr)	As per manufacturer stard	
15	Specific Speed	Contractor to specify	
16	Head Range for Non Overloading Requirement.	+10 and -5% over dutypoint Head as per IS	
17	Year of Manufacture	Contractor to specify	
18	Material		
a	Impeller (Not Fabricated)	SS 410	
b	Casing Wearing Ring Neck/ Ring (if provided)	Bronze Grade LTB 4 of IS: 318	

Sr. No	Particulars	Departmental Requirement	Bidders' Data
C	Pump Bowl	C.I. Grade FG260 of IS:210	
d	Pump Shaft	Stainless Steel AISI-410/ A276	
e	Suction Casing/ Discharge Casing/ Last	C.I. Grade FG260 of IS:210	
f	Bush	Bronze Grade LTB4 of IS 318	
g	Nonreturn Valve	C.I. Grade FG260 of IS:210	
h	Studs	SS AISI 410	
i	Bowl Supporting Clamp	SS 410	
B	FORMOTOR		
1	Motor Type	Squirrel cage induction water cooled submersible type	
2	Name of the manufacturer		
3	Model		
4	Sr.No.		
5	Motor Rating (KW)	As per standard	
6	Rated Speed (rpm)	2900 RPM	
7	Maximum Current (A)	As per relevant IS	
8	Rated Voltage (V) with Variation (V)	400+10% . -15%	
9	Rated Frequency (Hz)	50 Hz.	
10	Connection	Star-Delta	
11	Type of Duty (Whether Continuous or Not)	S-1	
12	Method of starting	As per specifications	
13	Motor Efficiency (%) at Full Load	As per relevant IS	
14	Motor Efficiency (%) at Duty point	As per relevant IS	
15	Power Factor at Full Load	As per relevant IS	
16	Power Factor at duty point	As per relevant IS	
17	Current at duty point		
(a)	Current at duty point	As per relevant IS	
(b)	RPM at full load	As per relevant IS	
(c)	RPM at duty point	As per relevant IS	
(d)	Starting current as % of F.L. current	As per relevant IS	
(e)	Starting current as % of F.L. Torque	As per relevant IS	
18	Motor in put at duty point	As per relevant IS	
19	Max. O.D. of motor (mm)	As per manufacturer standard	
20	PVC Lead Cable (Sq. mm.)	Contractor to specify	
21	Year of Manufacture	Contractor to specify	
22	Material		
a	Material of Stator	SS 304/410	
b	Rotor Lamination	Silicon steel cold Rolled M-45	

Sr. No	Particulars	Departmental Requirement	Bidders' Data
		Not more than 0.5mm thick	
		IS:648 or approved by engineer in charge	
c	Stator Lamination	Silicon steel cold Rolled M-45 not more than 0.5mm thick IS:648 or approved by	
d	Thrust Bearing Housing for thrust Plate	1) DIFG 260	
		2) Thrust Plate C.I. Base with Carbon Plate.	
	Segments	3) Segments. SS 410	
	Ball Retainer (if provided)	4) Ball Retainer. SS 410	
	Steel Ball (if provided)	5) Steel Ball. SS Chrome Steel AISI. 410	
e	Bearing Bush	Rising bonded Carbon Metal as per IS:318/1981 LTB4 and One Rubber Bush	
f	Motor Shaft with Rotating Sleeve	as below	
g	Conductor of Winding Wire	Electro Grade Copper IS:613	
h	Strainer	SS 316 - 0.5 mm (Minimum Thickness)	
i	SG Guard	SS 410	
j	Coupling Sleeve	Stainless Chrome Steel AISI-410	
k	Bearing Sleeve	AISI - 410	
l	Breather Diaphragm (Pressure)	Nitrile Rubber	
m	Components	Nitrile	
n	Cable	PVC Flat Cable IS : 694	
2	Overall Efficiency (%)		
C	Cable Type		
1	Size of Flat Submersible Copper Cable (Sq.mm.)		
2	Make		
3	Maximum current carrying capacity of above cable (A)		
D	Overall Efficiency of Unit		

Sr. No	Particulars	Departmental Requirement	Bidders' Data
1	Please confirm materials as per specification otherwise		
2	Pump motor are required as		
(a)	Discharge V/s Head		
(b)	Discharge/s Power Input(KW)		
(c)	Discharge V/s Overall Efficiency of Pump- Motor Set		
(d)	Submersible Motor characteristic curves as under:		
(I)	Load V/s Power Factor		
(II)	Load V/s RPM		
(III)	Load V/s Efficiency		
(IV)	Load V/s Current		
E	Cross section drawing for both pump motor showing clearance at bearings wearing run out material specification For major components		

4.ELECTRO MAGNETIC FLOW MEASURING SYSTEM

A. Generally, the flow meter shall be as follows:

Flow metering System

Each flow metering system shall consist of the primary transducer (Sealed to IP-67 for above ground / non-submerged application and IP-68 for below ground within chamber for submerged application), Earthing electrode / rings, the necessary signal converter and power supply unit and all cabling between the primary transducer and signal converter and power supply unit.

Each of the signal converts / power supply units shall be supplied for remote mounting, unless otherwise specified.

The signal converts / power supply units shall be provided with a 4-20 mA output signal, linear with flow and suitable for retransmission to remote instrumentation. The above units shall operate from a 230 VAC / 24V DC supply.

The contractor shall provide sufficient suitable cable to allow for the primary transducers to be situated up to **30** meters from their signal converters, unless a longer length is specified.

The Contractor shall provide full details of the cable; he proposes to use. The general specifications for electromagnetic flow meter shall be as under:

Sr.No	Description	Particulars		
1	General			
1.1	Items	Electro magnetic flow Meter		
1.2	Service	Water Flow Measurement and analysis		
1.3	Fluid	Raw water /Treated water		
1.4	Area Classification	Non Hazardous		
1.5	Temperature	Ambient		
2	Flow Sensor			
2.1	MOC			
a	Electrode / Sensor MOC	SS316/SS316L/SS304/SS304L/Hastellon/Titanium		
b	Flow tube MOC	SS316/SS316L/SS304/SS304L/Metallic Alloy		
c	Coil Housing MOC	SS316/SS316L/SS304/SS304L/Die cast aluminium/Carbon steel (cs)/Sheet steel		
d	Earthing Ring/Electrode MOC	SS316/SS316L/SS304/SS304L/Hastellon/Titanium		
e	Liner MOC	Neoprene /Polyurethane/Ebonite/Rilsan/EPDM/PTFE/PFA		
2.2	Process Connection	•Flanged		
		•Reducer- Expander is accepted for ≥ 500 mm pipe diameter and shall be in contractor scope.		
		•Contractor may allow to reduced flow meter size as per below.		
			Pipe Dia	Reduction allowed
			≥ 500 mm to <1000 mm	50 mm reduction of pipe line
			≥ 1000 mm to <1500 mm	100 mm reduction of pipe line
			≥ 1500 mm	150 mm reduction of pipe line

		•The Tapper flange degree of reducer and expander to the flow meter shall be same as flow meter flange dimensions			
a	Flange MOC	Carbon steel (CS) / SS304/SS304L/SS316/SS316L			
b	Flange Standard	IS 1538/AWWA/DIN/EN 1092/JIS/ANSI or equivalent			
c	Counter Flange	Counter flange shall be in contractor scope and dimension of flange shall be same as flow meter flange dimension.			
2.3	Housing Ingress of Protection(IP)	IP 68 or NEMA 6P			
2.4	Pressure Rating	PN 16 (16 Kg/cm2)			
2.5	Spool Piece	Spool piece of each size of flow meter to be provided by contractor .			
		Bidders are required to provide required Spool piece as per below table and it is to be kept at nearest GWIL office/ GWSSB Office? Nearest Head work or store.			
			Flow Meter Quantity (Nos)	Spool Quantity(Nos)	Piece
			1	1	
			≥ 2 to ≤ 5	2	
			> 5 to ≤ 20	5	
			> 20	10	
3	Flow Indicator and Transmitter				
3.1	Type	Microprocessor Based (Remote/ Integral Mounted) •Remote mounted where Building available. •Integral type where Building are not available/ Remote area			
3.2	Power Supply	•230 VAC type flow meters in case of Indoor/ Where Buildings is available			
		•Contractor shall provide inbuilt battery-operated flow meters in case of outdoor/ remote area(min battery life 5year)			
		•In case of battery operated flow meter, contractor must replace all batteries after completion 5th year without any additional cost to tenderer. Further 1% of capex cost will be released upon successful completion of this task			
		•If battery fails during O and M period, contractor has to replace battery without any additional cost implication to client			
		•In case of 230VAC flow meter, contractor has to supply and lay cable from the source of power supply to Flow meter, also installed UPS with in-built stabilizer/ Constant voltage transformer to provide stabilized voltage to instruments. Contractor has to provide UPS with minimum of 2 hours battery back - up at full load.			
3.3	Accuracy	0 to ± 1 % of measured value			

3.4	Transmitter Ingress Protection of	•≥ IP 65 or equivalent for remote type display.
		•IP 68 or equivalent for integral type display.
3.5	Transmitter MOC	Die-cast Aluminium/ Polycarbonate /Polyamide/SS304/SS316
3.6	Output	Digital Output-Modbus/ HART or equivalent
3.7	Communication	Flow meter will communicate to PLC / Data Logger/ RTU through Digital output.
3.8	Display	Min. 2 line LCD
		•Actual Flow rate/ Instantaneous Flow rate
		•Cumulative Flow/ Sum/ Totalizer
		•Alarm Indicator
		Actual Flow rate and Totalized reading can be display simultaneously
3.9	Display	Minimum 8 Digits
3.10	Data Logger/Local Storage (Internal/ External)	•Flow meter reading can be log/ store locally in data logger for every 15 minutes
		•Minimum 30 days storage required in Data logger.
3.11	Communication protocol	•Push - pull type where flow meter is 230 VAC flow meters
		•Push type where flow meter is inbuilt battery operated
		•Communication from the Flow Meter (Both ways) Remote Terminal Unit(RTU) to Centralized Monitoring Station(CMS) shall be through any cellular technology provided through reliable Telecom Service provider(TSP).
		•In case of GSM/ GPRS based communication system required SIM cards and its subscription; recurring charges shall be borne by Tenderer/bidder as per below. * SIM card and its subscription shall be bone by contractor for first 3 year of O and M * After successful completion of 3rd year O and M (i.e 4th year to 8 th year O and M period) SIM card and its subscription change shall be borne by department
		•However bidder is responsible for performing variousactivities like coordinator activation and maintenance of the same.
		•In case of 230 VAC flow meter ,time stamped data shall be transfer from meter RTU to CMS at every 15 Minutes.
		•In case of battery operated flow meter ,time stamped data for every 15 minutes shall be shaved locally and after every 12 hour data will be transferred from flow meter RTU to CMS.
3.12	Zero and Span	•Required

	Adjustment	•Zero and span adjustment can be done with the help of Password.
		•Protection of all parameters(calibration and revenue parameters) to be protected with thee help of factory set password.
		•Contractor shall share Password of flow meters to client at the end of every year. Further the release of subsequent quarterly O and M charges will only allowed upon successful confirmation of receiving of the same.
3.13	Facility for on line diagnosis (local indication as well as Central Monitoring Station Indication	Required as following:
		Diagnostic
		•Continuous self test shall include(But not limited to):
		•Flow Meter On-Off
		•Circuit Break Alarm
		•Major error/ alarm like non-function of device, battery failure etc. will trigger immediately at central monitoring System
3.14	Cable Gland	Required
3.15	Cable length(sensor to transmitter	For remote type flow meter, cable to be supply as per site requirement along with 5-meter extra cable.16 Gauge copper cable is required
3.16	Data Protection	Stored parameter and measured flow data should not ger erased during power failure.

Flow (Instantaneous and Totalized) readings shall be continuously displayed locally as well as in remote at Panel mounted PLC / HMI and at Master control SCADA at control room

Flow meter shall be mounted as per manufacturer's recommendation and good engineering practices and each flow meter shall be provided with a bellows at suitable location to enable ease of removal / insertion of flow meter for maintenance. For flow meter mounted below ground level, chamber shall be sized suitably to accommodate flow meter and bellows in the same chamber.

The Flow meters shall be calibrated according to the ISO-8316. Standard. Performance Type Testing Certification (ISO 9104) strictly not acceptable. The suppliers shall also have a testing facility in India or abroad so that methodology and procedures can be verified. The testing facility shall be duly accredited in accordance with ISO 17025 standards in India.

Test bed shall be accredited by national /international certifying authority (FCRI and NABL) as per ISO 8316 (Calibration by Volumetric Method) or ISO 4185 (Measurement of fluid flow in closed conduits - weighing method).

Minimum 10% or one no. (Whichever is higher) of flow meters of each size shall be wet calibrated at accredited facility / test bed as mentioned above either at manufacturer works or any other such facility in India. Flow meters shall be tested for accuracy, calibration and sealed in presence of the Client Engineers / TPI / PMC at manufacturer's works / Calibration Facility. All electro-magnetic flow meters shall be provided with manufacturer's calibration certificates.

Also 10% of Total quantity other than tested at manufacturer place (Minimum one of each size) of the flow meter shall be reviewed and inspected at FCRI Lab. Dispatch clearance of flow meter will be given only after submission of FCRI inspection report.

Note:

- 1. It is compulsory to submit backup guaranty from manufacturer of make suggested on duly stamp paper valid for whole contract period.**

Deputy Executive Engineer
P.H. San. Sub Division
GWSSB, Ahwa

Deputy Executive Engineer
P.H. Mech. Sub.Division
GWSSB, Ahwa