

**BRIHANMUMBAI MUNICIPAL CORPORATION
MUMBAI SEWAGE DISPOSAL PROJECT
STAGE – II PRIORITY WORKS**



**UPGRADATION OF GHATKOPAR INFLUENT PUMPING
STATION & CARRYING CAPACITY OF RISING MAIN TO
DESIGN PFF CAPACITY OF 699 MLD**

VOLUME - II

GENERAL SPECIFICATIONS

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EMPLOYER

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Volume– II

GENERAL SPECIFICATIONS

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GENERAL SPECIFICATIONS

GS: 1 INTRODUCTION

The subject tender is for the work of Upgradation of Ghatkopar Influent Pumping Station & Carrying Capacity of Rising Main to Design PFF Capacity of 699 MLD. The Volume II – General Specifications related to the work are comprehensive, but, not limited to the clauses mentioned here below. The tenderer shall consider additional requirement if any to execute the work successfully and shall include such cost while submitting the bid. The enclosed drawing shows the location of existing pumping plant at Ghatkopar along with the existing structures, approach road etc. The work site is situated at the premises of Ghatkopar Influent pumping station, Brihanmumbai Municipal Corporation.

GS: 2 SCOPE OF WORK

The Contractor shall include for obtaining statutory permissions/clearance/liasoning with concerned departments, design, material, manufacture, testing at works, packing for shipment, delivery to the Site, unloading, storing, complete erection, setting to work, commissioning, testing, operation and maintenance for 36 months, rectification of defects and maintaining during the defects liability period of the following :-

- a) Dismantling of existing supply and exhaust blowers along with its FRP ducting and supply, installation, testing and commissioning of new supply blowers (2 nos.), exhaust blowers (2 nos.), plenum, FRP ducting along with fitting and supporting arrangement.
- b) Dismantling of existing Screens with belt conveyor, Sluice Gates and FRP ducting and supply, installation, testing and commissioning of new Screens with belt conveyor, Sluice Gates at inlet and outlet and FRP ducting to existing Blowers along with fitting and supporting arrangement. Along with the dismantling and removing of existing Shed.
- c) Dismantling of existing 2 nos. sluice gates in wet well and supply, installation, testing at manufacturer works and commissioning of new sluice gates including all necessary ancillaries as per schedule of quantities, Datasheet and Technical Specifications.
- d) Dismantling of existing 5 pumps and Design, supply, installation, testing at manufacturer works and commissioning of new 6 nos. Vertical Non-clog Submersible Pump-Motor set (dry pit installation) of capacity 139.8 MLD at a duty point head of 36 MWC, suitable for 6.6 kV including other necessary accessories as per schedule of quantities, Datasheet and Technical Specifications.
- e) Dismantling of existing 6 nos. (size: 1200 NB) Knife gate valves (Suction side of Pumps) and replace with new Motorized Knife gate valve (size: 1200 NB) including design, supply, installation, testing at manufacturer works and commissioning including all necessary ancillaries as per schedule of quantities, Datasheet and Technical Specifications.
- f) Dismantling of existing 5 nos. (size: 900 NB) plug valves (delivery side of Pumps) and replace with new 6 nos. Motorized Knife gate valve (size: 1000 NB) including design, supply, installation, testing at manufacturer works and commissioning including all

- necessary ancillaries as per schedule of quantities, Datasheet and Technical Specifications.
- g)** Dismantling of existing 5 nos. (size: 900 NB) Non-Return valves (delivery side of Pumps) and replace with new 6 nos. Multi-door Non-Return valve (size: 1000 NB) including design, supply, installation, testing at manufacturer works and commissioning including all necessary ancillaries as per schedule of quantities, Datasheet and Technical Specifications.
 - h)** Dismantling of existing 6 nos. (size: 1200 NB) Dismantling joints (Suction side of Pumps) and 5 nos. (size: 900 NB) Dismantling joints (delivery side of Pumps) and replace them with new 6 nos. Dismantling joints (size: 1200 NB) on suction side and new 6 nos. Dismantling joints (size: 1000 NB) on delivery side including design, supply, installation, testing at manufacturer works and commissioning including all necessary ancillaries as per schedule of quantities, Datasheet and Technical Specifications.
 - i)** Modification in Suction and Delivery Piping complete with companion Flanges, reducers and expanders with jointing hardware for the proposed 6 nos. Pumping arrangement.
 - j)** Dismantling of existing 20 Tons and 7.5 Tons EOT in dry well and supply, installation, testing and commissioning of new E.O.T. crane of 20 Tons and 7.5 Tons one each Capacity on existing LT rail as per schedule of quantities, Datasheet and Technical Specifications.
 - k)** Dismantling of existing Elevator in dry well and supply, installation, testing and commissioning of new Elevator as per schedule of quantities & Technical Specifications.
 - l)** Dismantling of existing 1 Ton Electric Hoist in Blower room of pump house and supply, installation, testing and commissioning of new 1 Ton Electric Hoist as per schedule of quantities, Datasheet and Technical Specifications.
 - m)** Dismantling of existing Air conditioning unit in Panel room and supply, installation, testing and commissioning of new HVAC system in the proposed VFD panel room along with false ceiling and trap doors as per the technical specification and Schedule of quantities.
 - n)** Repairs / Modifications / Providing new foundations and supports for the newly installed equipment, Machinery and Piping as per specifications including demolition of existing.
 - o)** Repair of all the structures as per the proposed Structural Audit report. The Structural Audit shall be conducted by the contractor for whole Ghatkopar IPS premise and submit the report for approval prior to the repair works.
 - p)** Conduct all kinds of prior investigations like geotechnical investigations, land survey, etc. required for the project
 - q)** Construction of new structures which are required for operation of upgraded capacity of Rising main.
 - r)** Fabrication of Steelwork, ladders and chequered plating and grating as required for the equipment.

- s)** Construction of new Surge Tank of dimensions as per Tender drawings and TOC 41.5m along with new 2200 X 2200 mm sluice gate in the suction end of the Surge Tank. This will include bypassing the existing rising main from existing surge tank using new 2200mm dia. pipe as shown in the Tender drawings. The contractor shall arrange temporary bypass to the sewage during the refurbishment of Surge Tank and connections of Piping.
- t)** Supply, laying, Testing and commissioning of 1800 mm diameter pipeline (maintaining centre level of pipe at 26.8 m THD) of approx. length 1000 meters from pumping station to existing WwTF along with all required fittings and flanges with fasteners and Gaskets including required Thrust blocks as per schedule of quantity and technical specification and connecting the proposed 1800 mm pipe with existing 1800 mm pipe near pumping station and WwTF. Scope shall also include supply, laying, Testing, and commissioning of 2200 mm diameter pipeline of length 10 meters near WwTF and 2200 mm diameter pipeline for bypassing rising main from existing surge tank to new surge tank near pumping station.
- u)** Supply and installation of pipe specials such as Y fittings, Domes, reducers and Manholes on the 1800 mm diameter rising main from Ghatkopar IPS to Ghatkopar WWTF as per schedule of quantity and Technical specification.
- v)** Supply, installation, testing and commissioning of 5 Nos. Knife Gate Valves of 1800 mm diameter on Existing and proposed 1800 mm line as per Tender Drawing.
- w)** Supply tools as per schedule.
- x)** 3 Phase, 6.6kV, 50Hz, IP 68 enclosure Motor integrated with Submersible pump
- y)** 6.6 kV, 6 nos. of VFD for HT sewage pump & motors
- z)** Supply, installation, testing & commissioning of Power & control cables as per schedule of quantities & Technical specifications (for motors, capacitors etc.).
- aa)** G.I. conductor Earthing system (comprising equipment connections)
- bb)** Electrical equipment and accessories shall be suitable for continuous operation at their rated outputs for 22 kV, 50 Hz, 3 Phase AC supply / 6.6 kV, 50 Hz, 3 Phase AC supply / 415 V, 50 Hz, 3-phase AC supply as applicable.
- cc)** Two nos. of existing 22/6.6 kV 3.5MVA transformers will be replaced by two nos. of 22/6.6 kV, 6.3 MVA transformer, Two nos. of existing 22/0.433kV 630kVA transformers will be replaced by two nos. of 22/0.433 kV, 800kVA transformers. All existing 22kV, 6.6kV and LT switchboard will be replaced by new 22kV, 6.6kV and LT switchboard.
Scope of the contractor will start from the tapping of power from existing 22 kV TATA POWER switchboard located at pump-house. To facilitate the same, existing 22 kV cable will be replaced by new 22kV cable. For the size of 22 kV cable refer SLD TCE.11710A-EL-4001-AU-40001. Replacement of one bus section of existing 22 kV switchgear panel located in IPS will be done by keeping bus-coupler and incomer of that bus-section of existing 22kV switchboard in "off" condition. Full shutdown is not permitted during the replacement. While replacing one bus-section; the other bus-section of the 22kV

switchgear shall be in “on” condition so that the load connected to that bus-section shall be in running condition and our plant is running under 50% load. After replacement of one bus-section another one will be replaced accordingly in same manner. In the similar manner replacement of one bus-section of existing 415V and 6.6kV switchboard by new 415V switchboard and 6.6kV switchboard will be done by keeping bus-coupler and incomer of that bus-section of both existing 415V and 6.6kV switchboard in “off” condition. Full shutdown is not permitted during the replacement. While replacing one bus-section; the other bus-section of both the LT, HT switchgear shall be in “on” condition so that the load connected to that bus-section shall be in running condition and our plant is running under 50% load. After replacement of one bus-section another one will be replaced accordingly in same manner. If required, necessary changes to be done in 22kV panel of TATA POWER.

- dd)** 2 nos. Power transformer oil type 22/6.6 kV 6.3MVA with NGR, 2 Nos. Distribution Oil type transformer 22/0.433 kV 800 KVA.
- ee)** Automatic power factor correction at 0.433 kV system
- ff)** 22 kV Switchgear panel - 2 nos. incomers, one bus coupler, 2 nos. of Bus PT, 2 nos. of power transformer outgoing feeders and 2 nos. Of Distribution transformer outgoing feeders.
- gg)** 6.6 kV Switchgear panel - 2 nos. incomers, one bus coupler, 2 nos. of Bus PT, 6 nos. motor feeders, 6 nos. VFDs, 1 no. spare feeder.
- hh)** LV (415 V switchgear (MCCs), control panels, distribution boards, Local Control Stations etc)
- ii)** HV, LV, Control cable XLPE/F/PVC
- jj)** Local emergency stop push button station
- kk)** The indoor, outdoor and emergency lighting including all poles, brackets, fixings, etc. for the IPS. The lightning protection as per IEC 62305
- ll)** Contractor will submit complete electrical equipment layout (HT/LT switchgears) showing all spacing along with extension of cable trench for client’s approval
- mm)** Standalone solar lighting systems for street light
- nn)** Design, Supply, install, testing and commissioning of Electromagnetic Flow meters at individual delivery line (of 1000 mm diameter) of submersible pumps with all required flanges, dismantling joints and fasteners as per schedule of quantities and Technical specifications.
- oo)** Supply, installation, Testing & Commissioning of Radar type Level transmitters at each wet well compartment and Conductivity type Level switches in dry well sump with mounting accessories as per Schedule of Quantities & Technical Specifications
- pp)** Supply, installation, Testing & Commissioning of Ultrasonic type differential level transmitters across each screen channel with mounting accessories as per Schedule of Quantities & Technical Specifications

- qq)** Supply, installation, Testing & Commissioning of Diaphragm type Pressure gauges at each pump suction and discharge lines with 100mm dial size, SS body with three-way SS isolation valve, and Pressure transmitters at each pump discharge line with pressure range 0-10 kg/cm² as per schedule of quantities & Technical Specifications
- rr)** Supply, installation, Testing & Commissioning of Temperature indicators and RTDs for each pump bearing temperature, each motor bearing temperature and 3 winding phases temperature with 12 channel Temperature scanner mounting accessories as per Schedule of Quantities & Technical Specifications
- ss)** Supply, installation, Testing & Commissioning of Vibration sensors for each pump bearings X-Y axis and motor bearings X-Y axis with Vibration Monitoring System and mounting accessories as per Schedule of Quantities & Technical Specifications
- tt)** A PLC based SCADA system shall be installed along with necessary software and hardware, field instruments interfacing devices, cables, panels, redundant controller, power and communication modules etc. Contractor has to design the system to monitor pump parameters like pressure, temperature, vibration, etc. on real time basis. PC desktop system comprising of Operator Station, Database server with integral web server, Historian server, Laptop based Engineering station shall have latest hardware configuration subject to approval of Engineer's representative and from approved makes. 1 No. A3 sized colour laser multifunction printer shall be supplied. Suitable hardware mounting furniture with chairs shall be provided at existing control room. Minimum 5 kVA, 230V AC, single phase UPS supply comprised of battery and redundant battery charger unit with 120 minutes backup time shall be provided.
- uu)** All the associated civil, electrical, mechanical or of any other type of related work, required to be carried out for successful completion and commissioning of the entire system, and not specifically mentioned anywhere, is in the scope of work.
- vv)** All necessary statutory permissions for mechanical & electrical works from electrical inspector, factory inspector, electric supply authority, etc. at appropriate time. Employer shall provide only supporting letters to Contractor for submission to the statutory authorities. Contractor shall be solely responsible for all the liasoning and documentation whatsoever required for the same. Also, liasoning with various departments of the Corporation and other Consultants or Contractor employed by BMC and liasoning with various authorities for getting permissions/ clearances as Applicable. Similarly, all the requisite permissions (as applicable) from State Government., Central Government., Collector, Electrical supply authorities, Environmental, Local surroundings, Ward office etc. required to commence & execute the project under reference smoothly, shall be obtained by bidder. Government deposits including TATA POWER power contract demand, charges and fees related with statutory authorities for getting permission and licenses shall be paid initially by the Contractor and the same will be reimbursed by BMC on submission of original receipts. The payment receipt shall be generated in the name of

BMC.

However, the liasoning and documentation shall be done solely by the Contractor as per Vol. IV- Sr.No.11, Schedule of Bill of Quantities & Rates - Section 14: Miscellaneous items, Sr.No.03

ww) All the necessary statutory permissions for the subject project works from MPCB, CPCB, MOEF&CC, CRZ, Forest and associated Government Authorities, etc., shall be obtained within 6 months of award of work by the Contractor. Employer shall provide the Contractor only supporting letters to be submitted to the statutory authorities. Contractor shall be solely responsible for all the liasoning and documentation whatsoever required for the same. Contractor shall also liasoning with various departments of the Corporation and other Consultants or Contractor employed by BMC and liasoning with various authorities for getting permissions/ clearances as applicable.

Similarly, all the requisite permissions (as applicable) from State Government, Central Government., Collector, Electrical supply authorities, Environmental, Local surroundings, Ward office etc. required to commence & execute the project under reference smoothly, shall be obtained by Contractor.

Government deposits, charges and fees related with statutory authorities for getting permission and licenses shall be paid initially by the Contractor and the same will be reimbursed by BMC on submission of original receipts. The payment receipt shall be generated in the name of BMC.

However, the liasoning and documentation shall be done solely by the Contractor as per Vol. IV- Sr. No. 11, Schedule of Bill of Quantities & Rates - Section 14: Miscellaneous items, Sr.No.03

xx) All applicable statutory clearances like CRZ, Environment, PESO, Consent to Establish, Consent to Operate and any other associated Government Authorities shall be obtained by successful tenderer (Contractor) on behalf of BMC.

Tenderer shall note that the land under proposed project falls in CRZ. The project therefore attracts certain statutory clearances under provisions of relevant Government Notification/Act, before starting the actual work. The relevant Environmental clearances may require revalidation/renewals/fresh approvals etc as the case may be. Before submitting the tender, the tenderer shall go through and study all the documents at MSDP office. Tenderer shall have to obtain all necessary clearances, revalidation/ renewal of necessary clearances. Tenderer shall comply with all the necessary Government requirements at their own cost before starting the actual work.

Government deposits, charges and fees related with statutory authorities for getting permission and licenses shall be paid initially by the Contractor and the same will be reimbursed by BMC on submission of original receipts. The payment receipt shall be generated in the name of BMC.

However, the liasoning and documentation shall be done solely by the Contractor as per

Vol. IV- Sr.No.11, Schedule of Bill of Quantities & Rates - Section 14: Miscellaneous items,
Sr.No.03

The Contractor shall allow sufficient time for carrying out necessary procedures in his programme. Any delays associated with obtaining any licenses, permits and consents shall be the responsibility of the Contractor.

It is essential to obtain all the clearances/ approvals from relevant statutory authorities before the Contractor can start work at site. Hence the Contractor shall ensure that all the clearances/approvals are in place within 6 months from award of work.

yy) The Contractor shall request and obtain Non-Objection Certificate (NOC) from Tree Authority, Storm water and Drain Department, Sewerage Department, Electrical Department, Environmental Department, Traffic and Coordination Department and from CFO.

zz) The IPS is in continuous operation and any outages required by the Contractor to interface with the existing system shall be discussed with the Engineer/Engineer's Representative and mutually agreed upon. The Contractor shall take all safety precautions with respect to working in confined spaces and hazardous gases while carrying out the works in this regard.

aaa) The Contractor shall provide operation & maintenance services for a period of 36 months after successful commissioning and 7-day trial test of Ghatkopar IPS.

bbb) The structural audit carried out by BMC is for estimation purpose only. Upon award of work to successful bidder, the Contractor (i.e., successful bidder) shall appoint his own structural consultant to carry out the detailed structural audit of all the structural members to ascertain the required repairs before execution.

After successful completion of repair works, the Contractor shall submit the structural stability certificate from his structural consultant stating/ confirming the enhancement of structural life by not less than 15 years from the date and also confirm that the structure is safe to be used for its intended purpose during that period.

GS: 3 SPECIFICATION DRAWINGS:

The drawing listed are the specification drawings and are illustrative of the specification requirements and are provided for general guidance only. It shall not be taken as defining the final layout, scheme of work of design of the equipment to be supplied.

GS: 4 DRAWING GENERAL:

All drawings to be provided by the contractor shall be on standard size sheets with the maximum size of A1 in the form of black lines on white background and shall show the following particulars in the lower right-hand corner in addition to the contractors name, date, scale, number and title. Drawings/ documents submitted by the contractor shall

be legible.

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A blank space of 90 mm. x 50 mm. shall be provided for the Engineer’s approval stamp and provision also shall be made for the details of the revision to be recorded. Number of copies to be provided of the drawings described hereinafter shall be as indicated below:

Contractors preliminary drawings & : 6 copies of each
detailed drawings/ equipment files

Approved drawings : 6 copies as above

GS: 5 PRELIMINARY DRAWINGS:

After award within one-month contractors shall furnish 6 sets of all such drawings giving details/ dimensions and general layout of the plant, equipment complete with details of civil works, foundations, mounting bolts, cable run, ducting, piping, wiring diagram, opening in wall / floor etc.

These drawings will be scrutinized by the Engineer. Any changes required will be communicated to the Contractors so as to incorporate the changes and resubmit amended drawings along with quality assurance plan as per relevant standard for approval of engineer.

GS: 6 APPROVED DRAWINGS:

Any manufacturing done before the approval of drawings will be at Contractor’s risk. The Engineer shall have right to make any alternations which are necessary to meet the specification requirement. Approval of the Engineer to Contractor’s drawings shall not relieve the Contractor all or any part of contractor’s responsibility under the contract to meet all the requirements/ specifications.

GS: 7 RECORD DRAWINGS:

- i) At the time of taking over of the plant work, contractor shall supply 6 sets of record drawings, one set of its tracing or transparency neatly bound volume encapsulated in plastic folder using dividing cards etc. And two sets plastic laminated along with AUTOCAD Latest version of the same on C.D. Record drawing shall show whole of the plant as installed including schematic/ wiring diagrams of all items of mechanical and electrical equipment. The tracings of the record drawings shall be signed by the Engineer’s representative before taking out the copies
- ii) Factory test reports (6 sets) and at site test reports in bound form for equipment and machineries which are to be supplied under the contract

GS: 8 INSTRUCTION MANUALS:

The contractors shall provide 6 bound sets of approved instruction manuals. All descriptive leaflets, instruction sheets, charts, lists, pamphlets and other documents that are contained in compiling each manual shall be contained in a binder approved by the Engineer.

The manual shall be printed on A4 size sheets. Reduced copies of record drawings shall also be included in the manuals.

The operating instructions shall include the following:

Step by step directions of setting the plant to work listing of adjustments and settings necessary for correct operation of the plant.

Instructions on sample log sheets for the plant, to be filled in by the operators on a routine basis.

Do's and Don'ts in plant operation. Operator's attention shall be drawn to all operations considered to be dangerous to operators or likely to cause damage to the plant.

The maintenance instructions shall include the following:

- Checking, testing and replacement procedure to be carried out on electrical/mechanical equipment on daily, weekly and monthly basis or on longer intervals for trouble free operations.
- List of probable faults with the remedies.
- List of recommended lubricants.
- List of item wise spares with part Nos. and ordering reference.
- Manufacturer's instructions for operation and maintenance of all bought out equipment with the list of manufacturers and their addresses, giving model No. and literature, drawings, etc. shall be included in the manual.

GS: 9 CODE & STANDARDS:

Except as noted in the specifications, all equipment and material supplied, erected, tested and commissioned shall comply with relevant applicable latest edition of codes of practices and Indian Standard Institution, Indian Electricity Rules. Where these standards are in conflict with stipulation of tender specifications, tender specifications supersedes them. Some important Indian standards and British Standards are listed below.

IS: 1239	Part – I – Mild steel tubing
	Part – II – Mild Steel tubular and other wrought steel pipes.
IS: 12615	Three phase induction motors.
IS: 1271	Electrical insulation – thermal insulation and designation
IS/IEC 60034-5	Degree of protection provided by enclosures for rotating electrical machineries.
IS/IEC 60034-8	Terminal marking and direction of rotation for rotating electrical machine.
IS: 6362	Designation of methods of cooling for rotating electrical machines.
IS: 4029	Guide for testing three phase induction motors.
IS: 2253	Designation for types of construction and mounting arrangement of rotating electrical machines.
IS 12075	Mechanical Vibration of Rotating Electrical Machines
IS: 900	Code of practice for installation and maintenance of Induction motors.

IS: 4889	Determination of efficiency of Rotating electrical machines.
IS : 7098 Part (I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100 Volts.
IS: 7098 Part (II)	Cross linked polyethylene insulated PVC sheathed cables for working voltages from 3.3 kV upto and including 33kV
IS: 1554 Part (I)	PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 Volts.
IS 1248	Electrical indicating instruments.
BSEN 60529	Degree of Protection provide by enclosure for switchgear
IEEE 519	Requirement of harmonic control in Electrical Power System
IS 2551	Code of Practice for danger notice plates.
IEC 61439-1 & 2	Low Voltage switchgear and control gear assemblies
IEC 60947	Air Circuit Breaker & Moulded Case Circuit Breakers
IS: 2629	Recommended practice for hot-dip galvanizing of iron and steel.
IS 3156	Specification for Potential Transformers
IS: 13585/ IS: 2834	Shunt capacitors for AC power systems
IS: 3043	Code of practice for earthing.
IS: 3231	Electrical relays for power system protection.
IS: 375	Marking and arrangement for switchgear, bus bars, main connection and circuit wiring.
IEC 62271	High Voltage switchgear and Control gear
IS: 722	A.C. Electricity Meters.
IS: 732	Code of practice for electrical wiring installation.
IS 5216	Recommendation on Safety procedures and practices in electrical work
IS 1293	Plug & socket outlets of rated voltage upto & including 250 Volts and rated current up to & including 16 Amp.
IS: 1364	Hexagonal head bolts, screws & nuts of product grades A&B.
IS: 1913	Electrical lighting fittings general and Safety requirements
IEC 61131	Programmable controllers.
IS: 3646	Code of practice for interior illumination.
IS:10322 Part 5	Luminaries for street lighting
IS :1944	Lighting of Public Thoroughfare
IS: 6665	Code of practice for industrial lighting
IS: 3854	Switches for domestic & similar purpose.
IS: 15652	Specification for Insulating mats for electrical purpose;
IS: 60947-4-1	Motor starters
IS: 10118	Code of practice for selection, installation & maintenance of switchgear & control gear.
IS: 10322	Luminaries
IS: 12065	Permissible limits of noise level for rotating electrical machines.
IS/ IEC 60898	Miniature circuit breakers boards
IS: 2026	Power Transformer - General
IS 1180	Oil immersed Distribution Transformer upto & including 2500kVA,22kV
IEEE 32	Requirements, Terminology and Test Procedures for Neutral Grounding Devices
IEC/EN 61800-4	Adjustable speed electrical power drive systems – Part 4: General requirements – Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV
IS/IEC 62305	Code of Practice for Lightning Protection
HIS/ Relevant IS Standard	Centrifugal Pumps
ISO 9906	Performance Testing for Submersible Pumps
ISO 10816	Vibration Limit Measurement

ASTM A-48 Class 35B / IS: 210 Gr FG 260	Grey Cast Iron casting.
IS 3177, IS 807	Design Standards for EOT Crane
IS 2266	Standard of Steel Wire Ropes for Hoist.
AWWA C520-14 / MSS-SP-81	Design and Testing Standard for Knife Edge Gate Valve
BSEN 1092	Flange Drilling Standard for Valves and Fittings.
IS 13349	Cast Iron Single – Faced Thimble-Mounted Sluice Gates
IS 5312-2	Swing Check Type Reflux (non-return) Valves
IS 2825	Pipe Fabrication code
AWWA C560	Standard for Cast-Iron Slide Gates
BS 7775	Specification for penstocks
IS 9338	Cast Iron Flush-Bottom Sluice Gates
IS 2062	Hot Rolled Medium and High Tensile Structural Steel — Specification
AWWA C219	Design Standard for Dismantling Joints
IS: 3938	Design Code for Electric Wire Rope Hoist
IS: 14665 Part 1	Guidelines for Outline dimensions of Passenger, Goods, Service & Hospital Lifts.
IS: 14665 Part 2	Code of practice for Installation, operation and maintenance of Electric Passenger and Goods Lifts.
ASTM D 3567	Practice for determining dimensions of fiberglass pipe and fittings.
ASTM C 582	Standard specification for contact – moulded reinforced thermosetting plastic (RTP) laminates for corrosion resistant equipment.
ASTM D 3982	Standard specification for contact moulded fiberglass ducts and hoods.
ASTM D 2563	Classifying visual defects in glass reinforced plastic laminate parts.
Notes -	Installation work & safety procedures shall also comply with the requirements of following rules, regulations & authorities viz.
	Indian electricity rules – 1956.
	Electricity supply Act.
	Factory Act.
	Chief Electrical Inspector of State
	Director of Safety & Health of State
	In the event of conflict between this specification and the BS/IS codes for mechanical / electrical equipment, provision of this specification shall govern.
	The applicable standards established by the Bureau of Indian standards that govern the materials and workmanship for the work are mentioned in the civil technical specifications and the same shall be followed without deviation.

GS: 10 DELIVERY AND UNLOADING AT SITE:

The Contractor shall make all the necessary arrangements to ensure that sufficient plant has been or is about to be delivered to the site so that there shall be no delay in starting of erection work.

The Contractors shall obtain the approval of Engineer's representative in writing before delivering the plant to the site. The Contractors shall be responsible for the delivery to the site and for the unloading and storing on the site of every item of plant included in this Contract.

The Contractor shall be responsible for checking all materials delivered to the site and shall keep the Engineer fully informed of the delivery schedule.

The Contractor shall be responsible for the care and insurance of the plants. The contractors shall pack in separate cases all the tools included in the item with the plant so that same are not mixed up with loose accessories of the plant meant for erection.

The tenderer shall also make all necessary arrangement & meet all the cost involved in the provisions of lifting equipment for unloading & erecting plants supplied under the contract.

The Contractor shall take prior approval / permission while supplying the piping material, as there is paucity of space at site for storage and stacking. However, no extra payment will be made for double handling of pipes.

GS: 11 STORAGE, PROTECTION, CLEANLINESS, WATCH & WARD AND ELECTRIC SUPPLY ON SITE:

- 11.1 On delivery to site, the plant and equipment shall be protected and stored in proper storage facility to be provided by the contractor. All the precautions shall be taken to protect the plant and equipment against corrosion, damage, dust, sunlight, rain, humidity etc. Watch and ward of the plant and equipment till it is taken over shall be provided by the contractors at their costs.

FACILITIES FOR STORAGE AND SITE OFFICE

11.2 Storage

An area of land 25 m long by 15 m wide will be made available to the Contractor free of charge for the erection of his offices and covered stores. The Contractor will be responsible for the provision and erection of stores, for maintaining them in dry condition and of sufficient size and suitably equipped to enable all items of Plant and equipment, which are liable to deteriorate in the Indian climate, to be stored until required. If the Contractor wishes, he may make arrangements at his own cost for covered and/or uncovered storage at other than above location. The Engineer's

Representative shall be given full details of such storage and shall have access provided at all times for inspection.

The Contractor shall also make all necessary arrangements and meet all costs involved in transportation of goods to, loading/unloading and storage of goods at Project site.

11.3 Facilities to be provided by the Contractor during the Contract period

11.3.1 To the Employer

All items provided by the Contractor shall be to the satisfaction of the Engineer's Representative and shall become the property of the Contractor at the end of the Contract unless specified otherwise.

The Employer's Representative's main office shall be established on the same Site as the Contractor's Representative's main office. The accommodation shall be separate from and located adjacent to the Contractor's accommodation and shall be clearly marked "Employer's Representative". The accommodation shall be in a single storey, single, weatherproof office which shall be of good quality and of substantial build. Minimum area of the Employer's Representative's office shall be 25 sq.m.

The accommodation area shall be covered by hardstanding surface with macadam, and properly drained and fenced off.

Rooms within the office shall be divided by full height partitions, suitably insulated. Walls and ceilings shall be lined in approved colours and the external walls shall be in an approved colour.

Floors shall be close boarded and carpeted with industrial quality carpets, with the exception of the messing areas where the floors shall be linoleum covered.

All doors shall be secure and lockable and 2 nos. sets of keys provided. A doormat shall be provided at each external door together with boot cleaning facilities.

There shall be adequate natural and artificial lighting and ventilation and windows shall be fitted with blinds. Air conditioning units shall be integrally fitted, and adequate power points provided in each room.

Emergency exits, and emergency lighting shall be provided. Suitable fire extinguishers shall be provided. Safety gear at each office shall be provided.

An adequate and reliable electricity supply shall be provided to each office and a potable water supply and sanitation facilities provided to the kitchen messing area and toilets.

Contractor shall ensure rooms including floors, kitchen, basins and toilets are cleaned daily and windows as and when required.

The Contractor shall be responsible for providing and removing the electrical, water, telephone and sanitation services. He shall be responsible for the cost of all bills and user charges relating to their use or consumption.

The Contractor shall provide and maintain two (2) no. of vehicle (including fuel and drivers) for use by the Employer's Representative during till commissioning of the Plant. The vehicles shall be SUV approved by the Employer's Representative and shall not be more than 3 years old.

Vehicles shall be suitable for a minimum of six passengers excluding driver and shall have air conditioning. The vehicles shall have Tourist permits and shall be available to the Employer's Representative at any time, 7 days per week on a 2 shift per day basis. The Contractor shall be responsible for the running and upkeep of the vehicles including payment of taxes, insurance, licenses, permits, tolls, parking charges, fuel, oil, lubricants, repairs and maintenance and shall also provide competent drivers with each vehicle. The Contractor shall provide alternate arrangements if the vehicles(s) are not available due to the breakdown or planned service/ maintenance or absence of driver. Failure to provide same shall result in penalties of Rs.2000/ day/ car. This vehicle facility shall be provided from commencement date of project till the commissioning of the works.

Office equipment and Supplies

Contractor shall provide necessary office equipment and office supplies as and when required by the Engineer's Representative.

An area of minimum 25 sq.m. will be made available at the Project site to the Contractor free of charge for erection of his site office.

The Contractor will have to make his own arrangement at his cost for the electric power supply required for the work either by taking connection from electricity supply authority or arrange his own generators.

The contractor will be given 12 mm dia. or 20 mm dia (or as decided by the Hydraulic Engineer) metered water connection for drinking purpose only if necessary. Extra water required for construction purposes will have to be brought by the contractor at his cost and no extra claims on this behalf will be entertained. The contractor have to obtain necessary permission for such connections from Competent Authority and shall pay the necessary connection charges.

The Contractor shall make his own arrangements for the installation of a telephone or telephones at Site.

The Contractor shall provide 2 nos. desktops, 2 nos. laptops at each office which shall

become the property of the Employer at the end of the Contract. The specifications are as follows:

1. Provide laptop and/or desktop of following configuration at each site. Laptop and /or desktop to have scanner, printer and internet facilities for exclusive use of the Engineer and its representative:
 - Operating system installed – 64 bit Windows 10
 - Processor family - Intel Core i7
 - 4 GB RAM
 - Internal drives - 1TB
 - Display size (diagonal) – not less than 15.0”
 - Latest graphic media accelerator
 - 8 GB pen drive -2 Nos
2. Provide one digital camera with the following components and characteristics each site for the exclusive of the Engineer:
 - 8.0 Megapixel resolution or higher;
 - 2 GB compact flash card;
 - Camera case;
 - USB cable with software.
3. Take every reasonable precaution to protect the office and its contents against fire and theft, or other damage. Indemnify the Engineer and its agents against loss by fire, theft and injury to the building, to the office or its contents.

A daily record of the day's activities shall be completed by the Contractor and handed to and certified by the Employer's Representative at the end of each working day. The report shall include, as a minimum, for: work done, all labour utilised, all plant and equipment (used/ standing), weather temperature/ conditions, deliveries, visitors, etc. The detailed of the daily records, formats, checklists to be maintained/ completed by the contractor shall be finalised after consultation with Employer's Representative.

11.3.2 To the Consultant

All items provided by the Contractor shall be to the satisfaction of the Engineer's Representative and shall become the property of the Contractor at the end of the Contract unless specified otherwise.

The Engineer's Representative's main office shall be established on the same Site as the Contractor's Representative's main office. The accommodation shall be separate from and located adjacent to the Contractor's accommodation and shall be clearly marked "Engineer's Representative". The accommodation shall be in a single storey, single, weatherproof office which shall be of good quality and of substantial build.

Minimum area of the Engineer's Representative's office shall be 25 sq.m.

The accommodation area shall be covered by hardstanding surface with macadam, and properly drained and fenced off.

Rooms within the office shall be divided by full height partitions, suitably insulated. Walls and ceilings shall be lined in approved colours and the external walls shall be in an approved colour.

Floors shall be close boarded and carpeted with industrial quality carpets, with the exception of the messing areas where the floors shall be linoleum covered.

All doors shall be secure and lockable and 2 nos. sets of keys provided. A doormat shall be provided at each external door together with boot cleaning facilities.

There shall be adequate natural and artificial lighting and ventilation and windows shall be fitted with blinds. Air conditioning units shall be integrally fitted and adequate power points provided in each room.

Emergency exits and emergency lighting shall be provided. Suitable fire extinguishers shall be provided.

11.4 ELECTRICITY SUPPLY

Ghatkopar Pumping Station receives power supply from TATA Power at 22 kV. This is stepped down to 6.6 kV through 22/6.6 kV transformers. The motors for the main pump set shall operate on a 6.6 kV - 3 phase 50 Hz supply. Auxiliary transformers rated for 22 kV/433 V is provided to derive 415 V, 3 ph., supply, which will be utilised for the smaller motors, auxiliary services and lighting.

The supply is subject to a $\pm 5\%$ variation in frequency, and $\pm 10\%$ variation in voltage. The combined frequency and voltage variation will be $\pm 10\%$.

Contractor shall liaise with electric supply authority for any necessary changes and replacements in TATA POWER 22kV switchboard panels for upgradation and also for any increase in load.

11.5 The contractor shall maintain the site in tidy condition throughout the duration of the Contract.

The Contractor shall ensure that any public or private roads used by construction traffic are not contaminated with material from site, by the installation and operation of wheel-wash facility or similar, if necessary. The Contractor shall bear the cost of keeping clean any roads contaminated by material from the site, and of any consequential effects of dust arising from materials deposited on the road outside the site.

11.6 The Contractor shall comply with the requirement of the Air (Prevention and Control of

Pollution) Act 1981 and associated Rules and Notifications.

The Contractor shall take adequate measures to control the emission of dust from the site. Such measures shall include sprinkling of surfaces, revegetation and delayed stripping of vegetative cover where practical.

11.7 Employer's representative is entitled to impose penalty/ fine for any lapses observed in the poor workmanship for the work carried out against the specification @INR 5000 per day per lapse till the rectification is done. This penalty will be non-refundable and will be recovered in the interim bill.

11.8 Throughout the period of construction of the works the contractor shall provide, maintain and keep clean suitable and sufficient latrines for use by his employees; he shall ensure that his employees do not foul the site, and shall be instructed in the proper use of the latrines. The Contractor shall connect the latrines to sealed units suitable for disposal or to the influent stream upstream of all treatment processes subject to agreement from the Employer's Representative.

11.9 For each structure which is to be modified or demolished under the Contract, in addition to reviewing any available information about the materials used in constructing the structure or which have been handled in the structure, the Contractor shall carry out chemical or other appropriate tests to verify the identity of any materials that it is believed may be hazardous.

The Contractor shall also identify other features, e.g., fragile roofs, flammable materials etc, which could give rise to hazard during the modification or demolition work.

11.10 The Contractor shall take samples of material arising on the Site at suitable locations and frequencies to determine whether the material is harmful to construction workers, whether it is suitable for reuse on the site and whether, if it is to be disposed of off-site, it requires special permit or licences for disposal. Adequate time shall be allowed for analysis and interpretation of results in advance of relevant work. Sample shall be analysed at an accredited laboratory and the results provided to the Employer's Representative.

GS: 12 ERECTION STAFF

The contractor shall provide as approved by engineer one senior working erector to supervise the erection of all the plant supplied under the contract and to act as the contractor's representative.

The contractor shall also appoint skilled workers in electrical, mechanical and instrument engineering to ensure completion of the various items of the plant in time.

GS: 13 WORKMANSHIP

The Contractor shall be responsible for setting all the plant, equipment and pipe work

to the line and level required. Where plant has to be built in to the structure, he shall secure and fix such plant by suitable means and carry out the civil works without disturbing the line and level of the plant so fixed and shall be in attendance to supervise the work and see that no error occurs. Maintaining alignment during the building in the plants remains the Contractor's responsibility.

Any sundry civil works as may be required for correct alignment, support, etc. or minor civil works which may be required shall be responsibility of the contractor.

The Contractor shall supply all holding down, alignment and levelling bolts complete with anchorages, nuts, washers, and packing required to attach the plant to its foundation and all bed plates, frames and other structural parts necessary.

GS: 14 LIST OF ACCEPABLE MAKE OF EQUIPMENT & ACCESSORIES:

Unless otherwise mentioned specifically elsewhere, only one of the approved make/brand of various equipment and accessories contained in the tender at Vol. III list of Approved Makes will be allowed to be used. Tenderer will have to select the equipment and accessories accordingly and state the list of same along with tender. It will not be prerogative to insist on using a particular make/brand in the even of multiple makes. The final selection will have to be done with the approval of the Engineer.

GS: 15 REFERENCE LIST OF REPUTED MECH / ELECT CONTRACTING FIRMS:

Not used

GS: 16 PERIOD AND PROGRAMME OF COMPLETION OF WORK

The period fixed for completion of the whole work is as mentioned elsewhere in the tender document from the date of Letter of Acceptance. The work shall be programmed so that the supply, manufacture, delivery, testing, dismantling of existing equipment, installation, commissioning of equipment and accessories described in the tender is completed within this time period. Tenderer shall furnish along with the tender bar-chart showing time period required for completing all activities till commissioning of the work. Immediately after award of the work, contractors shall submit detailed programme in the form of bar- chart for approval which shall include items of works such as submission and approval of drawings, placing orders with the vendors, period of manufacture, inspection/ testing at works, delivery at site, dismantling, installation, testing and commissioning. The dates mentioned in the bar-chart are binding on the contractors. However, same may be updated from time to time during contract period. The programme shall allow adequate time for Corporation to check up and approve drawings and to carry out inspections/ testing and for processing sanctions of competent authorities.

Since the dismantling and installation works is required to be carried out simultaneously with the running of other plants, the necessary care shall be taken while preparing bar chart programme such that the operation of existing pumping station is not disturbed.

GS: 17 INSPECTION & TESTING:

All the items of the plant/ machinery and accessories fabricated/ bought as per specifications and drawings shall be of approved class and are liable for inspection and testing before dispatch. All the similar materials and removable parts of similar equipment shall be inter-changeable with each other

The contractor shall arrange all necessary tests (Routine as well as functional) in presence of the Engineer at manufacturer's premises and at site in accordance with the appropriate standards as per specifications. No material shall be dispatched without the consent of the Engineer.

All the instruments used for such test shall be previously calibrated & certified by an approved Lab and NABL accredited. not more than twelve months prior to the test and satisfaction of the engineers' representative. The Engineer's representative reserves the right to calibrate / verify any instrument in his presence if he feels necessary before approving the test results.

The Laboratories which are used for the Sample test shall be NABL accredited and BMC approved.

The Engineer may at his discretion consider the waiver of inspection and testing of equipment at manufacturers works subject to production of manufacturer's internal test certificates for review and approval.

If the engineer's representative witnesses a test, he shall be given a copy of the test results & certificates immediately. Whether he witnesses a test or not, copies of the test certificate shall be sent to engineer's representative.

The engineer or his appointed inspecting agents shall be entitled at all reasonable times during manufacture to inspect, examine & test in contractor's premises the materials & workmanship of all plant to be supplied under the contract and if part of the said plant is being manufactured at other premises, the contractor shall obtain engineer's permission to inspect, examine & test as if the plant said were being manufactured on the contractor's premises. Such inspection, testing if made shall not relieve the contractor from any obligation under the contract.

The contractor shall bear the cost of inspection for two number of engineers including transport, boarding & lodging of the inspector/s appointed by the engineer. However, if the inspection cannot take place (during such visit of the inspector appointed by the

engineer) owing to goods not being kept ready for inspection or such reasons resulting in unproductive visits, the contractor shall be solely held responsible & expenses towards such unproductive visits shall be charged to the contractor. Likewise, if the goods inspected is defective and unacceptable and the contractor is required to mend / provide replacement, re-inspection of the goods shall be required. For such re-inspection the contractor shall be solely held responsible and the expenses towards such re-inspection visits shall be borne by the contractor.

It is proposed that not more than two separate visits for inspection will be made at one place of manufacturer for a set of similar goods unless otherwise agreed by the engineer. If the contractor cannot meet this requirement charges of additional visits shall be borne by the contractor. The above pertains for only final inspection and not for stage wise inspection.

The following information shall be given in inspection call letter:

- a) name of manufacturer / supplier.
- b) address & place where inspection is to be carried out.
- c) proposed date/s & equipment to be inspected.
- d) name of contact personnel with their fax nos. & telephone nos.
- e) name of the contractor's representative.
- f) copy of Quality Assurance plan as approved by the engineer
- g) confirmation that internal inspection has been carried out along with submission of all the relevant internal test certificates.

Details of tests to be carried out on a particular item of plant are as follows, all of which shall be witnessed by the engineer's representative.

All Mechanical/ Electrical/ Instrumentation equipment shall be tested at their respective factory which will be witnessed by tri parties (Contractor, Client/ Consultant inspecting team) in line with approved QAP and Equipment data sheet.

The test observation sheet, material tests certificate (chemical and mechanical test at laboratory) and joint inspection report shall be signed by the Contractor, Client/ Consultant officials after successfully completion of tests.

The Contractor shall forward all the original reports to the client and copy to the Consultant for verification and issuances of Dispatch Clearance Certificates. No Dispatch Clearance Certificate will be issued at the factory itself by the inspecting agency.

In case if Joint inspection at factory is not permissible due to Lockdown or any Government imposed restrictions, in such case the Contractor shall arrange for Third

party inspection for all the major plant equipment. The third party shall be internationally reputable firm and shall be subject to approval of the Employer's Representative. Only after the submission of Inspection test reports of Third party and approval from the Engineer and Engineer's Representative, the contractor shall be allowed to dispatch the equipment to the plant as per dispatch clearance from Engineer's Representative.

17.1 Inspection and Testing During Manufacture

17.1.1 General

- a) All inspection and testing shall be carried out in accordance with the approved documents & drawings and specification. In absence of specification relevant Indian Standard or internationally approved equivalent standard shall be followed. After award of contract, Contractor shall furnish a QA plan for approval by Engineer's Representative. QA plan shall include testing for incoming supply of raw materials and bought out items, stage inspections and tests on finished products at manufacturer's works / appropriate testing station. QA plan shall clearly indicate tests which are intended to be conducted and those which have to be witnessed by the Engineer/Engineer's representative.
- b) Inspection and tests schedule shall be as follows;
 - In process inspection at Manufacturer's works
 - Acceptance inspection / Quantity checking
 - Install /site inspection
 - Site acceptance test
 - Tests on Completion
 - Process Wet Tests (by Raw Sewage)
 - Operation Test (Tests After Completion)
 - Test furnished as per IS Code/manufacturer QAP
- c) The Contractor shall carry out inspection of equipment at the place of manufacture, as per approved QAP.
- d) The Engineer/Engineer's representative shall be entitled to attend the aforesaid inspection and/or tests.
- e) The Engineer/Engineer's representative shall always have access to the Contractor's premises to inspect and examine the material and workmanship of the mechanical and electrical plant and equipment during its manufacture there. Testing (including testing for chemical analysis and physical properties) shall be carried out by the Contractor and certificates submitted to the Engineer who will have the right to witness or inspect the above-mentioned inspection /testing at any stage desired by him. Where inspection or testing is to be carried out at a subcontractor's works, a representative of the Contractor shall be present.

- f) Contractor shall provide test procedure, pre-factory test results, and calculation sheet, photo in advance and provide all the test results with necessary document/s including their data and photo/s to show Engineer that test/s is/are carried out in proper condition and their test results are authentic. Construction material shall be tested by the Contractor at approved laboratory.
- g) The procedure for the testing and inspection to be carried out during or following the manufacture of the materials to ensure the quality and workmanship of the materials and to further ensure that they conform to the Contract in whatever place they are specified shall be as described below.
- i. The Contractor shall give the Engineer at least 21 clear days' notice in writing of the date and the place at which any plant or equipment will be ready for inspection/testing as provided in the Contract. Prior to notice, Contractor shall submit pre-factory test results as per clause 17.1.1(f). The Engineer/Engineer's representative shall at his discretion notify the Contractor of his intention either to release such part of the plant and equipment upon receipt of works tests certificates or of his intention to inspect. The Engineer shall then give notice in writing to the Contractor and attend at the place so named the said plant and equipment which will be ready for inspection and/or testing. As and when any plant shall have passed the tests referred to in this Part, the Engineer shall issue to the Contractor a notification to that effect after obtaining clearance from the consultants/engineer's representative.
 - ii. The Contractor shall forward to the Engineer 6 duly certified copies of the test certificates along with characteristics performance curves/tables if any for all equipment obtaining dispatch clearance from the consultants/Engineer's representative.
 - iii. If the Engineer(s) fails to attend the inspection and/or test, or if it is agreed between the parties that the Engineer(s) shall not do so, then the Contractor may proceed with the inspection and/or test in the absence of the Engineer and provide the Engineer with a certified report of the results there of as per (ii) above.
 - iv. If any materials or any part of the works fails to pass any inspection / test, the Contractor shall rectify or replace such materials or part of the works and shall repeat the inspection and/or test upon giving a notice as per (i) above except that in such scenario, notice period may be reduced to 7 days with mutual consent/understanding. Any fault or shortcoming found during any inspection or test shall be rectified to the satisfaction of the Engineer before proceeding with further inspection of that item. Any circuit previously tested, which may have been affected by the rectification work, shall be re- tested.
 - v. Where the plant and equipment are a composite unit of several individual pieces

- manufactured in different places, it shall be assembled and tested as one complete working unit, at the manufacturer's works.
- vi. Neither the execution of an inspection test of materials or any part of the works, nor the attendance by the Engineer (s), nor the issue of any test certificate pursuant to (iii) above shall relieve the Contractor from his responsibilities under the Contract.
 - vii. The test equipment, meters, instruments etc., used for testing shall be calibrated at recognized test laboratories (should be NABL accredited) at regular intervals and valid certificates shall be made available to the Engineers at the time of testing. The calibrating instrument used as standards shall be traceable to National/International standards. Calibration certificates or test instruments shall be produced from a recognised/Laboratory (should be NABL accredited) for the Engineer's consent in advance of testing and if necessary instruments shall be recalibrated or substituted before the commencement of the test.
 - viii. Items of plant or control systems not covered by standards shall be tested in accordance with the details and program agreed between the Engineer and Contractor's Representative in consultation with Consultant. If such materials or works are found to be defective or not conforming to the Contract requirements, due to the fault of the Contractor or his sub-contractors the Contractor shall defray all the expenses of such inspection and/or test and of satisfactory reconstruction.
 - ix. Tests shall also be carried out such that due consideration is given to the Site conditions under which the equipment is required to function. The test certificates shall give all details of such tests.
 - x. The Contractor shall establish and submit a detailed procedure for the inspection of materials or any part of the works to the Engineer/Engineer's representative for approval within the date indicated in the Programme Details. The detailed procedure shall indicate or specify, without limitation, the following:
 - Applicable code, standard, and regulations.
 - Fabrication sequence flow chart indicating tests and inspection points.
 - Detailed tests and inspection method, indicating the measuring apparatus to be used, items to be measured, calculation formula, etc.
 - Acceptance criteria.
 - Test report forms and required code certificates and data records.
 - Method of sampling, if any sampling test to be conducted.
 - Contractor's or Engineer/Engineer's representative's witness points.
 - xi. The Contractor shall not pack for shipment any part of the Plant until he has obtained from the Engineer/Engineer's representative his written approval to the

release of such part for shipment after any tests required by the Contract have been completed to the Engineer's satisfaction.

- xii. The following Inspection and Testing procedures shall be carried out for the equipment as per approved QAP.

The detailed procedure shall indicate or specify, without limitation, the following:

- Raw Material
 - Visual Inspection/Appearance.
 - Chemical and Mechanical property tests
 - Dimension Checking
 - Dynamic balancing for all rotating parts
 - Stage inspection
 - Hydrostatic / Leak testing for all pressure parts, Pneumatic Leak Test wherever applicable
 - Repair procedure
 - Operation check
 - Procedure Qualification Record (PQR); Welding Procedure Qualification (WPQ) and Welders Qualification Report (WQR)
 - Material Test
 - Assembly/Connection
 - Documentation
- h) The Contractor shall maintain proper identification of all materials used, along with reports for all internal / stage inspection work carried out, based on the specific job requirement and or based on the datasheets / drawings / specifications.
- i) All expenses incurred by the Engineer, or his representative or persons nominated by the Engineer including third party in attending inspection/ reinspection and tests of Plant carried out within India and abroad shall be borne by the Contractor. Maximum three persons from Employer's side will witness the Inspection and testing which shall include two Engineers and one Engineer's Representative along with the Contractor's representative. The expenses incurred during inspection shall include all expenses but not be limited to all travelling, boarding, lodging including visa charges etc. Cost of inspection when material or any part of the facilities is not ready at the time specified by the Contractor for inspection or when re-inspection is necessitated by prior rejection shall also be borne by the Contractor.
- j) Witnessed testing may be waived on standard types of equipment such as small motors made by approved manufacturers, individual standardised instruments, small, mass-produced components used in the manufacture of Plant items, small bore pipework and fittings and minor installation materials. This shall not relieve the Contractor of his obligation/s under the Contract to ensure that all

equipment/machinery is tested at the manufacturer's works prior to delivery to Site.

- k) As a guide to the Contractor the Engineer reserves the right to witness testing of the following but not limited to the following Plant items:

A. Mechanical:

- Non-clog Submersible Dry Pit Sewage Pump
- Valves
- Pipes
- Fittings & flanges
- Sluice Gates
- Dismantling Joints
- Screens
- Blowers
- EOT Cranes and Hoists
- Elevator
- Air Conditioners

Tests at Manufacturer's Premises – Mechanical Equipment

As per approved QAP and relevant code.

Mechanical Equipment Test at Site

All mechanical equipment shall be tested at site for the following:

- a) The test will be verified for any damage/missing part, nos. of equipment to be installed, material, location as specified in drawing, levelling, centreline, solid installation, and condition of installation to be fitted in levelling of pipeline and valves.
- b) Testing run will be conducted for verifying rotation direction, vibration, noise, and stability and any leakage.
- c) The test will be verified to check maintenance space and ease of equipment maintenance work.
- d) The testing shall be performed in full compliance with the latest version of the applicable standard testing protocol. These tests shall be witnessed by Engineer as per procedures set forth for witnessing elsewhere in this document.

Plant Tests at Site

- a) In addition to the progressive supervision and inspection by Engineer, the Contractor shall offer for inspection to Engineer, the completely erected plant/part of Plant on which tests are to be carried out. After such inspection, each equipment/sub-system shall be tested by the Contractor in accordance with the applicable standards in the presence of Engineer. Such tests shall include but not be limited to the tests specified in the following clauses.

- b) The Contractor shall possess during the entire working period the Contractor's license of appropriate class from the concerned statutory authorities governing the area of workplace. The Contractor shall fully comply with the relevant statutory rules and regulations. On completion of the installation or at intermediate stages, if required by the statutory authorities, the Contractor shall arrange for inspection and obtain the approval from the concerned statutory authorities. If any fees are to be paid to statutory authorities for testing, inspection and calibration these shall be paid by the Contractor and shall be included in his erection and commissioning charges.

Pumps, Piping and Valves

- a) The erected pipe work shall be subjected to a hydraulic test at 1.5 times the maximum 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 pipework, pumps, and valves immediately after erection and where possible before being built in.
- c) Operating tests and seat tests shall be conducted on valves.
- d) The pump set shall be tested for satisfactory operation. The vibration and noise level shall be checked to be within the specified limits as specified in Datasheet.

Motors

For winding insulation, the pump Manufacturer shall submit Internal test certificates. All the other motor parameters shall be tested as per approved QAP.

Cranes

The crane and lifting tackle shall be tested to 125% of the safe working load. The Contractor shall arrange the test load. The Contractor shall also arrange for the appropriate certificates from the concerned authorities before regular use of the cranes and other lifting equipment. The cranes shall be tested as per approved QAP.

Mechanical Screens

After erection, all screens shall be tested for smooth operation and capability to handle typical wastewater solids and grits including stringy materials. Clearance between the dead plate and tines shall be checked as applicable. The screens shall be tested as per approved QAP.

Sluice Gates

- a) Leakage test shall be performed by the Contractor after installation of all Gates.
- b) Under the design seating head and unseating head, the leakage shall not exceed the limit specified in IS:13349, for shop testing.
- c) The Sluice gates shall be tested as per approved QAP.

Laying and Joining of Steel Cylinder Pipes and Specials

- a) After laying and jointing of steel cylinder pipes and specials with concrete lining and coating is completed the pipeline shall be washed with enough water and be tested at work site as per the following Employer's Requirements and as directed by the Engineer. All equipment for testing at work site shall be supplied and erected by the Contractor. Water for testing of pipes shall be arranged by him. Damage during testing shall be Contractor's responsibility and shall be rectified by him to the full satisfaction of the Engineer. Water used for test shall be removed from pipes and not released to the excavated trenches.
- b) Each section of the pipeline shall be slowly filled with clean water and all air shall be expelled from the pipeline. The pressure in the pipeline should then be raised and maintained by means of pump to the test pressure. The test pressure should not be less than 1.5 times the working pressure at the lowest point or the static head pressure, whichever is higher. Under the test pressure no leak or sweating shall be visible at the welded joints. The duration of test shall be not less than 24 hours. The exposed joints shall be carefully examined and all such joints showing visible leaks shall be rewelded. Any cracked or defective pipes and specials in consequences of this pressure test shall be removed and replaced by sound material by Contractor and the test shall be repeated to the satisfaction of the Engineer.
- c) Hydrostatic shop test for pipes and fittings shall be as per code/standard requirement. After erection at site, complete pipes and fittings shall be hydrostatically tested for a pressure of 1.5 times operating pressure.
- d) If no drop-in pressure occurs over the ensuing period of 30 minutes the test shall be deemed to be successful. If the test pressure cannot be maintained for 30 minutes all defects in the weld shall be cut back and rewelded and the test reapplied until successful. The cost of initial and subsequent testing of defective welds shall be at the Contractor's own expense.

Laying and joining of Pipes and Fittings

- a) After the pipes and fittings are laid, jointed and the trench partially backfilled except at the joints the stretch of pipeline as directed by Engineer shall be subjected to pressure test and leakage test after washing the pipe line out with enough water.
- b) Where any section of the pipeline is provided with concrete thrust blocks or anchorages, the pressure test shall not be made until at least five days have elapsed after the concrete was cast. If rapid hardening cement has been used in these blocks or anchorages, the tests shall not be made until at least two days have elapsed.
- c) Each section of the pipeline shall be slowly filled with water and all air shall be expelled from the pipe by tapping at points of highest elevation before the test is made and plugs inserted after the tests have been completed. The specified test pressure based on the elevation of the lowest point of the line or section under test and corrected to

the elevation of the test gauge shall be applied by means of a pump connected to the pipe as directed by the Engineer.

- d) The duration of test shall not be less than 5 minutes. The exposed joints shall be carefully examined and all such joints showing visible leaks shall be caulked until watertight. Any cracked or defective pipes and fittings in consequence of this pressure test shall be removed and replaced by sound material by Contractor at no extra cost to the Engineer and the test shall be repeated to the satisfaction of the Engineer.
- e) Necessary equipment and water used for testing shall be arranged by Contractor at his own cost. Damage during testing shall be Contractor's responsibility and shall be rectified by him at no extra cost to the Engineer. Water used for testing shall be removed from the pipe and not released in the excavated trenches.
- f) After the tests mentioned above are completed to the satisfaction of the Engineer, the backfilling of trenches/encasement of pipe by concrete shall be done as per the Employer's Requirements specified elsewhere.

Elevators:

- a) Elevators shall be tested as per Approved QAP.

Blowers:

- a) The Blowers shall be tested as per technical specifications and datasheets.

Air conditioning:

- a) Air conditioning shall be tested as per Approved QAP.

B. Electrical

The following equipment / items shall be subjected to inspection, routine /acceptance tests as per the latest edition of relevant Indian / International standards in the presence of Engineer/Engineer's representative.

- a) Power Transformers and Distribution Transformers
- b) HT Metal enclosed switchboards & Switchgears (22kV and 6.6kV Panels)
- c) 415 V metal enclosed switchgears (PCC / MCC)
- d) Neutral Grounding Resistor (NGR)
- e) Automatic Power Factor Correction Panel
- f) Battery, battery charger and DC Distribution Board
- g) Variable Frequency Drives
- h) Power & control cables
- i) Cable carrier system
- j) Lighting system
- k) Earthing and lightning protection systems

Copies of test Certificates for the type tests and Special tests not later than 3 years conducted as per relevant and reputed Indian / International Standards for all the

equipment/items of above shall be furnished for the perusal of Engineer/Engineer's representative. If type tests and special tests have not been conducted on any of these items, the same shall be carried out in the presence of owner/ Engineer at no extra cost.

These tests will be conducted in the presence of consultant and client engineer. All the expenses for carrying out the tests will be borne by the contractor.

C. Instrumentation & Control

The following equipment / items shall be subjected to inspection, routine /acceptance tests as per the latest edition of relevant Indian / International standards in the presence of Engineer/Engineer's representative.

- i) Complete assembled PLC panel and SCADA system along with tender described hardware
- ii) Pressure Gauge
- iii) Pressure Transmitter
- iv) Radar Level Transmitter
- v) Ultrasonic Differential Level Transmitter (with 2 Nos. level sensors)
- vi) Conductivity type Level Switch
- vii) Electromagnetic Flow Meter
- viii) Temperature Scanner
- ix) Vibration Sensors and Monitoring System
- x) Instrumentation Signal, Control and Power Cables
- xi) Junction Boxes
- xii) UPS and Power Distribution Box
- xiii) Gas Monitoring System

GS: 18 PRECOMMISSIONING TESTS: -

At least three weeks prior to the start of pre-commissioning checks & tests, the Contractor shall submit a programme for the same. The detail to include the order, in which each item of plant shall be checked and tested, and duration of test. All instruments, apparatus, and testing equipment required for testing and commissioning shall be provided by the contractor. During the trial runs, the contractor shall arrange the necessary skilled personnel to supervise, adjust, test service and operate the plant satisfactorily.

Before commencing pre-commissioning, tests Contractor shall notify the Employer/Consultant in writing at least 7 days before. The formats mentioning the activities involved in the pre-commissioning tests shall be submitted for the approval of the Employer/Consultant

GS: 19 COMMISSIONING:

The work of commissioning of the plant shall be commenced after entire plant has been inspected and pre-commissioning checks and tests are carried under General Conditions of Contract.

During commissioning and the round, the clock 7 (seven) days running trials, the Contractor shall arrange all necessary personnel to supervise, operate, keep in operation, adjust, test, service, repair and do all things necessary to keep the plant system running.

Commissioning tests which shall be deemed to be the 'Test on Completion' referred in clause GCC 51 of the Conditions of the Contract shall be of round the clock or as per system requirement for seven consecutive days duration or for such number of broken days as the Engineer may consider equivalent.

GS: 20 TAKING OVER:

No item of the plant will be certified for taking over by the Corporation under clause GCC 55 of General Conditions of Contract unless it has successfully completed the operation and maintenance period including training of the Employer's staff and completion of a 72-hour demonstration towards the end of the O&M period.

A taking over certificate for the plant will not be issued unless the instruction manuals for operation and maintenance of the plant and record drawings have been received to the satisfaction of the Engineer.

Taking over certificates may be issued for sections of the plant as provided for by clause of the Conditions of Contract. These will not be issued for individual items of the plant but only for complete systems as the Engineer decides appropriate.

GS: 21 DEFECT LIABILITY PERIOD (DLP):

The contractor shall keep the entire equipment installed under this contract in proper working condition / order and shall without additional charge, replace defect due to faulty workmanship or inferior quality of material within one year of DLP.

DLP of 36 months as defined in clause of general condition of contract shall commence from the date of issue of certificate for successful completion of commissioning and subsequent 7-day trial run tests.

The contractor shall have to attend the major emergency repair without interrupting the system operation. If the contractor fails to do so, the work shall be attended by the Corporation at the risk and cost of the contractor. Necessary charges to attend the work and failing to attend the work shall be recorded as detailed at the special condition of contract. In the case of emergency arising the contractor shall have the services and labour unreserved by at the disposal of the corporation at any time.

GS: 22 PAINTING

Phosphatising shall be carried out on the cleaned surface.

After cleaning, picking and phosphatising process, the surface shall be applied with primer coat of zinc rich synthetic primer/epoxy primer and thereafter intermediate and final coat of synthetic enamel paint/epoxy enamel.

The sheet metal surface in the corrosive / areas as desired by the engineer shall be coated with epoxy primer and epoxy enamel while in other areas they can be coated with synthetic primer and synthetic enamel paint.

Unless otherwise specifically stated the paint shade shall be as per relevant IS.

In addition to above, contractor shall have to paint various metal surfaces wherever required after completion of testing with minor touch-up and repairs as per the site instructions.

GS: 23 DISPOSAL OF SPOIL AND WASTE

The Contractor shall give due consideration to the environmental benefits of re-using excavated material.

The Contractor shall be fully responsible for removal and disposal off Site of any excavated material that is not re-used on Site. He shall be responsible for obtaining the necessary permits, licences or other permissions required for its safe disposal in accordance with any relevant legislation and shall produce such documentation on request by the Engineer's Representative. The disposal site shall be subject to the approval of the Engineer's Representative. The Contractor shall ensure that vehicles are suitably loaded, or covered, if necessary, to ensure material is not lost during transport.

Contractor shall furnish detailed debris management plan within 7 days after starting of the excavation/related work to debris.