

II. SUBSTRATE

ZINC OR GALVANISED IRON OR ALUMINIUM
(Parts not immersed under water)

System E	Priming	Over-coating	Finishing
	Etch Primer	Zinc Chromate	Approved quality
	(one coat)	Primer	Synthetic Enamel
	25 microns	25 microns	50 microns

Total D. F. T. = 100 microns

Drying = Etch primer to be over-coated within 2 hours,
Give 12 hours drying between subsequent coats.

10. COUPLING

10.1 The tenderer shall provide the coupling for motors and pumps together with a suitable guard complying with BS : 1943 and BSC : 3004. The material of the guard shall be of anti-spark types. Couplings shall incorporate all necessary flexibility for axial, lateral and torsional movements to deal with the shock vibratory and driving requirements of the transmitted loads.

11. SLUICE VALVES AND PENSTOCKS

11.1 All types of valves (SV, BF, air valve, swing check valves) etc shall be per specifications described in the tender document and MOC shall be DI.

11.2 Penstocks shall be suitable to withstand the water pressure on front or back as the case may be. They shall be of strong heavy pattern of the type and shall be obtained from an approved manufacturer. All single faced cylinder gates (pen stocks) shall be mounted on C.I. puddles and shall have two gunmetal faces. The screws of penstocks shall work in gunmetal bushes or nuts. They shall be manufactured as per IS : 3042.

11.3 All extended spindles of penstocks or sluice valves coming in contact with water shall be made from corrosion resistant steels.

12. HAND-WHEELS FOR VALVES / PENSTOCKS

12.1 Hand-wheels shall be of grey cast iron and shall have cast on the upper side of the rim the mark "OPEN" and "SHUT" with appropriate directions for valves and penstocks installed outdoor. Indoor valves and penstocks shall be provided with brass direction indicator plates fixed at the centre of the hand wheels with G. M. cap nut Manufacturer design of such marking may be considered by the Engineer if good alternative system is provided.

13. REFLUX VALVES

13.1 As per specification given in the tender.

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14. JOINTING

- 14.1 The jointing shall be made with compressible rubber (IS : 638) of thickness 3mm, bolts and nuts. The bolts and nuts shall be of mild steel and these shall conform to IS : 1362 and 1363 unless otherwise specified.
- 14.2 The bearing surface of the nuts shall be smooth and the nuts shall be taped at right angles to the surface to ensure axial loading. Bolts and nuts shall be coated with a rust preventing lubricant after threading of tapping.

15. DI/ PVC/ HDPE/ MS PIPES & SPECIAL

- 15.1 As per specifications given in the tender document.

16. PIPE WORK

- 16.1 Pipes and fittings for filter pipe gallery, wash water supply, wash and waste water pump suction and deliveries shall be of DI flanged and for S & S and suitable for the maximum working pressure, including surge pressures. On the wash main an expansion joint of approved design at the appropriate position shall be provided. Pipe with puddle flanges shall be supplied in all cases where the pipes pass through the walls of the water retaining and basement structures. Detachable fixtures shall be provided whenever possible for ease of maintenance.
- 16.2 Small bore pipes for pump vents, cooling water supply, etc. shall be of heavy gauge galvanized iron. Galvanized iron pipes upto 50 mm bore may be supplied with screwed and socket joints, larger sizes shall have screwed flanges.
- 16.3 Copper pipes upto 25 mm bore may have compression rings, larger sizes shall be flanged.
- 16.4 All pipes to pressure vessels etc, shall have flanged connections. Where a common delivery is used, individual pump delivery branches shall be joined to it in a horizontal plane.
- 16.5 All pipe works shall be supplied to the limits specified.
- 16.6 The layout and design of the pipe-work shall be such as to facilitate its erection and the dismantling of any section for maintenance.

Adequate supporting arrangements for all pipes shall be included except in cases where they can more conveniently be supported on concrete cradles to the Contractor's design.

17. GROUTING

- 17.1 Tenderer will include in his price all cost for labour and materials for grouting in all fixings, pipes and any other fittings at the time of construction work. The Contractor will make arrangements for delivery of such items which will be grouted in the building work in time so that construction work can proceed smoothly without any interruption whatsoever.

18. SUPPORTS & FIXINGS

- 18.1 All supports, fixing bolts, screws and other fixings shall be provided by the Contractor and his price shall be inclusive of such items.

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19 DRIVING UNIT SUPPORT

- 19.1 Each driving unit shall be supported on a cast Iron or fabricated steel frame or guide rails as appropriate. The fabricated frame shall be constructed to afford adequate access to the coupling between the driving motor and driven unit.

20 DISSIMILAR METALS

- 20.1 Where metals of dissimilar character are used in construction, precautions shall be taken to prevent deterioration of the structures due to electrolytic action.

21 BEARINGS

- 21.1 Bearings shall be of type, size and construction to ensure that the plant and equipment of which they form part shall operate efficiently and continuously under normal operating conditions without overheating and with minimum inspection and attention.
- 21.2 Housing and enclosures of bearing assemblies shall be suitable for the worst atmospheric conditions in which they are required to work. All ball and roller bearings shall conform to the International Boundary Plan (ISO). Liners and bushes of plain bearings shall be easily renewable.
- 21.3 Provision shall be made for ready lubrication of all contact surfaces having relative movement. Contact surface of bearings and the lubricant shall be such that there is no corrosion, electrolytic action or excessive wear.

22 SPEED REDUCERS

- 22.1 All reduction gear boxes shall be of approved make and design with service factor not less than 2.0 and shall be continuously rated. Extra roller bearings to be provided so as the cater to overhung load. All speed reducers shall be of heavy duty type design. All gears shall be capable of transmitting starting overload 100% (minimum). Gears subject to axial thrust shall not be fitted with keys for location. Shaft shall be fitted with oil and dust seals. All gear boxes with oil bath lubrication shall be equipped with dipstick, drain plug and breather. Speed reducer with vertical output shaft shall be of heavy duty "Stirrer Class".

23 LUBRICATION

- 23.1 In designing the equipment, consideration shall be given to ensure that adequate lubrication is achieved with the minimum of attention. The central turntable assembly/wheel bearings shall be pre-packed with ample quantity of grease of appropriate grade and as far as practicable parts shall be so designed that these are not required to be lubricated more frequently than once per month. Adequate provision shall be made for the lubrication of the bearings from convenient points on the bridge decking.
- 23.2 All equipment, pipelines and fittings for lubrication system shall be manufactured from corrosion resistant materials or shall be suitably protected against corrosion.
- 23.3 Lubricating oil, grease and graphite paints and seals which require manual replenishing shall be clearly visible and readily accessible. Units to be filled with oil shall be arranged for easy filling without spillage. Protection shall be provided to prevent excess lubricant dripping into platforms and floors. Where connections have to be broken frequently and loss of oil is possible, connections shall be self sealing.
- 23.4 The grade type and frequency of lubrication to be used shall be stated on metallic lubrication parts permanently attached to the plant. Lubricating oils and grease shall be designated by

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approved trade name or in terms of mineral, vegetable, animal or blends of these basis together with their viscosity and flash point characteristics and not as 'Light' or 'Heavy'.

24. COUPLINGS DRIVES & CLUTCHES

- 24.1 Couplings shall incorporate all necessary flexibility for axial, lateral and torsional movements to deal with the shock vibratory and driving requirements of the specified transmitted loads.
- 24.2 All couplings shall be guarded. In couplings of the male /female type, the male section shall be located at the driving end of the coupling.
- 24.3 Rigid shaft couplings shall have minimum of six bolts and each half shall be marked to indicate it matching half coupling.
- 24.4 Flexible couplings exposed to dust shall be fitted with oil resisting muffs.
- 24.5 Couplings used for connection of electric motors to drive machinery shall be of the flexible type in cases where a break on the coupling is incorporated; this shall be located on the driven half of the coupling.
- 24.6 Fluid couplings shall be equipped with a fluid level indicator; Type of fluid required shall be indelible marked on the coupling casing.
- 24.7 Plates clutch couplings shall be fully engaged and shall be steel bronze type running in oil, or dry type with steel plates and dices with non-metallic facings.
- 24.8 All belts used on belt drives shall be of the endless type. The number of belts used shall be sufficient for the transmitting load without slip or overheating. Tension on multi belt drives shall be uniform and facilities shall be provided to enable assessment to be made to ensure uniform tension. Without slip, Jockey tensioning devices shall not be used.
- 24.9 Chain driven shall be of the case hardened roller type and be simplex, duplex or triplex as necessary for efficient and quiet transmission of the specified loads. Wheels used on chain driven assemblies shall have precision machine cut teeth. The assemblies shall incorporate facilities for chain adjustment to take up roller wear.
- 24.10 All pinions, wheels and couplings shall be pressed on to the associated shaft and keyed as necessary, or make solid with the shaft.

25. CENTRIFUGAL PUMPS

- 25.1 The pumps shall be designed to give prolonged running at the specified output under site conditions. The pumps shall be manufactured and tested as per IS : 6595 and other relevant Codes. Waterways through the pumps shall be smooth in finish and free from recesses and obstructions. The pumps shall be so placed that these can be put into operation without priming and that these shall not draw air under any condition.
- 25.2 Eye rings and wearing plates wherever used shall be of substantial construction and renewable.
- 25.3 The rotating elements shall be statically and dynamically balanced before final assembly.
- 25.4 The impeller shall be readily withdraw-able from the pump casing without the need to

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disconnect the adjoining pipe-work and with minimum disturbance to pump drive shafting. This provision is particularly applicable for recirculation pumps and sludge pumps.

25.5 The suction arrangement shall be such as will avoid pre-rotation in the suction pipe-work and present a good flow pattern at the entrance to the impeller. The NPSH requirement shall be satisfied keeping a margin of 0.5 m. at least.

25.6 Pump bodies, impellers, covers, brackets, bearing blocks, wearing plates, eye-rings, supports, etc. . . shall be of best quality closed grained cast iron (not below grade 20 of IS : 210) for wash water pumps while these for sludge / recirculation pumps shall be with NPSH requirement to be satisfied keeping a margin of 0.5 m. at least and "non-clang, back pull out", horizontal, centrifugal type with material of construction as follows :

- Casting - CI IS 210 FG 260
- Impeller - Stainless Steel 316
- Shaft - C 40

Pumps casings shall be substantial construction to give long life under all types of working conditions, Special care shall be exercised in the manufacturing process to avoid undue stress being set up in the finished product.

25.7 Shafting shall be of adequate sizes and proper material to avoid the possibility of fatigue failure and shall be shock and corrosion resistant for pumps handling corrosive liquid.

The shafts of pumps fitted with conventionally packed glands shall be made specially wear resistant by providing suitable stainless steel or equal sleeves. Intermediate shaft (wherever used) shall be made up in suitable lengths coupled together with a steady bearing adjacent to each coupling.

For vertical single entry pumps a short length of shafting above each pump shall be readily removable to facilitate the withdrawal of impeller.

25.8 Glands may be fitted with conventional soft packing. Means for readily removing lantern rings, where fitted, such as tapped holes, shall be provided. Conventional packed glands shall be provided with water flushing or spring loaded non-return greasing arrangements" The lantern rings for soft packed glands shall be provided with means for ensuring their correct location and for checking this under running conditions. A sufficient number of turns -of packing shall be allowed above and below the lantern ring to avoid wastage of grease include flushing water, pipe-work, fittings, valves, etc,



25.9 Air release arrangements shall be fitted from the high point of the pump casing (and else if considered desirable by the manufacturer). The pipe-work shall be not less than 20 mm nominal bore. The discharge from the air release pipe-work shall be arranged to avoid striking platforms and ladders. A shut off valve of Saunders required full bore straight through type, or equal approved, shall be fitted at the high point(s). Above this valve shall be fitted a bronze check valve of approved nature. The air release pipe-work shall be fitted with crosses to facilitate rodding. Where this pipe-work passes through a wall into a wet wall the bore shall be increased to 25 mm and it shall be terminated with an elbow directed downwards.

25.10 The pump drainage arrangements shall be fitted as close to the lowest point of the pump suction as is practicable. The drain valve shall be not less than 50 mm bore, Drainage pipe-work shall be led to the floor drainage system and not discharge direct to the floor,

25.11 Gland drainage arrangements shall be fitted; the drainage parts shall be not less than 12 mm bore. Pipe work shall be led to the drainage system.

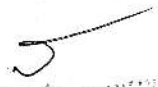
25.12 Detachable plates shall be fitted around the gland access areas to confine any liquid which may be thrown out in the event of gland failure.

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25.13 Air release and pump drainage pipe-work shall be of G. I. pipe-work unless otherwise directed.

25.14 Pressure and compound gauges of approved make shall be fitted to each pump.

The gauges shall be mounted on a mahogany base bracketed to the pump casing, unless otherwise specified.

The diaphragm body shall be screwed to Saunders type 25 mm full bore straight through pattern cast iron diaphragm valve, or equal approved. The valve shall be attached to the pipe-work at the gauge tapping points.

Pressure gauges shall have scales reading meter head of water and in kg/cm². Compound gauges shall additionally read upto 759 mm of mercury vacuum.

25.15 The drive motor, switch gears electrical works required for the completion of the job shall be carried out as per technical specification stated in section H.,

26. ROAD WEIGHBRIDGE

26.1 Road weighbridge shall be designed, assembled and tested in accordance with the relevant Indian Standards (IS : 1435 and 1436). The Road weighbridge shall be outdoor type weighbridge having dial with indicating and recording attachment and consisting of platform's not less than 6 M x 2.5 M. width. The minimum graduation shall be 10 kgs. Printing mechanism shall be electrically operated suitable for 230 volts, single phase, 50 cycles A. C. supply. The instrument shall be installed complete with all necessary electrical works namely, cab lings, switches, earthings, etc. The electrical works shall be carried out in accordance with the specification given in section H.

26.2 The indicating devise of the weighbridge shall be dial type, shock resistant with suitable device for controlling indicator oscillation.

26.3 Recording mechanism shall be so that it can print on both ticket and internal control paper tape weight, consecutive number and one hand set code letter.

The design shall be of non-self contained lever mechanism having levers suspended from reinforced concrete pedestals.

All main levers and transoms shall be made of heavy duty cast iron conforming to IS : 210-1962 grade 20.

26.4 The weighbridge shall be made of robust constructions having ample safety margin over and above the weighing capacity.

26.5 All longitudinal thrusts should be harmlessly absorbed by a suspension design by allowing the levers to swing in the direction of the traffic.

26.6 The platform shall be of mild steel, roughened 12 mm thick, arranged in convenient lengths. The platform shall be preferably supported by longitudinal joists and cast iron transverse support members. The verges shall be bolted to this. Meeting surfaces of verges and transoms shall be machined for perfect alignment.

26.7 The indicating mechanism shall be housed in a dust and moisture proof cabin. The graduations shall be black on white chart. The weight to be indicated on a 750 mm (approx.) diameter indicating chart.

The indicator shall provide shadow less line to line indication of weight.

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The total capacity shall be obtained by replacement unit weights together with consecutive number or code of letters to identify each weighing on a ticket and control tape.

The weight recording shall be prevented until the weight a hand lever situated at the side of the cabinet. The machine shall automatically charge the major figures on the chart at the time of operating unit weights.

- 26.8 The machine shall be fitted with a self contained manually or electrically operated recording mechanism. This mechanism shall not have any connection with weighing mechanism except at the instant of reading weight.

The recording mechanism shall make a printed record of weight pointer it at rest by incorporating a suitable safe guarding device in recording mechanism.

The work error shall be printed if the printing handle is pressed while the pointer lies on the under graduated portion of the dial. The time cycle of printing mechanism shall not be more than 4 seconds after arrival of the weight Pointer at rest.

The cabinet shall be of cast iron and sheet metal finished in enamel paint, The length of the control, tape shall be sufficient to give at least 5000 impressions.

- 26.9 The road weighbridge shall be installed slightly above the road level. The accumulated rain water from the main pit has to be bailed out by a suitable bilge pump in case drain age by gravity is not possible due to site condition. Tenderer shall provide one set electrically operated bilge pump (one in action and one stand by) complete with all pipe work for drainage upto the nearest drain.

- 26.10 The contractor shall after commissioning maintain the weighbridge in a lawfully running condition paying the statutory charges / fees to the legal Metrology Department of the Government of West Bengal and shall also keep a number of weights at the weighbridge as specified by the said Department. The maintenance shall continue till completion of the maintenance period for 12 months.

26.11 WEIGHING MACHINE

- 26.11.1 The platform type weighing machine shall have a dial not less than 500 mm diameter. The platform shall not be less than 900 mm square Indicator graduation shall be 1000 kg x 2 kg. The indicator shall provide shadowless line to line indication of weight. Platform shall be of cast iron and it shall, . be mounted on ball bearings. Strong backrail shall be provided on the platform, Scale shall be mounted on four cast iron wheels enclosed in a east iron frame, Machine shall be capable of absorbing shock loading. The whole mechanism shall be housed within adjust proof and moisture proof housing. The instrument shall be suitable for using in corrosive atmosphere and handling alum. A locking device shall be provided to prevent damage to the indicator mechanism during movement of scale.

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SECTION - J

GENERAL CONDITIONS FOR ERECTION & COMMISSIONING

1. UNLOADING, HANDLING & STORAGE

- 1.1. The Contractor shall be responsible for the delivery at site/sites of all equipment, material and supplies required for the fulfillment of the contract upto handing over of the plant to the Employer.
- 1.2. The Contractor shall at his own expense and responsibility transport or shift to plant site, all materials, equipment and supplies furnished for the purpose of this contract. All movement of materials and equipment to and from storage shall be at the expense of the Contractor. Space for storage facilities will be provided by the Employer at the site of the work as available. If the Contractor does not promptly shift and place for use in the premises, where the work is to be done, any material, equipment or supplies delivered, the Employer may do so, and charge all the costs thereof to the Contractor and in any event the Employer shall not be responsible for any damages, arising out of, or in any way connected with such shifting, unpack the materials, verify contents against invoices and notify shortages or breakages to the Engineer within one week of the receipt of materials and equipment at site, failing which the Contractor shall be held responsible for any consequences.
- 1.3. If requested by the Engineer, the planned method of transport of equipment shall be submitted to the Engineer for approval. This approval shall not relieve the Contractor of any responsibility for the safety of the equipment and personnel.

2. CONTRACTOR INFORMED AS TO CONDITIONS

- 2.1. The Contractor shall inspect, examine, obtain all information and satisfy himself regarding all matters relating to the execution and maintenance of the works to be carried out under the contract or any hindrances or interferences to or with the construction or maintenances of the works from any cause whatsoever including any other operations of works which may or will be carried out on or adjacent to the site of the works before or during the construction or maintenance of the works under the contract and shall make allowance for all such contingencies in the contract price and will not raise any claims or objections against the Employer in respect of any of the matters mentioned above.
- 2.2. The Contractor shall take field measurements when or where necessary before detailing, ordering or fabricating any material.
- 2.3. The acceptance of the order or making of a contract will be construed as evidence that such an examination was made and later claims for labour, equipment or materials required or for difficulties encountered, which could have been foreseen, will not be allowed.

3. EXECUTION OF THE WORK

- 3.1. The Contractor shall furnish adequate, courteous and competent labour, supervisors and engineers of all classes for the duration of the work to maintain progress of erection in accordance with the requirement of the scheduled completion date, and shall begin the work included in the contract at such time as well ensure its completion as specified and shall complete the same, free of all liens and charges, at or before the time specified for completion. The Contractor shall make available qualified engineers for placing the equipment in operation, carrying out the necessary tests and trials and the training of Employer's operating staff, as directed by the Superintending Engineer.
- 3.2. The Contractor shall be completely responsible for the satisfactory erection, testing and commissioning of the works notwithstanding that he may have been assisted by the Engineer in doing so.

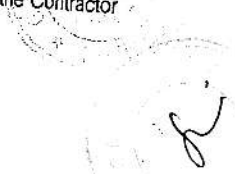
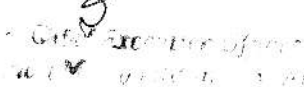
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4. WORK PERFORMED AT CONTRACTOR'S RISK

- 4.1 The Contractor shall take all precautions necessary and shall be responsible for the safety of the work to be performed by him, and shall maintain all lights, guards, signs, temporary passages, or other protections necessary for the purpose. The Contractor shall be responsible for any loss or damages to his personnel, materials, tools or other articles used or held for use in connection with such work. Such work shall be carried on to completion without damage to any work or property of the Employer or of others and without interference with the operation of existing machinery or equipment.

5. CONSTRUCTIONS TOOLS, EQUIPMENT AND SITE FACILITIES

- 5.1 The Contractor shall, at his own expense, furnish all necessary false work, erection tools, hoist, cranes, air compressors, rigging, skids, cribbing, blocking, scaffolding, equipment, appliances, materials and supplies required for erection and/or testing for performances and start up (hereinafter in this section called 'construction tools and equipment') that may be required to accomplish the work under contract unless otherwise provided for. Adequacy of such shall be to the entire satisfaction of the Engineer.
- 5.2 All piping for service and drinking water to work area shall be furnished, installed and maintained by the Contractor at his own cost. He shall also furnish, install and maintain at his own cost the power lines, junction boxes or any other electrical receptacles, apparatus or equipment from starting points, to his area.
- 5.3 The Employer shall not be responsible or held liable for any damage to person or property consequent upon the use, misuses or failure of any construction tools and equipment used by the Contractor or any of his subcontracts, even though such construction tools and equipment may have been furnished, rented or loaned to the Contractor or any of his agents by the Employer, the acceptance and/or use of any such construction tools and equipment by the Contractor or his agents shall be construed to mean that the Contractor accepts all responsibility for and agrees to indemnify and save harmless the Employer from said use, misuse or failure of such construction tools and equipment.
- 5.4 The Contractor shall bear and pay all charges including freight, clearing, insurance, duty on all construction tools and equipment furnished by him.

6. TRAVELLING AND LIVING EXPENSES

- 6.1 The contract price shall include all salaries and wages, all traveling time and expenses and boarding and lodging allowances for all personnel furnished by the Contractor and all payments which the Contractor may have to make in relation to the work of the labourers and other personnel employed for complete installation.

7. SIMULTANEOUS WORK BY OTHERS

- 7.1 The Employer reserves the right to perform or have performed in and about the works during the time when the Contractor is performing his work hereunder such other work as the Employer desires and the Contractor shall make all reasonable effort to perform his work hereunder in such manner as will enable such other work to be performed without hindrance from the Contractor and will make no claim for damages against the Employer arising out of such other work or interference there from. The Contractor will work in harmony with such other contractors regardless of race, religion, colour or national origin and any dispute between contractors shall be arbitrated by the Employer if necessary.

8. START-UP AND GUARANTEES

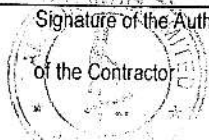
- 8.1 Until such time as the equipment or material installed and erected under the contract is finally accepted by the Employer in keeping with the terms and conditions of this contract and associated specifications the responsibility for proper testing, maintenance and efficient operation of the same shall be that of the Contractor. Prior to start-up, the Contractor shall be

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required to service the equipment and during start-up render such assistance as may be necessary or requested for by the Employer.

- 8.2 Where the equipment has not been manufactured by the Contractor the manufacturer's recommendations for installation of the same shall be strictly adhered to and any defects developing due to faulty installation and/or erection during start-up or during a period of one year from the date of commissioning shall be rectified, remedied or made good by the Contractor through the manufacturer if considered necessary by the Employer at his own expense. When the equipment has been manufactured by the contractor himself, rectification within similar period is compulsory.

9. EMPLOYER'S USE OF EQUIPMENT

The Employer shall have the right to use the materials and the equipment as be required, even prior to final acceptance.

10. Removal of Debris

- 10.1 The Contractor shall at all times keep the site free of rubbish, debris and surplus materials so as to render the place of work clean and safe for all personnel working in that area and upon completion of the work shall remove all rubbish and waste materials resulting from his work and leave the works and work site on a clean and finished condition. If the contractor fails to comply, such work will be performed by the Employer at Contractor's expense.
- 10.2 Whenever demolition or other work of any kind creates harmful dust or fumes, equipment for the complete protection of all personnel and property against dust fumes shall be installed, maintained and effectively operated by the Contractor as required by statute.

All such equipment shall be of a type approved by the State govt. / Central Govt. / or municipal or any other regulatory body and the expression harmful dust or fumes shall have the meaning assigned to it be such appropriate regulatory body.

11. Contractor's Obligations

- 11.1 Over and above the responsibilities of the Contractor stipulated in this document, the following obligations shall be fulfilled by the Contractor:

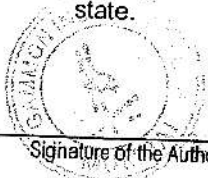
11.1.1 The Contractor shall satisfy the Engineer that adequate provision has been made.

a) to carry out his instructions fully and with promptitude;

b) to ensure that parts required to be inspected before use are not used before inspection; and

c) to ensure that adequate supervision is provided at all stages of the work and each portion of the work is checked for accuracy before erection.

- 11.1.2 The Contractor shall make necessary arrangements including provision of suitable spaces and facilities for testing, for inspection at any stage of manufacture of plant and equipment by the Engineer or his agents, as and when deemed necessary by the Engineer; the time schedule for any inspection will, however, follow the inspection schedule suggested by the Contractor and agreed upon by the Engineer during scrutiny of delivery plan. Irrespective of any inspection and tests made by the Engineer, the Contractor shall be entirely responsible for the proper execution of the Contract notwithstanding any approval which may have been given by the Engineer or the work or of tests carried out either by the Engineer or the Contractor. At least 15 days notice shall be required for inspection to be carried outside the state.



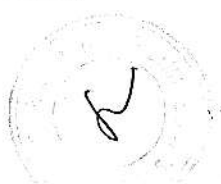
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11.1.3 The Contractor shall at his own cost.

- a) establish, self maintain the area placed at his disposal for office/ storage purposes.
- b) provide the necessary power and water connection from the supply mains and install and maintain the temporary distribution lines within the working area;
- c) erect and maintain necessary offices and storage space;
- d) provide temporary lighting at erection site required for erection;
- e) arrange for personnel accident insurance for his own personnel at site;
- f) arrange adequate security lighting and watch system to safeguard the equipment from any type of mishandling, theft, fire hazards etc. during the construction period and trial period and defect liability period.

11.1.4 The Contractor shall design, manufacture,, erect and dismantle any false work, staging temporary support, etc. required for safe and accurate plant and equipment erection and structural steelwork and shall be fully responsible for the adequacy of the same. The cost of such work shall be deemed to have been included in the rate quoted in the Schedule of prices.

11.1.5 The contractor shall, when required by the Engineer, furnish drawings and design of such false work, staging, scaffoldings, centering, supports etc required for construction & erection.

11.1.6 The Contractor shall provide for the convenience of inspection/testing adequate temporary and sufficiently strong and stable stairs and access ladders, gangways, etc, wherever necessary at his own cost.

11.1.7 The Contractor shall abide by the instructions and decisions of the Engineer at any stage of execution of the job unless he can convince that the same goes against the interest of satisfactory progress and completion of this work as per agreed schedule.

12. SHOP TESTS

12.1 Shop tests shall include costs of all tests to be carried out at contractor's works, works of his agents at manufacturer's works and at works.

12.2 The tests to be carried out shall include but not be limited to the tests mentioned below :

- i) Composition of all materials, castings, forgings, etc.
- ii) Hydraulic test for pressure vessels, tanks, pump castings etc.
- iii) Hydraulic tests for valves, specials etc.
- iv) Test to check faults in rubber lining (as per IS : 4682) or its equivalent and painting.
- v) Static and dynamic balancing test on all impellers.
- vi) Static balancing test on agitators, stirrers, paddles etc.
- vii) Performance test (Head, Capacity, BHP) on pump and blowers.
- viii) Tests on motor as per IS : 4029.
- ix) Any other test that may be provided in I. S. Specification.

12.3 All test certificates and reports shall be submitted to the Engineer for approval. All tests are normally to be carried out in presence of the Engineer or his representative. However, waiver may be allowed in specific cases by the Employer at his discretion.

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- 12.4 The employer's representatives or his appointed agents shall be given full access to all tests. The contractor shall inform the Engineer allowing adequate time so that the Engineer in charge or his appointed agents can witness the test, if it is so desired by the Engineer in charge.
- 12.5 No component or equipment shall be dispatched unless accompanied by approved test certificates and reports. The approval shall be given provided the corresponding drawings /technical particulars are already approved on the Employer's representatives or his appointed agents have witnessed the tests or a letter of inspection waiver is issued by the Engineer in charge.

13. SITE TESTS

13.1 General

After erection at site, all components, equipments as described below shall be tested to prove satisfactory performance and /or fulfillment of functional requirement without showing any sign of defect as individual equipment and as well as systems, The Contractor shall make all arrangements for testing and inform the Engineer for witnessing the tests.

- i) All pipes, fittings and valves, after installation will be tested hydraulically at a pressure, at least 1.5 times the maximum attainable pressure in the system, to check against leak tightness. A higher factor shall have to be adopted in specific cases if so specified by the B. I. S.
- ii) All manually operated valves / gates shall be operated throughout 100% of the travel and these should function without any trouble.
- iii) All pumps shall be able to run with the specified fluid from shut off conditions to valve wide open condition. During the test the pumps and drive motors shall run without any undue vibration, leakage through gland, temperature rise in bearing parts, noise, flow pulsation etc.
- iv) Visual check on all structural components, welding, riveting, rubber lining, FRP lining, painting etc. and if doubt arises will be tested again.
- v) All mechanical hoists and its components shall be tested subjected to double the full working load during all motions without showing any sign of defect.
- vi) All test instruments and equipment shall be furnished by the Contractor to the satisfaction of the Engineer.

13.2 Mechanical Tests

All the rotating / moving components like agitators, paddles etc. shall be run at the rated speed with water /chemicals upto the normal water /liquid level continuously for a period of twenty four (24) hours. During this period all the components shall function smoothly without any unbalance vibration, overheating at bearing parts, etc.

14. ERECTION SCHEDULE

- 14.1 The Contractor shall prepare a time table for erection schedule of requirements of men and material and tools and tackles or erections and outlines of erection methods together with erection drawings and specifications and submit those for approval of the Engineer. Such schedules shall be submitted well in advance. Any revisions to such schedules shall only be effected after prior approval of the Engineer giving specific reasons for such revisions.

15. BLOCK GROUTINGS

- 15.1 All equipment after erection shall be properly grouted without charging extra.

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16 SETTING OUT AND FOUNDATIONS

16.1 Where setting out and preparation of foundations are carried out by others, the contractor shall approve the accuracy of the setting out before execution of foundation work. The Contractor shall be responsible also for the adequacy of such setting out and preparation of foundations.

17 PROTECTION OF PLANT

17.1 All plant shall be afforded with adequate protection against corrosion, mechanical damage, deterioration etc. until the plant is taken over. The Contractor shall submit his proposals for achieving this protection for the approval of the Engineer.

17.2 The Contractor shall make good to the satisfaction of the Engineer any deterioration of the protective coatings, paintwork, etc, which may occur during transportation, erection, commissioning etc. until the plant is taken over.

17.3 Finish painting of the plant at site, as specified shall be carried out before the plant is taken over.

17.4 Items of plant which are finished painted at the manufacturer's works, such as switch boards, etc. shall be suitably encased in their protection before dispatch. This plant may require to be returned to the works for making good any deterioration of the paintwork etc. at the Contractor's expense, which may have occurred during the period until the plant is taken over.

18 TOOLS AND TACKLES

18.1 All tools and tackles, measuring and testing equipment etc. required for the successful execution of all contract shall be provided by the Contractor as part of his responsibility with respect to erection and commissioning of the plant as per the terms of contract.

18.2 All tools and tackles supplied by him will be taken back by him after completion of works excepting special maintenance tools which shall be retained by the Employer till the plant is taken over by him. Such tools and tackles shall have test certificates for their strength and calibration.

19 DELIVERY AND ERECTION SCHEDULE

The tenderer shall quote his best schedules for delivery of equipment and plant, erection and commissioning, and shall indicate the expected delivery schedule required for components to suit the erection schedule of the plant including inspection costs..

20 COMPLIANCE WITH STATUTES, REGULATION ETC.

20.1 The Contractor shall conform in all respect with the provision of any such state Ordinance or Law as aforesaid and the regulations or Bye Laws of any local or other duly constituted authority which may be applicable to the work or to any temporary work and with such rules and regulations of public bodies and companies as aforesaid and shall keep the employer indemnified against all penalties and liability of every kind for breach of any such statute ordinance or law regulation or bye law.

21 REMOVAL OF IMPROPER WORK AND MATERIALS.

21.1 The Engineer shall during the progress of the work have power to order in writing from time to time.

a) The removal from the place of work of site within such time or times as may be specified in the order of any materials which in the opinion of the Engineer are not in accordance with the contract.

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- b) The substitution of improper and the suitable materials, and
- c) The removal and proper re-execution (notwithstanding any previous test thereof or interim payment therefore) of any work which in respect of materials or workmanship is not in accordance with the contract.

22 Packing

- 22.1 Materials used for packing of the equipment shall be of sound timber of dimensions proportional to the size the weight of contents. The seller shall not use second hand packing materials, All package shall be steel strapped with at least two (2) straps on each package to ensure a solid package and to prevent pilferage. Bundled materials shall be rigidly steel strapped.
- 22.2 Fragile materials shall be securely packed within the containers or other wise as ply protected and packed to prevent shifting or rattling.
- 22.3 The empty containers shall be fully covered by strong and durable water proof paper inside, before putting the material, in order to protect the contents from damage, dust and corrosion due to sea or rain water creeping into the cases and, in addition, they shall be properly lined to withstand the elements while in transit or stored without cover.
- 22.4 Machined parts shall be thoroughly greased and amply protected against rust forming and corrosive elements.
- 22.5 The Contractor shall not use open type crates or fiber board cartons, unless permission is received from the Employer.
- 22.6 The Contractor shall not forward any articles without packing as specified herein, without obtaining prior approval of Employer.
- 22.7 Spare parts shall be packaged separately; under no circumstances they shall be included in the containers with the related commodity.

23. DAMAGE RISK AND INSURANCE

- 23.1 The Contractor shall arrange the plant and equipment and each part thereof, to be insured against loss, damage or destruction to fire, lightening, earthquake theft and such other risks until it is handed over to the Employer after erection and trial run period as provided for in the contract and shall from time to time, when so required by the Engineer produce the policy and receipts for the premiums. All money received under any of such policies shall be applied in or towards the replacement and repair of the plant damaged or destroyed, but this provision shall not affect the Contractor's liabilities under the contract.

Separate insurance policies shall be obtained to cover

- i) Rail and / or road etc, transit of equipment to site; and
- ii) Period of storage and erection and commissioning at site.

24. COMMISSIONING AND PERFORMANCE TESTS

- 24.1 The Contractor shall undertake the complete responsibility for successful erection and commissioning of the plant and giving successful performance tests.
- 24.2 The commissioning of the plant shall involve the following steps of operations
 - a) Testing of each unit on no load, to make complete check of its mechanical operations, alignment, clearance and rigidity and making necessary adjustments or alterations required to make such unit properly operable mechanically.

b) After the mechanical check has been made, as stated above, the equipment shall be

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energized and run progressively from no load to full load.

- c) Thereafter, trial operations of the units under completion shall be taken at normal full load operating conditions for which the respective units are designed, Further the units shall be rechecked for operation under normal overload conditions and necessary adjustments and alteration of the units shall be carried out to prevent leakage, spillage, heating up, undue vibrations, etc. and ensure that the equipment as erected fulfill the design requirement. For this purpose, continuous 72 hr. operation shall be demonstrated as a necessary perpetuation to commissioning.

24.3 The initial performance tests shall involve the following steps of operations:

- a) Necessary pumps shall be started and flow established through all the streams, valves shall be adjusted so as to have rated distribution of flow through all streams.
- b) Various units of the plant shall be started simultaneously, Samples of water shall be drawn every hour in the presence of the Engineer or his authorized representative from the outlets of flash mixers, clarifiers, filters and chlorinators and tested in the plant laboratory or in any other laboratory approved by the Engineer. The test results shall be compared against the required parameters.
- c) Similarly samples of raw water shall be collected in the presence of the Engineer or his authorized representative and tested in order to determine the efficiency of treatment at different stages of treatment.
- d) The initial performance tests shall be carried out at least for 72 hours continuous operation.
- e) The performance tests of the water treatment plant shall be deemed as a failure in case performance as specified is not met regarding quality and flow.

All cost of the initial performance tests shall be borne by the Contractor.

After the initial performance tests the plant will be subjected to Trial Run during which performance tests will be carried out further as specified in section F.

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SECTION - K
TECHNICAL SPECIFICATION FOR PUMP

1. **GENERAL INFORMATION**

The horizontal centrifugal pumps (water cooled) are to be installed in a dry pit for horizontal execution. The prime-mover would be squirrel cage induction motor. Connection of pump & motor would be with direct coupling. The variation level should be 50 microns both in horizontal & vertical direction, sound level of maximum 65 db during running condition of pump & motor. The pump should be supplied with base plate, soleplate, grounding pad, lifting lug, eyebolts, anchor bolts, nuts etc. Reverse direction of rotation of pump must be restricted by providing non reverse ratchet. The pump shall have provision for fixing pressure gauge, vent pipe, air release valve. Deliveries of all pumps are to be fed to a common delivery manifold. Pipe lines would be taken from the common delivery manifold for distribution purpose. All bidders shall fill up the data sheets attached in this tender document. Each Jackwell for intake will have Vertical Turbine Pumps, one working and one standby. V.T. Pump specifications and data sheet shall have to be designed by the bidders. Successful bidder shall be required to submit alongwith design for approval.

2. **SPECIFIC REQUIREMENTS**

2.1 **Design**

The design, manufacturing, performance of the horizontal execution pumps as specified hereinafter, shall comply with the requirements of applicable codes, the latest applicable Indian/British/American/DIN standards, in particular and in that order of application, the following -

- | | | |
|----|------|---|
| IS | 1520 | Horizontal centrifugal pump for clean, cold, fresh water. |
| IS | 1710 | Centrifugal, Vertical Turbine Pumps |
| IS | 5120 | Technical requirements, rotodynamic special purpose pumps. |
| IS | 9137 | Code for acceptance test for centrifugal, mixed flow and axial pumps - Class C. |
- Hydraulic Institute Standards.
- | | | |
|-----|------|---|
| BS | 599 | Methods for Testing Pumps. |
| BS | 5316 | Acceptance tests for centrifugal, mixed flow and axial pumps. |
| PTC | 8.2 | Centrifugal pumps-Power test codes. |

The materials of the various components shall be as per data sheet or equivalent material conforming to applicable IS/BS/ASTM/DIN Standards in that order of application.

In case of any contradiction between the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail. In case of contradiction between this specification and the pump data specification sheets enclosed, stipulations of the data specification sheets shall prevail.

2.2 **GENERAL PERFORMANCE REQUIREMENTS**

The pump shall be designed to have best efficiency at the specified duty point. The Pump set shall be suitable for continuous operation at any point within the — 'Range of Operation', so as to match with the system resistance curve.

Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

Wherever specified in data specification sheet, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the bhp vs. capacity characteristics, etc., shall match to ensure equal load sharing and trouble free operation throughout the range. In the event of tripping

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of one of the operation pumps, the operated pumps shall be capable of passing the maximum flow through it as dictated by the system resistance corresponding to both maximum and minimum water level in the pump suction sump.

The pump motor set shall be designed in such a way that there is no damage on account of any reverse flow through the pump which may occur due to any mal-operation of the system.

Where reverse flow through the pump is specified in data specification sheets, the drive motor shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed without injurious heating, when power to the motor is restored with a minimum voltage of 90% at the motor terminal.

External head that may be imposed on the pump under reverse flow condition is to be decided by the Bidder after analysing the complete system and the particular abnormal condition of run. However, any specific requirement as mentioned in the Pump Data Sheet shall be adhered to Torque-speed curve for pump and motor for such reverse flow condition shall have to be submitted along with the offer.

3. DESIGN & CONSTRUCTION

3.1 Pump type

Pump shall be axially split case, single/double volute, double suction type and shall be constructed in a manner that they can be placed on their foundation with their shaft in horizontal axis.

3.2 Casing

The casing shall be a single/double volute, double suction design and shall be so constructed that when it will be placed on its existing foundation the integrally cast with one half of the casing so that the other half of the casing can be removed without having to disturb the suction and discharge pipelines. A suitable fixture shall be provided with each pump for easy removal of one half of casing which will have no connection with the pipelines, for inspection and / or replacement of the Rotating Elements.

3.3 Impeller

The impeller shall be double entry type and dynamically balanced.

3.4 Wearing Rings

Casing wearing rings shall be provided with torque and groove arrangement to prevent rotation and shall be easily removable.

3.5 Impeller Shaft

The impeller shaft shall be ground finished on its entire length and shall be protected with sleeves so that the shaft itself cannot come into contact with the actual liquid pumped.

3.6 Sleeves

Sleeves shall be keyed onto the shaft and located by grub screws to prevent relative rotation between the sleeve and the shaft. The impeller shall be kept in position on the shaft by means of two sleeves which in turn shall be locked by means of suitably designed nuts.

3.7 Stuffing Box

The Stuffing box shall be an integral part of the casing and shall be fitted with lantern rings. The lantern rings shall be sandwiched between gland packing. The packing inside the stuffing box shall be held in position by glands.

3.8 Glands

The glands shall be designed to facilitate easy removal for inspection and replacement of Packing.

3.9 Bearings

Adequate capacity thrust bearings ball/roller shall be provided to take the full axial thrust of the pump as well as the weight of the pump rotating element. Thrust bearing shall be placed in the non driving end of the pump and shall be grease lubricated anti friction type and ball bearing shall be

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placed in the driving end of the pump and shall be grease lubricated anti-friction type.

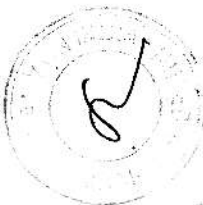


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