

K. Batch No.

TECHNICAL SPECIFICATION FOR EPDM RUBBER RINGS:

SPECIFICATION FOR SUPPLY & DELIVERY OF EPDM RINGS (EPDM RUBBER RINGS) SUITABLE FOR 80 TO 1000 MM DIA D.I. PIPE JOINT.

E. GENERAL TECHNICAL SPECIFICATION.

The supply shall be covering supplying and delivering of "EPDM" rubber rings confirming to relevant Indian standards.

F. STANDARDS:

The EPDM rubber ring to be supplied and delivered (under the scope of this rate contract) shall be manufactured in accordance and confirming to IS: 10292-1988 and specification followed to be IS: 5382-1985.

G. SCOPE AND FIELD OF APPLICATION.

The standard defines requirement and test methods for rings made of solid rubber ofr joint of couplers in pipe line to be transport drinking water.

H. DIMENSIONS AND VOLUME:

The nominal dimension and the nominal volume of the rubber rings and the permitted tolerance shall be same as per natural rubber rings. The stated value shall be such that the joints in which the rubber rings are used to meet the requirements to make the joint solid water tight.

I. MATERIAL:

EPDM rubber shall be used to produce the rubber ring,. The manufacturer shall have to specify the blending components used for manufacturing the ring and it shall be strictly 100 % EPDM.

J. REQUIREMENTS:

General Functional Requirement.

The rubber ring shall suit their purpose. The composition, the appearance, the form and the dimensions shall be that in view the type of application a good sealing of the joint under normal operating conditions during the use of the pipes system will be ensured.

Influence on Potable water:

The rubber rings shall not contain components under normal operating conditions that can have a negative influence on the quality of the potable water or can cause damage to the health. When tested, no taste and/or our deviations compared with the blank beaker shall be detected.

Resistance to Micro biological attack.

The rubber ring shall be resistant to Micro biological attach.

The supplier shall have to give guarantee in writing and if any attack is visualized or seen on ring within a period of 12 month, the supplier shall have to replace the

same without any cost.

K. RESISTANT TO DEVIATING TEMPERATURES:

The rubber rings shall be resistant to normally occurring temperatures is the rings be used in a pipes system in which for longer period of the temperature of 60o C. occur, they shall be resistant to that temperature.

F. RESISTANT TO CHEMICALS:

The rubber rings shall be resistant to chemicals that can be found in potable water and in discharge water in concentration that are considered to be normal.

G. APPEARANCE AND HOMOGENITY:

When inspected, the rubber rings shall not contain foreign components and should be free of internal cracks, air inclusions and porosity which can be detected with the naked eye. The filling and other additives shall be distributed homogeneously in the rubber. The appearance of the rubber rings shall be smooth and clean (With exception of marking and splitiness)

During the tensile test, pieces shall maintain smooth appearance (no contraction and/or thick ring)

H. WELDED RUNGS:

In a ring made of previously vulcanized material only one weld is permitted. The weld shall be made with a vulcanization process.

I. PHYSICAL AND MECHANICAL PROPERTIES:

Physical and mechanical properties shall be as per type-3 specified in table 1 & 2 of IS: 5382-1985 or its latest revision.

The material of entire lot shall be accepted on receipt of satisfactory test.

J. TESTING:

The manufacturer should specify the name of at least 3 vendors from whom they propose to purchase their requirement of EPDM rubber rings. "The GWSSB shall have to right to verify the details like manufacturing capacity which they are supplying and may from time to time draw samples from their general lot and send the same for testing with laboratories of GWSSB's choice. For the purpose of capacities of the lot by the Inspecting Agency the test as per available facilities shall be carried out at manufacturer's premises and may be agreed between GWSSB and respective authority, however, the manufacturer's test certificate must accompany each of rubber rings. In short, the identifications of the vendors for EPDM rings shall test with GWSSB.

12.1 TESTING PROCEDURE:

For testing purpose, representative samples of uncured and cured blends prepared for the manufacture of EPDM rings shall be collected for physical and chemical analysis of the said lot.

For Chemical analysis the samples shall be sent to the laboratory specified by the Department at the cost of the manufacturer and the test result shall be supplied with the materials.

For physical analysis the laboratory facility available at the factory premises of the manufacturers shall be utilized, however at the discretions of the Engineer-in-charge the sample can also be tested at any other standard laboratory.

The sampling and physical test for the rubber rings shall be in accordance with test procedure shall be carried by the Engineer-in-charge.

G. MAKING.

The rubber rings shall be marked in clear and durable way with the following indications. The used rubber type using the letter code as "EPDM"

The number, month and year of production should be mentioned on the label of the packed bag duly sealed.

H. COLOUR OF THE RINGS.

Colour of the ring shall be as specified in relevant Indian Standard.

I. INSPECTION:

Inspection of materials at factory site shall be carried out jointly by third party inspection agency as fixed by GWSSB and concerned Executive Engineer of GWSSB. The supplier or receipt of supply order from GWSSB shall intimate the said third party inspection agency and concern Executive Engineer to carry out inspection as soon as material is ready.

The inspection calls for all the items i.e. D.I. Pipes, with jointing materials, if the jointing materials are not offered for inspection, the inspection note only for pipes will not be issued by third party inspection agency, inspection will be carried out normally within on weeks' time and on receipt of such intimation the inspecting agency will inspect the materials as per the specification and on satisfying itself, will mark the inspection marks on all pipes and issue inspection note to supplier and concerned consignee. During third party inspection if the material offered for inspection is rejected by third party. Inspection agency in that case the third party inspection agency will mark the rejection marking and will take other precautionary measures so that the rejected material cannot be used in GWSSB in future.

Inspection agency will carry out the inspection as per procedure prescribed in relevant I.S. to confirm the quality of pipe as per IS: 8329/2000.

For inspection purpose the manufacture has to go in for line stenciling for identifying size and class for proper segregation. The offered material shall be staked in manageable batches with adequate space like spreading the pieces etc. to permit proper inspection and inspection authority to be present during stamping so as to ensure that only actually cleared material is stenciled. The inspected material should not be loaded after sunset to avoid inadvertent dispatch of wrong material.

Based on authority of inspection notes issued by the inspection agency to supplier as well as consignee (Concerned Executive Engineer) materials with inspection mark will be dispatched to stores stipulated in supply order and on receipt at stores the verification will be carried out by concerned Deputy Executive Engineer as regards quantity and quality, Here quality means physical soundness of materials as precaution against breakage during transit. The supplier has to submit the test certificate as well as detailed test result carried out by inspection authority to the consignee along with the dispatch documents of materials. The material shall be

considered as received only on receipt given by the concerned Deputy Executive engineer after verifying and satisfying the above requirements.

As regards post delivery quality inspection of pipes counter reference sample shall be collected at the time of inspection in presence of the third party inspection agency, the concerned Executive Engineer and the manufacturer with their signature on the samples and shall remain in custody of the concerned consignee and will be test at any agency as decided by GWSSB in case of doubt.

All inspection charges shall be paid by agency without any extra claim.

ISI MARK:

The material supplied shall be bearing ISI Mark. The supplier must have ISI certification marking valid on the original last date of receipt of tenders. IF the last date of receipt of tender is extended in that case the validity of ISI Certificate mark will be considered as on the original last date of receipt of tender and also on the date of entering into contract and during the currency of the contract. For this purpose, ISI marking license certificate along with its endorsement shall be submitted in the envelope of technical bid, also at the time of agreement certificate from ISI authority regarding validity of ISI marking on that date will have to be submitted by the successful tenderer. During the course of Rate contract, if new more sizes are included in the ISI Certificate by ISI authorizes, such new more sizes will not be included in the existing rate contract.

In case of ISI marking license of Rate Contract holder is suspended during the currency of the Rate Contract period, the firm must inform GWSSB immediately on the very next day, within the time limit of 30 days the firm has to get his suspended ISI marking license renewed from the BIS authority and to inform GWSSB along with the documents to that effect.

However, if the time taken for renewal of marking is more than 30 days then the Rate Contract will stand cancelled automatically, However, GWSSB may extend the time limit on request from the firm on reasonable ground. If suspension period is more than 30days the firm will have to compensate Board by supplying extra quantity towards their committed supply capacity for period in excess of 30 days, if Board so desires.

In case the firm fails to get its license renewed in reasonable time, even with sincere efforts on their part, the Board may treat this event as a breach of contract and all relevant clauses will become applicable.

MODE OF MEASUREMENT:

As per payment schedule. PRICE VARIATION CLAUSE:

Not applicable

'Lowering, laying and jointing C.I. S & S Spun pipes suitable for Tyton joints / Mortarlined D. I. K-9 pipes of various classes with CI / MS specials of following diameters in proper position, grade and alignment as directed by engineer in charge incl. conveyance from stores to site of work, labour, giving hydraulic testing etc complete.

GENERAL:

The pipes & joints shall be procured, supplied by the Contractor at work site at his own cost. Every care shall be taken in carting them to site. During transportation any damage shall be occurring to pipes for fittings the replacement of pipes given by the contractor at his own cost.

The trenches shall be well leveled so that pipes are laid evenly among them. The pipes shall be fixed within two rubber rings to be supplied by department at the place shown in schedule A, if directed by the Engineer-in-charge or mentioned in item of schedule B. The specification for titan joints i.e. Rubber Rings shall be as per details specification material section.

The contractor shall make his own arrangement for obtaining permission for storing & stacking of pipes etc. from land boards whether they are Government, Municipal Local Bodies or Private land owner.

Every pipes before lowering into the trenches shall be got checked and thoroughly cleaned and the beds of the trenches shall be properly graded and leveled as required on the line, without any claim for extra cost whether it is required. The pipe shall be carefully lowered into the trenches with the help of a suitable type of chain pulley blocks, which shall first be approved by the Engineer-in-Charge. Each pipe shall be properly jacked and the spigot perfectly fixed into the socket. No jointing operation shall be started unless the gradients levels are approved by the Engineer-in-Charge or his representatives.

The pipes shall be laid complete in centerline ranged accurately by means of a string attached to both marked center of site rails and no deviation shall be permissible without the permission of Engineer-in-Charge. The pipe shall be laid in reasonably dry trenches and no circumstances on slushy bedding.

The pipes shall be brushed before lowering any laying or remove any soil or dirt etc. that may have accumulated.

The inside socket and outside of the spigot-shall be carefully cleaned. The pipe shall be lowered carefully with socket and toward and the flow of water or up till or as directed and spigot and should be carefully inserted into the socket and the space shall be filled with the joint.

TESTING OF WATER PIPES:

After each section of the pipeline has been completed it shall be tested for water tightness before being covered. The contractor shall at his own cost fill up water in pipe line and given necessary hydraulic test section by section and the pipe line shall stand the pressure which shall exceed the working pressure by (a) 50% of the highest pressure in the section.

(b) 30m whichever is less without showing any leakage or sweating anywhere in the pipes joints specials valves etc. if any defect are found the contractor shall be made good the same at his own cost.

Any leaking joints shall be made good and above test pressure in to be lowered gradually after satisfactory test is & over.

GWSSB will not be able to provide water for testing of the pipelines & water containers of the project. This shall have to be managed by the contractor at his costs and risk.

The hydraulic test shall be given again if considered necessary by the Executive

Engineer or his representative to show that no further leakages or sweating is there. The contractor shall have to make necessary arrangements for water testing as well as plugging the opening of pipes etc. as directed without claiming any extra cost. The pipelines shall be kept filled with water for a work lines shall be kept filled with water for a week or till it is situated for testing is done.

If the pipe lines are laid in detached sanctioned & not in continuous length due to any reasons such as non-availability of specials or due to obstacle etc. The contractor shall see that no end of pipes length is kept open-ends are immediately covered up either by suitable blank flange or cap slug or by means of double layer gunny bags clothes tied properly by mild steel wire without any claim for extra-cost.

The rate shall be per meter of pipe line laid including all specials and fitting jointly etc. Cutting and waste shall not be paid separately. The length shall be measured not on the straight line and curves along the center line over the pipe and specials correct up to 1 cm.

Payment shall be as per payment schedule

Item No 2:

Providing, supplying, Lowering & laying & jointing ISI Mark C.I Sluice Valves of approved make & quality of following class and diameter, including all taxes, insurance, transportation, freight charges, Octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete.

PN-1.6 With hand wheel /cap operated (PD type short body)

150 mm dia

Resilient seated butterfly valve shall be as per IS 13095/ BS 5155. Valve shall be suitable for mounting in any position.

The valve seat shall be of integrally cast or replaceable design. When the valve is fully closed, the seal shall seat firmly so as to prevent leakage. The seat surfaces shall be machined smooth to provide a long life for the seal.

All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve and valve shall be suitable for throttling purpose.

All valve, spindles and hand wheels shall be positioned to give good access for operational personnel.

Valve of diameter 350 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Sluice Valve :

Sluice valve shall conform to IS 14846 or relevant internationally recognized standards. They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm

The gate face rings shall be securely pegged over the full circumference.

Valve of 350mm and above shall be provided with thrust bearing arrangement for ease of operation.

Valve of diameter 350 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Scour Valve :

The Scour valve shall be sluice valve as per IS: 14846 and shall be provided as per approved drawing and as directed by Engineer in charge. The Scour valve shall be provided with scour Tee, distance piece pipe and drain pipe up to nearest drain.

Material of Construction Sluice Valve: IS: 14846 shall be as per Particular technical Data Sheets.

Lowering, laying and jointing in position following C.I. D.F Reflux valves, Butterfly valves, sluice valves and Air valves including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete

[A] SLUICE VALVES, BUTTERFLY VALVES, REFLUX VALVE, SCOUR VALVE

SUPPLY OF MATERIAL

Cast iron double-flanged sluice valve/butterfly valves with two tailpieces suitable to pipe shall be supplied and carted by the contractor as per latest IS. The rate shall include loading, unloading and stacking at site.

The sluice valve/butterfly valves and tailpieces shall be examined before laying for cracks and other flaws. They shall be undamaged in all respect.

The sluice valves/butterfly valves shall be operated before laying.

All grits and foreign materials shall be removed from the inside of the valves before placing.

All the four faces shall be thoroughly cleaned and coated with a thin layer of mineral grease.

The tightening of gland shall be checked with a pair of inside-calipers. Clearance between the top of stuffing box and the underside of the gland shall be uniform all the sides.

JOINTING MATERIAL

The contractor shall provide all necessary jointing materials such as nuts bolts, rubber packing white zinc jute lead wool, C.I. tailpiece etc.

All tools and plant required for installation of sluice valve shall be provided by the contractor.

All jointing materials shall be approved from the engineer-in-charge before use

The nut and bolts shall conform to specification of materials.

The rubber packing shall conform all specifications as narrated in Specifications of materials.

INSTALLATION

The sluice valve/butterfly valve shall be lowered in to the trench carefully, so that no part is damaged during lowering operation.

If necessary tailpieces shall be fitted with sluice valve first outside the trench and then lowered in to the trench.

The rubber packing shall be three ply and of approved thickness. The packing shall be of full diameter of the flange with necessary holes and the sluice/butterfly valve bore. It shall be even at both the inner and outer edges.

The flange faces thoroughly greased.

If flange faces are not free, the contractor shall use thin fibers of lead wool.

After placing the packing, nuts and bolts shall be inserted and tightened to make the joint.

The valve shall be tightly closed when being installed to prevent any foreign materials from getting in between the working parts of the valve.

Each flange bolt shall be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively.

The sluice valve/butterfly valve shall be installed in such a way that its Spindle shall remain in truly vertical position.

The other end of tailpiece shall be fitted with pipes so that continuous lines can work.

Extra excavation required for facility of lowering and fixing sluice valve shall not be paid for.

TESTING

After installation of sluice valve/butterfly valve the same is tested to 1 1/2 times of its test pressure.

The joints sluice valve/butterfly valve shall withstand the test pressure of pipelines.

Defects noticed during test and operation of sluice valve shall be rectified by the contractor at his own cost without any extra claim to the entire satisfaction of the Engineer- in-charge.

Item No 3

Providing, supplying, Lowering & laying & jointing C. I. Air valves of approved make & quality of following class and diameter including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete.

Kinetic Air Valve (DK) 50 mm dia.

Refer Detail technical Specification of Section 1 to 7 as given Above.

'Lowering, laying and jointing in position following CI / DF Reflux valves, Butterfly valve, Sluice valve and Air Valve including cost of labour ,jointing material, including nut bolts and giving satisfactory hydraulic testing,etc.complete.Sluice valve -

Lowering and jointing in position

Supply of Material

Cast iron double-flanged sluice valve with two tailpieces suitable to pipe conforming to the latest relevant IS shall be supplied and carted by the contractor to the site of work including loading, unloading and stacking at site.

The sluice valve and tailpieces shall be examined before laying for cracks and other flaws. They shall be undamaged in all respect.

The sluice valves shall be cleaned before laying.

All grits and foreign materials shall be removed from the inside of the valves before placing.

All the four faces shall be thoroughly cleaned and coated with a thin layer of mineral grease.

The tightening of gland shall be checked with a pair of inside-calipers. Clearance between the top of stuffing box and the underside of the gland shall be uniform all the sides.

Jointing Material

The contractor shall provide all necessary jointing materials such as nuts bolts, rubber packing, white zinc, jute, lead wool etc.

All tools and instruments, which are to be required for installation of sluice valve shall be provided by the contractor.

11.2.3 All jointing materials shall be got approved from the engineer-in-charge before use the nuts and bolts shall conform to the relevant IS.

The rubber packing shall confirm all specifications as narrated in respective IS.

Installation

The sluice valve shall be lowered in to the trench carefully, so that no part is damaged during lowering operation.

If necessary tailpieces shall be fitted with sluice valve first outside the trench and then lowered in to the trench.

The rubber packing shall be three ply and of approved thickness. The packing shall be of full diameter of the flange with necessary holes and the sluice valve bore. It shall be even at both the inner and outer edges.

The flange faces thoroughly greased.

If flange faces are not free, the contractor shall use thin fibers of lead wool.

After placing the packing, nuts and bolts shall be inserted and tightened to make the joint.

The valve shall be tightly closed when being installed to prevent any foreign materials from getting in between the working parts of the valve.

Each flange bolt shall be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively.

The sluice valve shall be installed in such a way that its Spindle shall remain in truly vertical position.

the other end of tailpiece shall be fitted with pipes so that continuous lines can work.

Extra excavation required for facility of lowering and fixing sluice valve shall not be paid for.

Testing

After installation of sluice valve the same is tested to 1½ times of its test pressure.

The joints of sluice valve shall withstand the test pressure of pipelines.

Defects noticed during test and operation of sluice valve shall be rectified by the contractor at his own cost without any extra claim to the entire satisfaction of the Engineer-in-charge.

Measurement and payment:

As per payment schedule.

Item No.4

Excavation for pipeline trenches

Excavation for water supply pipe line trenches incl. all safety provision using site rails & stacking excavated stuff up to a lead of 90 m. cleaning the site etc. complete for lifts and strata as specified. (a) in all sorts of soil & soft murrum .up to 1.5 m depth.

GENERAL

- 1.1 The excavation for trenches will generally, refer to open excavation for trenches in wet / dry conditions for pipe laying work.

CLEARING OF SITES:

The site on which the pipelines are to be laid and shown on plan and the area required for setting out and other operations shall be cleared and all obstruction loose stones and materials, rubbish of all kinds, stumps, brushwood as trees shall be removed as directed the roots shall be entirely grubbed up.

The products of the clearing to restocked in such a place and in such a manner, as directed by the engineer in charge.

In jungle clearings, all trees not specially marked for preservation, bamboo's jungle wood and brushwood shall be cut down their roots grubbed up. All wood and materials from the clearing shall be the property of the Board shall be arranged as directed by the Board Engineer or his authorized agent, the material pronounced as useful by the Engineer will be conveyed and properly stacked as directed within the specified limit. Unless materials will be burnt or otherwise disposed off as directed.

All holes or hollows whether originally existing or produced by digging up roots, shall be carefully filled up with earth, well earth, well rammed leveled off, as may be directed.

3.0 SETTING OUT:

The center lines of all pipe trenches etc. shall be given by the Engineer-in-charge and it will be the responsibility of the contractor to install substantial reference marks, bench marks, etc. and maintain them as long as required true to line, level curve and slopes. The contractor shall assure full responsibility for alignment, and dimension of trench.

The labor materials etc. required for setting out and establishing benchmarks and other reference marks shall be arranged by the contractor at his own cost.

4 EXCAVATION

- 4.1 The excavation incl. Bailing out of water for the pipe trenches shall also incl.

Removal of all materials of whatever nature and whether wet or dry condition necessary for laying of pipelines exactly in accordance with alignment, levels grades and curves shown on the plans or as directed by the Engineer-in-charge. Trenches shall be excavated to the exact width and depth according to the size of pipe and the sides shall be left vertical as far as possible or according to the angle of repose of various soils. Unless there is a specific extra provision in the contract for shoring and strutting or for cutting side slopes the contractor shall at his own cost do the necessary shoring and strutting or cutting of slopes to a safe of repose or

both approved by the Engineer-in-charge. As per Site condition if Extra width or depth require then prior permission of concern chief engineer is require. The contractor shall notify the Engineer before starting excavation to enable him to take cross sectional levels for purpose of measurements before the ground is disturbed. The bottom of the trenches shall be leveled both longitudinally and transversely or slopped as directed by the Engineer. The contractor shall at his own cost to remove such portions of boulders or rocks, as are rectified to make the bottom of the trench level. No filling shall be allowed to bring the trench to level. If by contractor's mistake excavation is made deeper than shown on the plans and if ordered by the Engineer the extra depth shall have to be made with selected excavated stuff only with watering, remedying etc. as directed, by the Engineer and at the cost of the contractor. Other hard excavation shall be cleared of all sorts and loose materials and cut to firm surface, either level, stepped as directed by the Engineer. The Engineer may order such charges in the dimensions and alignment of pipe trench as may be deemed necessary to secure satisfactory cover over pipeline. The contractor shall, at his own expense, make provision for bailing out of draining water and the trenches shall be kept free of water, during laying work.

After each excavation is completed, the contractor shall notify the Engineer to that effect and no laying of pipeline will be allowed to laid until Engineer has approved the depth and dimensions of trenches level and measurements.

The minimum width of trench should be 25 CM on each side of the pipe the rate includes cost of dewatering, blasting if required and as per detailed specification etc complete.

5.0 SHORING AND STRUTTING:

Shoring & strutting and dewatering if required shall have to be carried out by the contractor, for which any extra charge will not be paid During excavation if water connections, sewage connections, telephone lines khalkuva (soak pits) etc. are damaged by the contractor, the same shall have to be restored by the contractor without any extra payment.

PROTECTION

The trenches shall be strongly fenced and red light signal shall be kept at night and arrangement of watchman to prevent accidents should be done, sufficient care protective measure shall be taken to see that the excavation shall not affect or damage the adjoining structure. The contractor shall be entirely responsible for any injury to life and damage to the properties etc. Necessary protection work such as guide ropes, crossing places, barricades, caution boards etc. shall be provided by the contractor.

7.0 The excavation in all sorts of soil, hard murrum, soft rock or hard rock or any type of soil shall have to be carried out up to the required depth by the agency, no extra payment shall be given for soft/ hard rock.

8 DISPOSAL OF EXCAVATED STUFF

No excavated stuff from trench are to be placed even temporarily nearer than 1.5 meter or greater distance up to 90 meter or as prescribed by the Engineer from the outer edge of trench. All excavated material will be the property of the board. The rate of excavated includes sorting out of useful materials and stacking then separately as directed within specified lead. The excavated stuff suitable and useful for refilling or for other use shall be stacked at convenient places. The materials not useful in any wet shall be disposal off as directed by the Engineer from the outer edge of trench.

8.2 The site should be cleared off on completion of work.

9.0 ADDITIONAL REQUIREMENTS

At the joints of pipes, the trench shall be excavated to an additional depth of 15 cm. and width of 30 cm. And length of 15 cm. beyond the edge of collar on both the sides or as directed. The rate include for such extra excavation made at the joints. The trenches shall be excavated perfectly in straight line. The bottom of the trench shall be kept as per invert level or as directed. To maintain the proper slop the usual method of site rails and boning rods shall be adopted. The contractor shall have to provide and fix and maintain sight rails and boning rod without any extra cost.

If the contractor fails or makes delay to give hydraulic test of the pipe line laid in any of the section, without any genuine reason, he shall be responsible to get any part of the length trenches refill in such case i.e. before tasting for safety of pedestrian and/or vehicular traffic as found necessary by the engineer-in-charge without any extra cost. If found necessary any directed by the Engineer-in-charge. The contractor shall have to excavate the refilled trenches, during hydraulic test without any extra cost.

At all road crossings, trenches shall be excavated only for half width of the road and pipe shall be laid. The other half shall be excavated only after back filling over the laid pipeline is done so as to make it suitable for the traffic. The contractor shall provide direction when the pipeline is to be laid along the road as required and shall maintain the diversion or any part of it, without any extra cost. At all road crossings, the pipe shall be laid below the crest of read.

The contractor shall break the road surface by excavation chiseling to the exact width and length as shown on the drawing or as directed by the Engineer-in-charge.

The excavated stuff shall be deposited in uniform layers to avoid mixing with other kind of materials at non-objectionable place or as directed by the Engineer-in-charge.

MEASURMENT AND PAYMENT

As per Price bid or Payment Schedule.

This item of excavation shall include unless and otherwise mentioned.

- (a) Clearing of site
- (b) Setting out work including all materials and labour.
- (c) Providing and subsequently removing, shoring and strutting outing slopes etc.
- (d) Excavation and removal and staking of all excavated stuff as directed.
- (e) Necessary protection including labour materials equipment etc. to ensure safety and protection against risk or accident.
- (f) Providing facilities for inspection and damage to property if caused during progress of work.
- (g) Compensation for injury to life and damage to property if caused during progress of work.
- (h) Restoring of water supply connections, sewer connections, telephone lines, khalkuva soapiest etc. if damaged by contractor without extra payment.
- (i) Dewatering of excavated pit trench during the progress of work.
- (j) Clearing the site on completion of works directed by the Engineer.

Item No 5

Providing and casting in situ C.C. in grade M-20 (1:1.5:3) (proportions as per mix design or as per table 9 of IS 456 2000 in masses by weigh batching) using granite, quartzite trap metal of size 6 mm to 20 mm for RCC work, including scaffolding centering, formwork, needle vibrated consolidation, curing complete up to 6 meter depth or height (excluding cost of reinforcement and neat finishing) with centering and shuttering/deshuttering etc. complete for structure other than water retaining (Below G.L) Footing for column or foundation (with form work)

Thrust block for Rising main of Dia. 150mm and Deviation angle 90 degree

SCOPE

- 1.1 This Specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete; form work; requirements in regard to the quality, storage, bending and fixing of reinforcement; grouting as well as mode of measurement and payment for complete works.
- 1.2 It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all work shall have to be carried out in accordance with the relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by Engineer from time to time. The decision of Engineer as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on Contractor and no claim whatsoever will be entertained on this account.

2 APPLICABLE CODES AND SPECIFICATIONS

- 2.1 The following specifications, standards and codes, including all official amendments / revisions and other specifications and codes referred to therein, should be considered a part of this specification. In all cases the latest issue / edition / revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

2.2 Code for Materials

- | | | |
|----|-----------------------------|---|
| 1. | IS : 269 | - Specification for 33 grade ordinary port land cement |
| 2. | IS : 455 | - Specification for port land slag cement |
| 3. | IS : 1489
(Part 1 and 2) | - Specification for port land pozzolana cement |
| 4. | IS : 8112 | - Specification for 43 grade ordinary port land cement. |
| 5. | IS : 12330 | - Specification for sulphate resisting port land cement |
| 6. | IS : 383 | - Specification for coarse and fine aggregates from natural sources for concrete. |
| 7. | IS : 432
(Part 1 and 2) | - Specification for mild steel and medium tensile steel bars and hard drawn steel wires for concrete reinforcement. |
| 8. | IS : 1786 | - Specification for high strength deformed steel bars and wires for concrete reinforcement. |
| 9. | IS : 1566 | - Specification for hard drawn steel wire fabric for |

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|-----|------------|---|---|
| 10. | IS : 9103 | - | concrete reinforcement. |
| 11. | IS : 2645 | - | Specification for admixtures for concrete. |
| 12. | IS : 4990 | - | Specification for integral cement water proofing compounds. |
| 13. | IS : 12269 | - | Specification for plywood for concrete shuttering work. |
| | | - | Specification for 53 grade ordinary portland cement. |

2.3 Code for Material Testing

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|----|------------------------------|---|--|
| 1. | IS : 4031
(Parts 1 to 15) | - | Methods of physical tests for hydraulic cement. |
| 2. | IS : 4032 | - | Methods of chemical analysis of hydraulic cement. |
| 3. | IS : 650 | - | Specifications for standard sand for testing of cement. |
| 4. | IS : 2430 | - | Methods for sampling of aggregates for concrete. |
| 5. | IS : 2386
(Parts 1 to 8) | - | Methods of test for aggregates for concrete. |
| 6. | IS : 3025 | - | Methods of sampling and test (physical and chemical) water used in industry. |
| 7. | IS : 6925 | - | Methods of test for determination of water soluble chlorides in concrete admixtures. |

2.4 Code for Material Storage

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|----|-----------|---|--|
| 1. | IS : 4082 | - | Recommendations on stacking and storing of construction materials at site. |
|----|-----------|---|--|

2.5 Code for Concrete Mix Design

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|----|------------------|---|---|
| 1. | IS : 10262 | - | Recommended guidelines for concrete mix design. |
| 2. | SP : 23
(S&T) | - | Handbook on Concrete Mixes. |

2.6 Code for Concrete Testing

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|----|-----------|---|---|
| 1. | IS : 1199 | - | Method of sampling and analysis of concrete. |
| 2. | IS : 516 | - | Method of test for strength of concrete |
| 3. | IS : 9013 | - | Method of making, curing and determining compressive strength of accelerated cured concrete test specimens. |
| 4. | IS : 8142 | - | Method of test for determining setting time of concrete by penetration resistance. |
| 5. | IS : 9284 | - | Method of test for abrasion resistance of concrete. |
| 6. | IS : 2770 | - | Methods of testing bond in reinforced concrete. |

2.7 Code for Equipment

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|-----|------------|---|
| 1. | IS : 1791 | - Specification for batch type concrete mixers. |
| 2. | IS : 2438 | - Specification for roller pan mixer. |
| 3. | IS : 4925 | - Specification for concrete batching and mixing plant. |
| 4. | IS : 5892 | - Specification for concrete transit mixer and agitator. |
| 5. | IS : 7242 | - Specification for concrete spreaders. |
| 6. | IS : 2505 | - General Requirements for concrete vibrators : Immersion type. |
| 7. | IS : 2506 | - General Requirements for screed board concrete vibrators. |
| 8. | IS : 2514 | - Specification for concrete vibrating tables. |
| 9. | IS : 3366 | - Specification for pan vibrators. |
| 10. | IS : 4656 | - Specification for form vibrators for concrete. |
| 11. | IS : 11993 | - Code of practice for use of screed board concrete vibrators. |
| 12. | IS : 7251 | - Specification for concrete finishers. |
| 13. | IS : 2722 | - Specification for portable swing weigh batchers for concrete (single and double bucket type). |
| 14. | IS : 2750 | - Specification for steel scaffoldings. |

2.8 Codes of Practice

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|-----|-----------------------------|---|
| 1. | IS : 456 | - Code of practice for plain and reinforced concrete. |
| 2. | IS : 457 | - Code of practice for general construction of plain and reinforced concrete for dams and other massive structures. |
| 3. | IS : 3370
(Parts 1 to 4) | - Code of practice for concrete structures for storage of liquids. |
| 4. | IS : 3935 | - Code of practice for composite construction. |
| 5. | IS : 2204 | - Code of practice for construction of reinforced concrete shell roof. |
| 6. | IS : 2210 | - Criteria for the design of reinforced concrete shell structures and folded plates. |
| 7. | IS : 2502 | - Code of practice for bending and fixing of bars for concrete reinforcement. |
| 8. | IS : 5525 | - Recommendation for detailing of reinforcement in reinforced concrete works. |
| 9. | IS : 2751 | - Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction. |
| 10. | IS : 9417 | - Specification for welding cold worked bars for reinforced concrete construction. |
| 11. | IS : 3558 | - Code of practice for use of immersion vibrators for consolidating concrete. |
| 12. | IS : 3414 | - Code of practice for design and installation of joints in buildings. |
| 13. | IS : 4326 | - Code of practice for earthquake resistant design and construction of building. |
| 14. | IS : 4014
(Part 1 and 2) | - Code of practice for steel tubular scaffolding. |
| 15. | IS : 2571 | - Code of practice for laying in-situ cement concrete flooring. |
| 16. | IS : 7861
(Part – 1) | - Code of practice for extreme weather concreting.
- Recommended practice for hot weather concreting. |

(Part – 2) - Recommended practice for cold weather concreting.

2.9 Code for Construction safety

1. IS : 3696 (Parts I and III) - Safety code for scaffolds and ladders.
2. IS : 7969 - Safety code for handling and storage of building materials.
3. IS : 8989 - Safety code for erection of concrete framed structures.

2.10 Code for Measurement

1. IS : 1200 (Part 1 to 28) - Method of measurement of building and engineering works.
2. IS : 3385 - Code of practice for measurement of Civil Engineering works.

3 GENERAL

- 3.1 Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve Contractor of any of his responsibilities. All materials which do not conform to this specification shall be rejected.
- 3.2 Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes / standards shall generally be used; other materials may be used after approval of the Engineer and after establishing their performance suitability based on previous data, experience or tests.

4 MATERIALS

4.1 Cement

- 4.1.1 Unless otherwise specified or called for by the Engineer, cement shall be Ordinary Portland cement conforming to IS specified above.
- 4.1.2 Where Portland pozzolana or slag cement are used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.
- 4.1.3 Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from Engineer.
- 4.1.4 Cement which is not used within 90 days from its date of manufacture shall be tested at a

laboratory approved by Engineer and until the results of such tests are found satisfactory, it shall not be used in any work.

4.2 Aggregates (General)

4.2.1 General

4.2.1.1 "Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete (vide BIS 456 & BIS 383) and conforming to tests as per BIS 2386 (Part I to VI).

4.2.1.2 "Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve.

4.2.1.3 All fine and coarse aggregates proposed for use in the works shall be subject to the Engineer-in-Charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-charge.

4.2.1.4 Aggregates shall consist of natural sand, stone (crushed or uncrushed) and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, durable against weathering, or limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mix design" and preliminary tests on concrete specified later. The aggregates shall be brought from the source as mentioned in Volume-I Clause C.1.39.

4.2.2 Sampling and testing

4.2.2.1 Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer-in-charge in advance of the work, for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by the contractor.

4.2.3 Storage of aggregates

4.2.3.1 All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign material and earth during storage and while heaping the materials shall be avoided. The aggregates must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be piled in layers not exceeding 1.20 m in height to prevent coning or segregation. Each layer shall cover the entire area of stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

4.2.4 Specific Gravity

4.2.4.1 Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be

used.

4.3 *Fine Aggregate*

4.3.1 Fine aggregate shall consist of natural or crushed sand conforming to IS 383 conforming to tests as per IS 2386 part I to IV. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities / strength/ durability of concrete.

4.3.2 Screening and Washing : Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.

4.3.3 Foreign Material limitations : The percentage deleterious substances in sand delivered to the mixer shall not exceeding the following :

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron IS sieve	3.0	15.0
2	Shale	1.0	--
3	Coal and Lignite	1.0	1.0
4	Clay Lumps	1.0	1.0

4.3.4 Gradation : Unless otherwise directed or approved by the Engineer-in-charge, the grading of sand shall be within the limits indicated hereunder.

IS : Sieve Designation	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
10 mm	100	100	100	100
4.75 mm	99 – 100	90 – 100	90 – 100	95 – 100
2.36 mm	60 – 95	75 – 100	85 – 100	95 – 100
1.18 mm	30 – 70	55 – 90	75 – 100	90 – 100
600 microns	15 – 34	35 – 59	60 – 79	80 – 100
300 microns	5 – 20	8 – 30	12 – 40	15 – 50
150 microns	0 – 10	0 – 10	0 – 10	0 – 15

4.3.4.1 Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 microns IS sieve, by total amount not exceeding 5%, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to grading zone IV shall not be used. Mix designs and preliminary tests shall show its suitability for producing concrete of specified strength and workability.

4.3.5 *Fineness Modulus*

The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.35 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by 100.

4.4 Coarse Aggregate

4.4.1 Coarse aggregate for concrete, except as noted above, shall conform to IS 383 and IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

4.4.2 Screening and Washing : Crushed rock shall be screened and or washed for the removal of dirt or dust coating, if so requested by the Engineer-in-charge.

4.4.3 Grading

4.4.3.1 Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits :

Sieve Size (mm)	Percentage passing for single sized aggregate of normal size					Percentage passing for graded aggregate of normal size			
	40 mm	20 mm	16 mm	5 mm	10 mm	40 mm	20 mm	16 mm	2.5 mm
75	100	100	100	100	100	100	100	100	100
40	100	100	100	100	100	100	100	100	100
20	100	100	100	100	100	100	100	100	100
16	100	100	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100	100	100
7.5	100	100	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100	100	100
4.75	100	100	100	100	100	100	100	100	100
4.25	100	100	100	100	100	100	100	100	100
3.75	100	100	100	100	100	100	100	100	100
3.0	100	100	100	100	100	100	100	100	100
2.5	100	100	100	100	100	100	100	100	100
2.0	100	100	100	100	100	100	100	100	100
1.5	100	100	100	100	100	100	100	100	100
1.18	100	100	100	100	100	100	100	100	100
0.75	100	100	100	100	100	100	100	100	100
0.6	100	100	100	100	100	100	100	100	100
0.425	100	100	100	100	100	100	100	100	100
0.3	100	100	100	100	100	100	100	100	100
0.25	100	100	100	100	100	100	100	100	100
0.15	100	100	100	100	100	100	100	100	100
0.075	100	100	100	100	100	100	100	100	100

4.4.3.2 The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability of concrete. The maximum size of coarse aggregate shall be 40 mm for M7.5 and M10 and 20 mm for M15 to M20 concrete, or as directed by the Engineer-in-charge or specified otherwise. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than $\frac{1}{4}$ th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. for heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover reinforcement whichever is smaller.

4.4.4 Foreign material limitations

4.4.4.1 The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following :

No.	Foreign Material	Percentage by weight	
		crushed	Crushed
1	Material finer than 75 micron	3.0	3.0

	re		
2	nd lignite	1.0	1.0
3	umps	1.0	1.0
4	agments	3.0	--

4.5 *Water*

4.5.1 Water used for both mixing and curing shall conform to IS : 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

4.6 **Reinforcement**

4.6.1 Reinforcement bars shall conform to IS : 432, IS : 226 or IS : 1786 and the welded wire fabric to IS : 1566 as shown or specified on the drawings.

4.6.2 All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty dust or any other substance that will destroy or reduce bond.

4.6.3 If permitted by Engineer, welding of reinforcement shall be done in accordance with IS ; 2751 or IS : 9417 as applicable.

4.7 *Admixtures*

4.7.1 Plasticizer, water-reducing admixture and concrete water proofer shall conform to IS : 9103 and integral water proofing admixtures to IS : 2645. Dosage of plasticizer used in concrete work shall be 300 ml / 50 kg of cement. Manufacturer must comply ISO-9002 specifications.

4.7.2 Admixtures may be used in concrete as per manufacturer's instructions only with the approval of Engineer based upon evidence that with the passage of time neither the compressive strength nor its durability is reduced. An admixture's suitability and effectiveness shall be verified by trial mixes with the other material used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedments.

4.7.3 Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

4.8 *Wastage*

4.8.1 No wastage allowance for cement and steel shall be considered and paid for.

5 *SAMPLES AND TESTS*

- 5.1 All materials used for the works shall be tested before use.
- 5.2 Manufacturer's test certificate shall be furnished, for each batch of cement / steel and when directed by Engineer samples shall also be got tested by the Contractor in a laboratory approved by Engineer at no extra cost to Client. However, where material is supplied by Client, all testing charges shall be borne by Client; but transportation of material samples to the laboratory shall have to be done by Contractor at no extra cost.
- 5.3 Sampling and testing shall be as per IS : 2386 under the supervision of Engineer. The cost of all tests, sampling etc. shall be borne by Contractor.
- 5.4 Water to be used shall be tested to comply with requirement of IS : 456.
- 5.5 Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed the admixture shall be got tested and approved laboratory at no extra cost.

6 *STORING OF MATERIALS*

- 6.1 All material shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS: 4082 shall be complied with.
- 6.2 Contractor will have to make his own arrangements for the storage of adequate quantity of cement even if cement is supplied by Client. Cost of such rejected cement, where cement is supplied by Client, shall be recovered at issue rate or open market rate which ever is higher. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by Engineer. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order or receipt.
- 6.3 Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.
- 6.4 Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.
- 6.5 The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground / water. Each type and size shall be stacked separately.

7 *CONCRETE*

7.1 *General*

Concrete grade shall be as designated on drawings. In concrete grade M15, M20, M25 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS : 456. Concrete in the works shall be "**Design**

Mix Concrete” or “Normal Mix Concrete”. All concrete works of **grade M5, M7.5 and M10 shall be Nominal whereas all other grades, M15 and above, shall be Design Mix Concrete.**

7.2 *Design Mix Concrete*

7.2.1 *Mix Design and Testing*

7.2.1.1 For Design Mix Concrete, the mix shall be designed according to IS : 10262 and SP: 23 to provide the grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS : 456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For water retaining structures, the mix shall also result in water-tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

7.2.1.1.1 **Ready mix concrete/Batch Mix Plant**

Minimum cement consumption shall be as specified in tender document. However, necessary computer print out for consumption of all materials and admixtures if permitted shall be made available as and when required in any frequencies as directed by Engineer –in-charge.

Necessary slump requirements at the pouring places shall be made available with ready mix concrete.

Concrete mix shall be design for 33% higher strength than the grade of concrete specified. The proportions for ingredients chosen shall be such that concrete has adequate workability for condition prevailing on the work in question and can be properly compacted with the means available. Use of cementitious material like Fly ash etc. shall not be permissible.

Except where it can be shown to the satisfaction of the Engineer-in-charge that a supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate should be strictly controlled. The different sizes shall be stocked in separate stock piles. Required quality of material shall be stock-piled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples use in the design mix.

The quantity of both cement and aggregate shall be determined by weight. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water – cement ratio constants and its correct value. To this end, the moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water

shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS: 2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weights of aggregates due to variation in their moisture content.

The special Conditions / Specification regarding RMC are as follows.

The details like locations, capacity, experience, delivery schedule etc. of the RMC agency shall be submitted by the successfully tenderer for prior approval of the undersigned.

The RMC shall be conforming to IS :4926 with its latest amendments.

All the responsibility of RMC i.e. procurement for all materials, operation of plant and machinery, transit mixers, pumping machineries relevant piping etc. shall be on the account of the contractor.

The GMDC shall not be held responsible for any delay / damage / loss due to deployment of RMC for this project.

The octroi for the RMC shall have to be borne by the contractor as per prevailing rates.

RMC process shall be fully automatic and computerized concrete batch mix plant.

When a transit mixer is used for transportation of concrete, no extra water should be added to the concrete from else where after initial introduction of mixing water from the batch, except when on arrival at the site of the work, the slump of the concrete is less than that specified : such additional water to bring the mixer under such pressure and direction of flow that requirements for uniformity are met.

Records and certificates : The contractor/GMDC shall keep from the manufacture batch records of the quantities by mass of all mixing and of the results of all tests. If required by the GMDC, the contractor shall furnish certificates, at agreed intervals, giving this information.

The contractor shall supply the following information for guidance of the manufacturer :

- Concrete as per approved mix design, as per specific concrete quality.
- The type of cement to be used
- Details Specification of aggregates to be used.
- Type of admixture to be used. If specified.
- Min. acceptable strength
- Slump of concrete or compaction factor
- Ages at which the test cubes or beams are to be tested and the frequency and number of test to be made.
- Any other requirement.

Tolerance : Unless otherwise agreed to between the GMDC and the contractor, the concrete shall be deemed to comply with the requirements of this, if these results of testes where applicable lie with in the tolerance specified below.

Consistency of workability : The slump average of two tests shall not differ from the specified value by + 10 mm for a specified slump of 75 mm. The compacting factor average of two test shall be within + 0.03 of the value specified. If any other method of determining consistency to be used a suitable tolerance shall be agreed to be between the purchaser and the manufacture. The tests for consistency or workability shall be complete within 15 minutes of the time of receipt of the ready mix concrete at the site.

Aggregate : When tested in accordance with IS 2386 (Part-I) 1963, the quantity of aggregate larger than the max size specified by the purchaser shall not exceed 5% of the qty. of coarse aggregate and all such pass sieve of next higher size.

7.2.1.2 Unless otherwise specifically mentioned, the minimum cement content for Design Mix Concrete shall be as given below.

Grade of Concrete Kg/Cu.M. of concrete	Minimum Cement Content in
M15	260
M20	320
M25	360
M30	400

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventually and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

7.2.1.3 It shall be Contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to Engineer at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS : 516 shall comply with the requirements of IS : 456.

Grade of Concrete	Minimum Compressive Strength (N/Sq.mm at 7 days)	Specified compressive strength (N/Sq.mm at 28 days)
M 15	10.0	15.0
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0

7.2.1.4 A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer is given below :

Structure / Member	Slump in millimeters
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	Maximum	Minimum
Reinforced foundation walls and footings	75	25
Footings, caissons and substructure walls	75	25
and massive compressor foundations	50	25
Beams and reinforced walls	100	25
and miscellaneous equipment foundations	75	25
Piling columns	100	25
Elements	50	25
Mass construction	50	25

7.2.2 *Batching and Mixing of Concrete*

7.2.2.1 Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

7.2.2.2 Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water cement ratio specified shall be maintained. Each time the work stops, the mixer shall be cleaned out and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

7.2.2.3 Arrangement should be made by Contractor to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of Engineer. Sampling and testing of strength and workability of concrete shall be as per IS : 1199, IS : 516 and IS : 456.

7.3 *Nominal Mix Concrete*

7.3.1 *Mix Design and Testing*

7.3.1.1 Mix design and preliminary tests are not necessary for Nominal mix Concrete. However works tests shall be carried out as per IS : 456. Proportions for Nominal Mix Concrete and **water / cement ratio may** be adopted as per Table 3 of IS : 456. However it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

7.3.2 *Batching and Mixing Concrete*

7.3.2.1 Based on the adopted nominal mixes, aggregates and cement shall be measured by weight.

8 *FORM WORK*

8.1 Form work shall be all inclusive and shall consist of but not limited to shores, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, false work, wedges etc.

8.2 The design and engineering of the formwork as well as its construction shall be the responsibility of Contractor. However, if so desired by Engineer the drawings and

calculations for the design of the formwork shall be submitted to Engineer for approval.

8.3 Formwork shall be designed to fulfill the following requirements :

- a) Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.
- b) Made of suitable materials.
- c) Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits.
- d) Capable of withstanding without deflection the worst combination of self weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
- e) Capable of easily striking without shock, disturbance or damage to the concrete.
- f) Soffit forms capable of imparting a camber if required.
- g) Soffit forms and supports capable of being left in position if required.
- h) Capable of being cleaned and / or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.

8.4 The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip form may be used with the approval of Engineer. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, work holes, warps and other surface defects. Joints between formwork and formwork and between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.

8.5 The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.

8.6 Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of Engineer. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

8.7 Permanent formwork shall be checked for its durability and capability with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

8.8 Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.

8.9 For liquid retaining structures sleeves shall not be provided for through bolts or shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

8.10 Where specified or shown on drawings, all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size.

8.11 Forms for substructure may be omitted when, in the opinion of Engineer, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations

shall be slightly larger, as directed by Engineer, than that required as per drawing to compensate for irregularities in excavation.

- 8.12 The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.
- 8.13 The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side limit the drop of concrete to 1.0 m or as directed by Engineer. The Contractor shall temporarily and securely fix items to be cast in (embedments / inserts) in a manner that will not hinder the striking of forms or permit loss of grout.
- 8.14 Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty form work, shall be entirely removed and formwork corrected prior to placement of new concrete at the cost of the Contractor.
- 8.15 The striking time for formwork shall be determined based on following requirements :
- a) Development of adequate concrete strength;
 - b) Permissible deflection at time of striking form work;
 - c) Curing procedure employed – its efficiency and effectiveness;
 - d) Subsequent surface treatment to be done;
 - e) Prevention of thermal cracking at re-entrant angles;
 - f) Ambient temperature; and
 - g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).
- 8.16 Under normal circumstances (generally where temperatures are above 20 Deg. C) forms may be struck after expiry of the time period given in IS : 456, unless directed otherwise by Engineer. For port land pozzolona / slag cement the stripping time shall be suitably modified as directed by the Engineer. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stressed arising during the construction period.

9 *Reinforcement Workmanship*

- 9.1 Reinforcing bars supplied bent or in coils shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg. C. Local warming may be permitted if steel is kept below 100 Deg. C.
- 9.2 All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings / schedules or as directed by Engineer.
- 9.3 Re-bending or straightening incorrectly bent bars shall not be done without approval of Engineer.
- 9.4 Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.
- 9.5 Binding wire shall be 16 gauge soft annealed wire. Ends of the binding wire shall be bent

away from the concrete surface and in no case encroach into the concrete cover.

- 9.6 Substitution of reinforcement, laps / splices not shown on drawing shall be subject to Engineer's approval.

10 TOLERANCES

- 10.1 Tolerance for formed and concrete dimensions shall be as per IS : 456 unless specified otherwise.
- 10.2 Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

11 PREPARATION PRIOR TO CONCRETE PLACEMENT

- 11.1 Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets etc. provided.
- 11.2 All arrangements formwork, equipment and proposed procedure, shall be approved by Engineer. **The Contractor shall maintain separate Pour Card for each pour as per the format enclosed** and shall produce before commencement of concreting to Engineer-in-charge.

12 TRANSPORTING, PLACING AND COMPACTING CONCRETE

- 12.1 Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.
- 12.2 In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation concrete shall not be rehandled or caused to flow. For locations where direct placement is not possible and in narrow forms. The Contractor shall provide suitable drops and 'Elephant Trunks'. Concrete shall not be dropped from a height of more than 1.0 m as stipulated in clause 8.13.
- 12.3 Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and shall never be allowed to fall freely through the water.
- 12.4 While placing concrete the Contractor shall proceed as specified below and also ensure the following :
- a) Continuously between construction joints and predetermined abutments.
 - b) Without disturbance to forms or reinforcement.
 - c) Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.
 - d) Without dropping in a manner that could cause segregation or shock.
 - e) In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.
 - f) Do not place if the workability is such that full compaction cannot be achieved.
 - g) Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the lining progressively as concrete is placed.
 - h) If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.

- i) Ensure that there is no damage or displacement to sheet membranes.
 - j) Record the time and location of placing structural concrete.
- 12.5 Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set. Over vibration shall be avoided.
- 12.6 Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.
- 12.7 Except when placing with slip forms, each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as determined by Engineer. Concrete shall be protected against damage until final acceptance.

13 *MASS CONCRETE WORKS*

- 13.1 Sequence of pouring for mass concrete works shall be as approved by Engineer. The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

14 *CURING*

- 14.1 Curing and protection shall start immediately after the compaction of the concrete to protect it from :
- (a) premature drying out, particularly by solar radiation and wind;
 - (b) leaching out by rain and flowing water;
 - (c) rapid cooling during the first few days after placing;
 - (d) high internal thermal gradients;
 - (e) low temperature of frost;
 - (f) vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.
- 14.2 All concrete, unless directed otherwise by Engineer, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of sacking, canvas, hessian or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.
- 14.3 Where a curing membrane is directed to be used by the Engineer, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be got approved from the Engineer before use and shall be applied with spraying equipment capable of a smooth, even textured coat.
- 14.4 Curing may also be done by covering the surface with an impermeable material such as

polyethylene, which shall be well sealed and fastened.

- 14.5 Extra precautions shall be exercised in curing concrete during cold and hot weather.

15 CONSTRUCTION JOINTS AND KEYS

- 15.1 Construction joints will be as shown on the drawing or as approved by Engineer. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approved of Engineer.
- 15.2 Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as directed by Engineer.
- 15.3 Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing / hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical joints and a 15 mm thick layer of cement sand mortar for horizontal layers, the ratio of cement and sand being the same as in the concrete mix.
- 15.4 When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this a layer of concrete not exceeding 150 mm thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

16 FOUNDATION BEDDING

- 16.1 All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy area shall be cleaned out and back filled with either soil cement mixture, lean concrete or clean sand compacted as directed by Engineer. The surfaces of absorptive soils shall be moistened.
- 16.2 Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

17 FINISHES

17.1 General

- 17.1.1 The formwork for concrete works shall be such as to give the finish as specified. The Contractors shall make good as directed any unavoidable defects consistent with the type of concrete and finish specified; defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

17.2 Surface finish Type F1

- 17.2.1 This type of finish shall be for non-exposed concrete surface against which back fill or concrete is to be placed. The main requirement is that of dense, well compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surfaces below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which could interfere with proper and effective application of waterproofing material specified for use.

17.3 *Surface finish Type F2*

17.3.1 This type of finish shall be for all concrete work which will be exposed to view upon completion of the job. The appearance shall be that of a smooth dense, well-compacted concrete showing the slight marks of well fitted shuttering joints. The Contractor shall make good any blemishes.

17.4 *Surface finish Type F3*

17.4.1 This type of finish shall be for concrete work which will be exposed to view but to give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discoloration, blemishes, arrises, air holes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. Any minor blemishes that might occur shall be made good by Contractor.

17.5 *Integral cement finish on concrete floor*

17.5.1 In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screened off to proper level and tamped with tamper having conical projections so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the Engineer shall be supplied and used as recommended by the manufacturer.

18 *REPAIR AND REPLACEMENT OF UNSATISFACTORY CONCRETE*

18.1 Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be brought to the notice of Engineer who may permit patching of the defective areas or reject the concrete work.

18.2 All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

18.3 Rejected concrete shall be removed and replaced by Contractor at no additional cost to Client.

18.4 For patching of defective areas all loose materials shall be removed and the surface shall be prepared as directed by the Engineer.

18.5 Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the Engineer as to the method of repairs to be adopted shall be final and binding on the Contractor and no extra claim shall be entertained on this account. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as directed by Engineer.

19 *VACUUM DEWATERING OF SLABS*

19.1 Where specified floor slabs, either on grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and trowelling as per equipment manufacturers recommendation. The equipment to be used shall be subject to Engineer's approval.

20 **HOT WEATHER REQUIREMENTS**

- 20.1 Concreting during hot weathers shall be carried out as per IS : 7861 (Part – I)
- 20.2 Adequate provisions shall be made to lower concrete temperatures which shall not exceed 40 Deg. C at the time of placement of fresh concrete.
- 20.3 Where directed by Engineer, Contractor shall spray non-wax based curing compound of unformed concrete surfaces at no extra costs.

21 COLD WEATHER REQUIREMENTS

- 21.1 Concreting during cold weather shall be carried out as per IS : 7861 (Part-II).
- 21.2 The ambient temperature during placement and upto final set shall not fall below 5 Deg. C. Approved antifreeze / accelerating additives shall be used where directed.
- 21.3 For major and large scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the formwork and its insulation and stripping period shall be closely monitored.

22 LIQUID RETAINING STRUCTURES

- 22.1 The Contractor shall take special care of concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.
- 22.2 The minimum level of surface finish for liquid retaining structures shall be type F2. All such structures shall be hydro-tested.
- 22.3 The Contractor shall include in his price of hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipelines etc.
- 22.4 Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.
- 22.5 Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement / epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer. All such rectification of the Client / Engineer at no extra cost to the Client.

23 TESTING CONCRETE STRUCTURES FOR LEAKAGE

- 23.1 Hydro-static test for water tightness shall be done at full storage by Engineer, as described below :
 - 23.1.1 In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.
 - 23.1.2 In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs.

over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven day shall be taken as an indication of the water tightness of the structure. The Engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account weather the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

23.1.3 Each compartment / segment of the structure shall be tested individually and then all together.

23.2 For structures such as pipes, tunnels etc. the hydro-static test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

24 OPTIONAL TESTS

24.1 If Engineer feels that the materials i.e. cement, sand coarse aggregates, reinforcement and water are not in accordance with the specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer, as per relevant IS Codes. Client shall pay only for the testing of material supplied by the Client, otherwise Contractor shall have to pay for the tests. Transporting of all material to the laboratory shall however be done by the Contractor at no extra cost to Client.

24.2 In the even of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, Engineer reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. All these tests shall be carried out by Contractor at no extra cost to the Client. Alternatively Engineer also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work at the cost of Contractor.

24.3 If the structure is certified by Engineer as having failed, the cost of the test and subsequent dismantling / reconstruction shall be borne by Contractor.

24.4 The quoted unit rates / prices of concrete shall be deemed to provide for all tests mentioned above.

25 GROUTING

25.1 Grout shall be provided as specified on the drawings. The proportion of standard Grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. Surface to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by ENGINEER. The grout proportions shall be limited as follows :

	Use	Grout Thickness	Mix Proportions	Ratio (max.)
	Thin mix	25 mm	1 part Portland cement to one part sand.	0.44
	Normal mix	25 mm and over but less than 50 mm	1 part Portland cement to 2 part sand.	0.53
	Rich mix	50 mm and over	1 part Portland cement to 3 part sand.	0.53

25.2 *Non Shrink Grout*

25.2.1 Non-shrink grout where called for in the Schedule of Quantities or specified on the drawings shall be provided in strict accordance with the manufacturer's instructions/specifications on the drawings.

26 *INSPECTION*

26.1 All materials, workmanship and finished construction shall be subject to continuous inspection and approval of Engineer. Materials rejected by Engineer shall be expressly removed from site and shall be replaced by Contractor immediately at no extra cost to Client.

27 *CLEAN-UP*

27.1 Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood etc. resulting from the work shall be removed and the premises left clean.

28 *ACCEPTANCE CRITERIA*

28.1 Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

- a) Properties of constituent materials;
- b) Characteristic compressive strength;
- c) Specified mix proportions;
- d) Minimum cement content;
- e) Maximum free-water / cement ratio;
- f) Workability;
- g) Temperature of fresh concrete;
- h) Density of fully compacted concrete;
- i) Cover to embedded steel;
- j) Curing;
- k) Tolerances in dimensions;
- l) Tolerances in levels;
- m) Durability;
- n) Surface finishes;
- o) Special requirements such as :

- i) water tightness;
- ii) resistance to aggressive chemicals
- iii) resistance to freezing and thawing
- iv) very high strength
- v) improved fire resistance
- vi) wear resistance
- vii) resistance to early thermal cracking

28.2 The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding of the Contractor.

28.3 For work not accepted, the Engineer may review and decide whether remedial measures are feasible so as to render the work acceptable. The Engineer shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor. Nothing extra shall become payable to the Contractor by the Client for executing the remedial measures.

Materials such as Cement, sand, coarse aggregate, bricks, reinforcement, water etc. to be used for this work shall be conforming to specification laid down in material section.

Location

Chamber shall be constructed at places approved by the Employer's Representative. Where valves are provided for maintenance of the pipeline.

Excavation / P.C.C.

Excavation, shoring, dewatering/ P.C.C. etc. for the pits of chambers, laying of pipes and fittings/specials shall be done in accordance with Employer's Requirements described elsewhere in the document.

Bed Concrete

The bed concrete 150 mm thick for chamber shall be done in C.C. 1:4:8 as directed by the Engineer-in-charge using trap metal of 25 mm to 40 mm.

Bricks

Bricks used for construction of manholes shall conform to the relevant Indian Standards. They shall be sound, hard, and homogeneous in texture, well burnt in kiln without being vitrified, table molded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square and parallel faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles, which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours, shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. The bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 50 kg/sq.cm. The class and quality requirements of bricks shall be as laid down in IS: 1077.

The size of the brick shall be 23.0 x 11.5 x 7.5 cm. unless otherwise specified; but tolerance up to \pm 3 mm in each direction shall be permitted. Only full size brick shall be used for masonry work. Brick bats shall be used only with the permission of Employer's Representative to make up required wall length or for bonding.

Sample

bricks shall be submitted to the Employer's Representative for approval and bricks supplied shall conform to approved samples. If required by the Employer's Representative, brick sample shall be tested as per IS: 3495 by Contractor. Bricks rejected by the Employer's Representative shall be removed from the Site within 24 hours.

Cement Mortar

Mortar for masonry shall be as per IS: 2250. Chambers shall be constructed in brick masonry with cement mortar (1:6) unless otherwise specified. Gauge boxes for sand shall be of such dimensions that one bag containing 50 kg. of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be as approved by the Employer's Representative. If required by the Employer's Representative sand shall be thoroughly washed till it is free of any contamination.

For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry conditions. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall be used within 25 minutes of mixing. Mortar left unused in the specified period shall be rejected.

The Contractor shall arrange for tests on mortar samples if so required by Employer's Representative. Re-tempering of mortar shall not be permitted.

Brick Masonry

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work of

Chambers shall be in the proportion specified in drawing. Brick work 230 mm thick and over shall be laid in English Bond unless otherwise specified. 115 mm thick brick work shall be laid with stretchers. For laying bricks, a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

All brickwork shall be in plumb and square/ circular unless otherwise shown on drawing and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be leveled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes unless otherwise specified. All interconnected brickwork shall be carried out at nearly one level so that there is uniform distribution of pressure on the supporting structure and no portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible, the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding 45 degrees. But in no case the level difference between adjoining walls shall exceed 1.25 M. Workmanship shall conform to IS: 2212.

Brick shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plastering to be done. When plastering is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If mortar in the lower courses has begun to set, the joints shall be raked out to a depth of 12 mm before another course is laid.

Cement Plaster

All joints in masonry shall be raked to a depth of 12 mm with hooked tool made for the purpose when the mortar is still green and in any case within 48 hours of its laying. The surface to be rendered shall be washed with fresh clean water free from all dirt, loose material, grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be rendered will however be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall

be uniform to get uniform bond between the plaster and the wall.

The proportion of the cement mortar shall be as approved on relevant drawings. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as per relevant I.S. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to remain for more than 25 minutes after mixing with water.

Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

Plastering shall be done on inner face of brick masonry in cement mortar (1:3) and 15 mm thick unless otherwise specified.

Cement pointing in C: M (1:3) shall be done on outside the chamber including racking out joints, curing etc. complete as directed by the engineer-in-charge.

Cement Concrete Block

The C.C. blocks for the chamber shall be constructed in cement concrete of M15 grade to take care of weight of valves.

Pipe Entering or Leaving Chamber

Whenever a pipe enters or leaves a chamber, bricks on edge must be cut to a proper form and laid around the upper end of the pipe so as to form an arch. All around the pipes, there shall be a joint of cement mortar (1:2) 13 mm thick between it and the bricks.

Precast Reinforced Cement Concrete Slab with key holes

Precast Reinforced cement concrete top slab shall be casted in pieces for covering the chamber. Necessary keyholes shall be provided at appropriate place for operation of spindle of valve. The minimum thickness of slab shall be 100mm and same shall be casted in C.C. of M20 grade. The required reinforcement shall be provided. The top & bottom surface of precast slab shall be finished with cement mortar 1:3.

Measurement and Payment - As per payment schedule.

Extra depth of valve chamber. beyond 1.00 mt. depth.

The work shall be measured and paid for additional meter depth of chamber beyond 1.0 m depth. The work in general shall be carried out as per instructions & approval of engineer in charge.

Item No 7

Providing bedding incl. ramming, watering, levelling, consolidating etc. Complete as per standard and instruction of engineer incharge with required quality Sand brought from outside including all lead.

As per General Specification

Item No 8

Refilling of pipeline trenches Refilling the pipeline trenches incl. ramming, watering, consolidating disposal of surplus stuff as directed within a radius of 3 km

REFILLING OF TRENCHES:

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of Trench Excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. The excavated material nearest to

the trench shall be used filling. Care shall be taken during backfilling, not to injure or disturb the pipes, joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline unless the trench has been filled to height of at least 30cm over the top of the pipe except as may be necessary for tamping etc., during backfilling work.

The remaining portion of the trench may be filled in with a mixture of hard and soft material free from boulders and clods of earth larger than 150mm in size if sufficient quantity of good earth and murrum are not available. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The top 300mm layer or fertile agricultural soil shall be kept aside during excavation and shall be laid in layers near ground level during refilling.

To prevent buckling of pipe shell of diameters 1200mm and above, pipes shall be strutted from inside while the work of refilling is in progress, for which no separate payment shall be made.

Strutting shall be done by means of strong spiders having at least 6 arms which shall be sufficiently stiff to resist all deformation. Spiders shall be provided at a maximum interval of 2m & shall be welded in such a way that internal coating does not get burnt.

The Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be for filling and in which portion of the site and in what manner it shall be so used.

If any material remains as surplus it shall be disposed of as directed by the Engineer, which includes loading, unloading, transporting and spreading as directed within all lead. If the Contractor fails to remove the earth from site within 7 days after the period specified in a written notice, the Engineer may arrange to carry out such work at the Contractor's risk and cost or may impose such fine for such omission as he may deem fit. Particular care shall be taken to keep the trench dry during the entire refilling operation.

If suitable material for refilling is not available for excavation the Contractor shall bring earth, murrum of approved quality as directed by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval of the Engineer has been obtained.

Subsidence in filling in : Should any subsidence take place either in the filling of the

trenches or near about it during the maintenance period of 24 months from the completion of the Contract Works, the Contractor shall make good the same at his own cost or the Engineer may without notice to the Contractor, make good the same in any way and with any material that he may think proper, at the expense of the Contractor. The Engineer may also, if he anticipates occurrence of any subsidence, employ persons to give him timely notice of the necessity of making good the same, and the expenses on this account shall be charged to the Contractor.

SCHEDULE-B3

RCC Platform for Package type STP

Item No.- 1

Excavation for foundation up to 1.5 mt depth including sorting out and stacking of useful materials and disposing of the excavated stuff up with all lead & lift (Manual Labour) (a)Dense and hard soil

0 to 1.5 mt depth.

As per above item of Schedule – B1 of item-4

Item No.-2

Providing and laying cement concrete 1:4:8 (1Cement : 4- coarse sand : 8- hand broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth

As per above item of Schedule – B1 of item-5

1.0 MATERIALS:

Water as per General specification. Cement shall conform to General specification. Sand shall conform to General specification. Stone aggregate 40 mm. nominal size shall conform to General specification.

WORKMANSHIP:

General:

Before starting concrete bed of foundation trenches shall be cleared of all loose materials, leveled, watered, and rammed as directed.

Proportion of Mix:

The proportion of cement, sand and coarse aggregate shall be one part of cement, 4 parts of sand, 8 parts of stone aggregates and shall so measured by volume.

Mixing:

The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case of break-down of machinery's and in the interest of the work. it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mixing in mechanical mixer shall be done for a period 1 to 2 minutes. The quantity of water shall be sufficient to produce a dense concrete of required workability for the purpose.

Transporting & placing the concrete:

The concrete shall be handled from the place of mixing to the final position in not more than 15 minutes by the method as directed and shall be placed into its final position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences.

The concrete shall be laid in layers of 15 cms. to 20 cms.

Compacting:

The concrete shall be rammed with heavy iron rammers and rapidly to get the

required compaction and to allow all the interstices to be filled with mortar.

Curing:

After the final set, the concrete shall be kept continuously wet, if required by pounding for a period of not less than 7 days from the date of placement.

2.0. MODE OF MEASUREMENT AND PAYMENT:

The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plans or directed.

The rate shall be for a unit of one cubic meter.

Item No.-3

Providing and cast in situ C.C. in grade M-25 (1:1:2) proportions of ingredients as per mix design by weigh batching using granite, quartzite trap metal of size 12 mm to 20 mm and or 6 mm to 12 mm including scaffolding centering formwork, needle vibrated consolidation, curing and hydraulic testing etc. complete (excluding cost of reinforcement) with centering and shuttering/deshuttering etc. comp. up to 6 meter height /depth Av. G.L.for all water retaining structures

Flat bottom slab/floor slab/slab without shuttering

Flat bottom slab/floor slab/slab with shuttering

Vertical Wall Above 15 cm and up to 20 cm

As per above item of Schedule – B1 of item-5

Item No.-4

Providing ISI Mark TMT Bars Fe415 reinforcement for RCC work including bending, binding and placing in position complete .

Specification for TMT bars reinforcement (Fe-415)

1 Scope of work :

The scope of work consists of providing and laying TMT reinforcement for RCC works of various components of the structure. This may be Tiscon or any other approved manufacturer branch and corrosion resistant steel bars approved by the Engineer-in-charge. This includes cuttings, bending, binding, placing, with all equipments and labour required for the work as directed by the City Engineer, GMDC, Ahmedabad and all operations covered within the intent and purpose of the specification.

2 Bending of Reinforcement :

Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision)

Bars shall be bent cold to the specified shape and dimensions or as directed by the City Engineer, GMDC, Ahmedabad using a proper bar bender, operated by hand or power to attain proper radii of bends.

Bars shall not be bent or strengthened in a manner that will cause injury to the material.

Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending.

The bending of the TMT bars shall be carried out as per the following :

No.	Operation	Size	TMT Fe-415
1		2 mm dia.	3d
		2 mm dia.	4d
2	d	0 mm dia.	4d
		0 mm dia.	5d

3 Placing of Reinforcement :

All reinforcing bars shall be accurately placed in the exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS : 280 and by using stays blocks or metal chairs, spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation over the work. All devices used for positioning shall be of no corrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices.

Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed.

To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.

In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed upto a level just below them.

Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the City Engineer, GMDC, Ahmedabad. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight in eight shape around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

4 Welding of Bars

Welding of TMT bars can be permitted if specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than 33 per cent of the rods are welded. No pre-warming or post heat treatment is necessary. Inter pass temperature should be limited to 200°C with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned property. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint

and other foreign matter before welding. Only competent welders shall be employed on the work. Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer, GMDC,

Item No.-5

Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth consolidating each deposited layer by ramming and watering. Compaction of soil is 95%

As per above item of Schedule – B1 of item-8

Item No.-6

Cement plaster 20 mm thick in C.M. 1:2 using water proofing compound of approved quality including finishing etc. complete.

CEMENT PLASTER WORK

- 1 All joints in masonry shall be raked to a depth of 12 mm with a hooked tool made for the purpose when the mortar is still green and in any case within 48 hours of its laying. The surface to be rendered shall be washed with fresh clean water free from all dirt, loose plastering work is commended. Concrete surfaces to be rendered will however be kept dry. The wall should not too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall.
- 2 The proportion of the mortar shall be as specified under the respective items of work. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as per IS : Standards. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to stand for more than 25 minutes after mixing with water.
- 3 Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. The decision, as to when the plaster has hardened, will be given by the Engineer. Curing shall be done by continuous applying water in a spray and shall be carried out for at least 7 days.
- 4 Whenever the specifications or the item of work calls for water proofing, the Contractor shall provide the percentage of water proofing compound as specified in the items of work.
- 5 Where lath plaster is specified, it shall be paid for at the same rate as for plasterwork without metal lath except that separate payment for metal lath will be made.
- 6 Ceiling plaster shall be done before wall plaster and wall plaster shall commence at top and work downwards.
- 7 **Interior plaster** - This plaster shall be laid in two coats of 12 and 8 mm for 20 mm and single coat for 15 mm & 10 mm thickness. The mortar shall be dashed on the prepared surface with a trowel and finished smooth by trowelling on the surface with Neeru (lime cream). Neeru shall be properly slaked fat lime. The standard of finish expected is high and shall conform to IS : 2394. Interior plaster shall be carried out on jambs, lintel and sill faces, top and undersides etc. as shown in the drawing or as directed by the Engineer.

Rate quoted for plasterwork shall be deemed to include plastering of all those surfaces. However, if the item of work includes plaster finish, no separate payment would be made under 'plastering work'.

- 8.1 **Exterior Plaster** – Exterior plasterwork shall be carried out in 2 layers. The first layer being 12 mm thick and the second layer being 8 mm thick. The first layer shall be dashed against the prepared surface with a trowel to obtain as even surface. The second layer shall then be applied and finished leaving as even and uniform surface, trowel finished unless otherwise directed by the Engineer.
- 8.2 **Exterior Sand Faced Plaster** – The plaster shall be applied in 2 coats. The first coat or the scratch coat should be approximately 12 mm and shall be continuously carried be without break to the full length of wall or natural breaking points such as doors, windows etc. The scratch coat shall be dashed on the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this scratch coat shall be as specified in the respective item of work. The scratch coat shall be cured for atleast 7 days and then allowed to dry.
- 8.3 The second coat shall be 8 mm thick and it shall not be applied until atleast 10 days have elapsed after the application of the scratch coat shall be evenly damped. This coat shall be applied from top to bottom in one operation and without joints, finish shall be straight, true and even. The mortar proportions of this coat shall be as specified under the respective item of work. Only approved white sand shall be used for the second coat and for finishing work. Sand for finish shall be used for the second coat and for finishing work. Sand for finish shall be even coarse size and shall be dashed on the surface and sponged.
- 8.4 Wherever 32 mm thick plaster has been specified, this is intended for purpose of providing beading, bands etc. This work should be carried out in two or three layers and as directed by the Engineer.
- 8.5 In the case of pebble face finished plaster, pebbles of approved size and quality shall be dashed against the final surface to obtain as far as possible uniform pattern. In all cases, workmanship shall conform to IS : 11.

9 Measurement

- 9.1 The quantity of work to be paid for under this item shall be calculated by taking the projected surface of the area plastered after making necessary deductions for opening, doors, windows, fan openings etc. The actual plasterwork carried out on jambs of doors, windows openings etc. shall be measured and added. However, for purposes of payment under this item, plaster work carried on surface of items of work, which include plaster finished, shall not be taken into account.

Item No.-7

Brick work using common Brunt clay building bricks having crushing strength not less than 35 Kg./Sqcm. In foundation and plinth in cement mortar 1:5 (1cement : fine sand) (A) Modular

- 1 Bricks used in works shall conform to the relevant Indian Standards. They shall be sound, hard, homogenous in texture, well bunt in kiln without being vitrified, table moulded, deep red, cherry or copper coloured, of regulator shape and size and shall have sharp and square edges and parallel faces. The bricks shall be free from pores, chips, flaws or humps or any kind. Bricks containing unground particles and / or which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours shall be rejected. Over-burnt or under-burnt bricks shall be liable to rejection. The bricks shall give

a clear ringing sound when struck and shall have a minimum crushing strength of 35 Kg/sq. cm. Unless otherwise noted in drawings. The classes and quality requirements of bricks shall be as laid down in IS : 3102.

- 2 The size of the brick shall be 23.0 x 11.5 x 7.5 cm unless otherwise specified; but tolerance upto (+/-) 3 mm in each direction shall be permitted. However, bricks conforming in size to IS : 1077 could be used. Bricks shall be provided with frogs. Only full size bricks shall be used for masonry work. Brick bats shall be used only with the permission of the Engineer to make up required wall length or for bonding. Sample bricks shall be submitted to the Engineer for approval and bricks supplied shall conform to approved samples. If demanded by Engineer, brick sample shall be got tested as per IS : 3495 by Contractor at no extra cost to Client. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

2.1 Fly Ash Bricks :

The bricks shall be hand or machine moulded and made from Fly ash, sand lime and additive. They shall be free from cracks, flaws. They shall have smooth rectangular faces with sharp corners and shall be uniform in colour. The bricks shall be machine moulded with a frog of size 100 mm. X 40 mm. and 10 mm. To 20 mm. Deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 6 m.

The size of the conventional bricks shall be (9"x 4⁴/₈" x 2³/₄") 225 mm. X 110 mm. X 75 mm.

Only bricks of one standard size shall be used on a particular work site. The following tolerances shall be permitted in the conventional size adopted in a particular work site.

Length : + 1/8"(3.0 mm.) Width : + 1/6" (1.50 mm.) Height : + 1/6" (1.50 mm.)

The crushing strength of the bricks shall not be less than 35 Kg/cm². The average water absorption shall not be more than 15% by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per IS : 3495 (Part I to IV) 1976.

3 Mortar

- 3.1 Mortar for brick masonry shall be prepared as per IS : 2250 Mix for cement mortar shall be specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one completed bag of cement containing 50 kg of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter shall be of sound, hard, clean and durable particles. Sand shall be approved by Engineer, sand shall be thoroughly washed till it is free of any contamination.

- 3.2 For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, though hand mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 25 minutes of mixing. Mortar left unused in the specified period shall be rejected.

- 3.3 The Contractor shall arrange for test on mortar samples if so directed by the Engineer. Re-tempering of mortar shall not be permitted.

4 Workmanship

- 4.1 All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 230 mm thick and over shall be laid English Bond unless otherwise specified. 115 mm thick work shall be laid with stretchers. For laying bricks a layer of mortar shall be spread over the full width of suitable length of the lower course. Each brick shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

- 4.2 All brickwork shall be plumb, square and true to dimensions shown. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick course shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. All

interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and so portion of the work shall be left more than one course lower than the adjacent work. Where this is not possible, the work shall be raked back according to bond (and not saw toothed) at an angle not exceeding 45 degree. But in no case the level difference between adjoining walls shall exceed 1.25 m. Workmanship shall conform to IS : 2212.

- 4.3 Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joints shall be raked to a minimum depth of 10/15 mm by raking tools daily during the progress of work when the mortar is still green, so as to provide a proper key for the plaster or pointing to be done. When plastering or pointing is not required to be done, the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brick work shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set, the joints shall be raked out to a depth of 12 mm before another course is laid.
- 4.4 All brick work shall be built tightly against columns, floor slabs or other structural members.
- 4.5 Where drawings indicate that structural steel columns are to be fireproofed with brickwork, the brick shall be built closely against all flanges and webs with all spaces between the steel and brickwork filled with mortar. Steel members partly embedded in brickwork and not indicated to be fireproofed with concrete, shall be covered with not less than 12 mm thick mortar unless directed otherwise by Engineer.
- 5 Miscellaneous inserts in masonry e.g. sleeves, wall ties, anchors, conduits, structural steel, steel inlets etc. shall be installed by the Contractor at no extra cost to the Owner. Furnishing of any of these inserts by the Contractor, will be paid for separately. Openings, arches etc. shall be provided as shown on the drawings. Chases, pockets etc. shall be provided as shown on the drawings to receive windows, louvers, doors frames etc. Wall ties and flashings shall be built into the brickwork in accordance with the drawings and specifications. It shall be clearly understood that the rates quoted by the Contractor include for fixing of inserts, leaving openings, cutting chases in brickwork for various trades etc.
- 6 Facing Brickwork**
 - 6.1 Facing bricks of the type specified shall be laid in the positions indicated on the drawings and all facing brickwork shall be well bonded to the backing bricks. No facing brickwork shall at any time be more than 600 mm above the backing brickwork.
 - 6.2 All facing brickwork shall be pointed as the work proceeds and internal faces of the brickwork shall be pointed with neat flush joint to give a fair face.
 - 6.3 Faced work shall be kept clean and free from damage, discoloration etc. at all times. The Contractor shall fill carefully all holes with bricks similar to the surrounding brickwork, point brickwork as required.
 - 6.4 For facing brickwork, double scaffolding shall be used no holes in brickwork for scaffolding shall be permitted.
- 7 The green work shall be protected from rain by suitable covering bricks shall be kept constantly moist on all faces for a minimum period of ten days. Brickwork shall not be raised more than one metre per day.
- 8 The rates quoted by the Contractor are exclusive of transoms and mullions. Contractor shall provide the same as shown or indicated on the drawings. These shall be generally provided only in half and full brick walls. Dimensions of the transoms and mullions shall conform to the thickness of the wall. Concrete work for transoms and mullions shall conform to the specifications for concrete and shall be of grade M200.

9 Where shown on the structural drawings, bricks for partitions walls shall be stacked adjacent to the structural member to pre deflect the structural member before the wall is built.

10 Measurement

10.1 Brick work of thickness one brick i.e. 230 mm and above shall, unless otherwise stated in the Schedule of Quantities, be paid in units of cu.m. or part thereof. Brickwork of thickness less one brick i.e. less than 230 mm thick shall be measured and paid on the basis of rates quoted per sq.m. of part thereof in all cases, the quantities measured and paid for shall be those actually executed after making necessary deductions for openings etc. Brick masonry for steps and such other mass works and encasement shall be paid on the basis of rates quoted per cu.m. or part thereof.

11 Mortar

The mortar for the work shall be as specified in the respective items of work and shall be prepared as per Clause 3.

11.1 Curing of masonry shall continue for a minimum of ten days.

11.2 Measurement

The unit of measurement shall be cu.m. or part thereof. Actual quantity of masonry shall be calculated from dimensions shown on the drawings less opening and shall be paid for.

Item No.-8

Finishing wall with Weather Proof Exterior Emulsion Paint on wall surface (Two Coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remainsof loose powdered materials etc. complete. (out side paint)

1 Distemping

1.1 The surface to be treated shall be thoroughly cleaned of all dirt and loose particles etc. Inequalities and holes shall be filled with gypsum, which would be allowed to set hard before distemper is applied.

1.2 Distemper shall be of well-known brands of approved make. It shall be applied by a board stiff brush in two coats over a coat of primer. The first and second coat shall be applied only after the primer has thoroughly dried. The first coat shall be of a lighter tint. The shade of the distemper shall be got approved by Engineer. Water bound and oil bound distemper shall conform to the requirements of IS : 427 and 428 respectively.

2 White Wash

2.1 Walls to be thoroughly cleaned before white wash is applied. White wash shall be of ordinary fat lime and of good quality. It shall be slaked with an excess of water to the consistency of a cream and allowed to remain under water for 2 days. It shall then be strained through a cloth and 2 kg of clean gum added for every cubic metre of like ready for white washing.

2.2 Each coat is to be applied with a brush. It shall be laid with a stroke of the brush from the top downwards, another from bottom upward over the first stroke and similarly, one stroke from the right and another from the left over the first brush before it dries. Three such coats shall be applied.

3 Colour Wash

3.1 Colour wash shall be applied the same way as white wash. Necessary and approved colouring matter shall be added to the white wash, which has been strained. Only wash sufficient for the day's work shall be prepared each morning. If the finished surface is powdery and comes off easily or the general appearance is streaky, the work shall be

rejected.

4 Painting

4.1 Paint to be used for the various items of work should be of approved make and colour. It is imperative that the Contractor should obtain Engineer's permission in regard to the make and colour of paint that he proposes to use for the various items of work. The painting work shall be carried out as directed by Engineer keeping, however, in view the recommendation of the manufacturer.

4.2 Where painting with plastic emulsion is specified, all uneven surfaces shall be made up by use of putty of appropriate quality, after the surface has been thoroughly cleaned of all dust, dirt and sand prepared. One primer coat and two coats of emulsion paint shall be applied. Workmanship shall conform to the requirements of IS : 2395.

5 Measurement

The actual quantity of work carried out will be measured in sq.m. after making deduction for openings etc. and shall be paid for.

- a. Biomass floating on the surface of the tank has to be removed before it is sent for further treatment. Equipment that can be used are DAF, Tube settler, Lamella clarifier, etc.
7. Final treated water collection tank
- a. After treatment, the effluent is stored in this tank from where it is taken for further treatment.
8. Sludge collection sump
- a. The dead bacteria that dies after consuming BOD and COD are retained in the form of sludge from the bottom of the tank.

BASIC TREATMENT- PRIMARY, SECONDARY & TERTIARY

PRIMARY TREATMENT- For REMOVAL OF LARGER PARTICLES, SUSPENDED MATTER

- Bar Screen chamber- By putting MS Bar screen we will remove larger particle or matter from sewage like clothes, polythene.
- O & G Chamber- Here we remove O & G of sewage treatment Plant.

SECONDARY TREATMENT - FOR REMOVAL OF BIOLOGICAL, CHEMICAL & SUSPENDED MATTER

- Aerobic –MBBR
- Secondary Sedimentation tank / Tube Settler

TERTIARY TREATMENT- FOR REMOVAL OF BIOLOGICAL, CHEMICAL, SUSPENDED, COLOUR, ODOUR, DEAD MICRO ORGANISM, INFECTED MATTER

- Disinfection Tank / Filter feed tank (Treated water disposal to drain)
- Dual Media Filter
- Activated carbon Filter(Treated water to be reused)

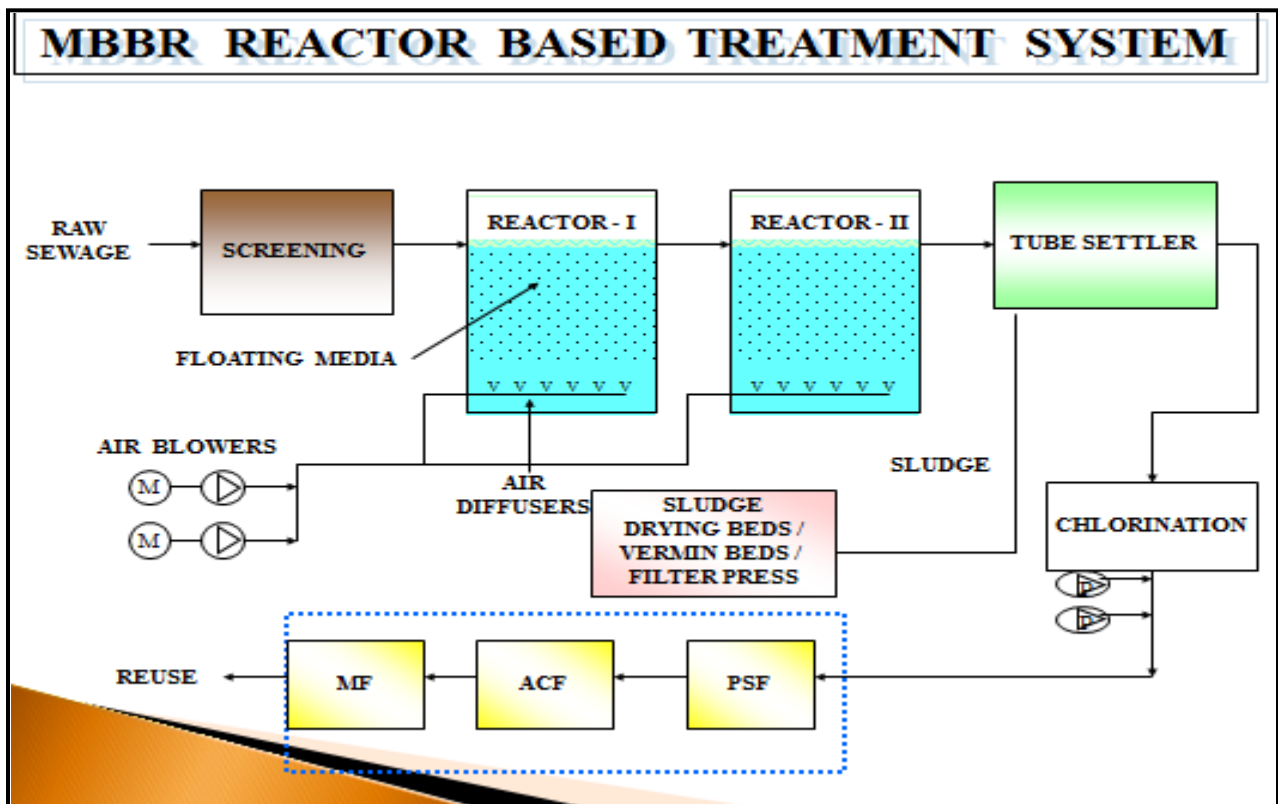
PROCESS & PROPOSED TECHNOLOGIES BENEFIT

AEROBIC PROCESS: Process Occur in the presence of Oxygen is called as Aerobic Process & bacteria which live in the presence of Oxygen in called as Aerobic Bacteria. There are various treatment aerobic treatment technology available in the market to treat the sewage water. For Example : Activated Sludge Process (ASP) – Mother Of technology , SBR (Sequential Batch Reactor) , RBC (Rotating Biologic Contractor) & Most advance MBBR or FAB (Moving Bed Bio Rector or Fluidized Aerobic Bio Reactor).

Here we have proposed most advanced technology called as MBBR / FAB – Moving Bed Bio Reactor .

ANAEROBIC PROCESS: Process Occur in the Absence of Oxygen is called as Anaerobic Process & bacteria which live in the absence of Oxygen in called as Anaerobic Bacteria. It is most efficient & best method to treat the waste water. It require proper handling, Expertize for running due to generation of harmful methane gas. For Example : UASB – Up flow Anearobic Sludge Bed Reactor, Trickling Filter, Septic Tank, BNR etc

SELECTED TECHNOLOGY & ITS TREATMENT PROCESS



1. BAR SCREEN CHAMBER, OIL & GREASE CHAMBER – AEROBIC PROCESS (PRIMARY STAGE)

Bar Screen: - This tank will remove floating materials, plastics, larger objects etc., which will otherwise clog the pump.

Oil & Grease Chamber: - This tank will remove Oil & Grease from sewage which removal help in development of bacteria & proper decomposition of biological & chemical matter of Sewage.

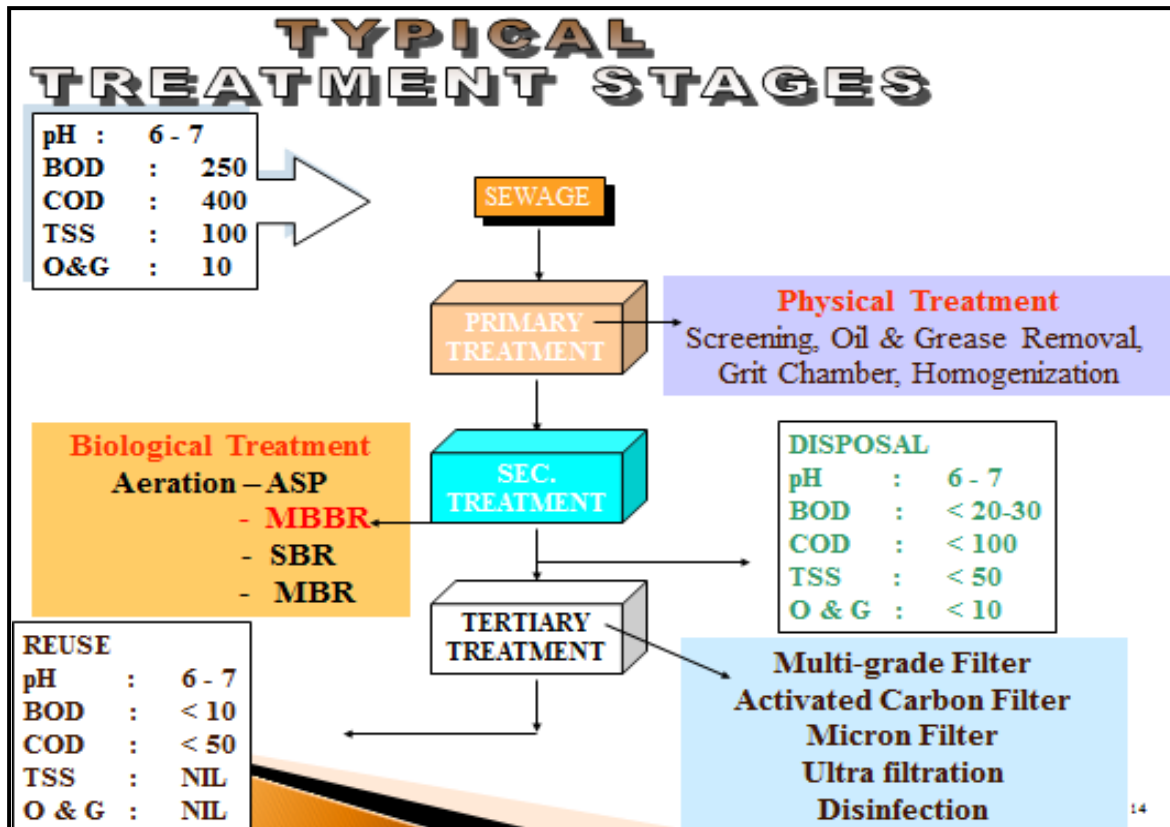
2. FAB REACTOR: (AEROBIC PROCESS- SECONDAR STAGE)

The sewage water pumped from septic tank is taken into this tank. The FAB Reactor is filled up with small carrier elements. This element are made up of special grade plastic of controlled density such that they can be fluidized using an aeration device. In course of treatment a bio-film develops on the elements which move along with the waste water in the reactor. The movement within the reactors is generated by providing aeration with the help of diffuser placed at the bottom of the reactor. The thin bio-film on the elements enable the bacteria to act upon the biodegradable matter in the water and reduce the BOD content while the rapid turbulent movement of the water in the presence of oxygen available from air, certain amount of COD is also removed. The overflow from outlet-launder is taken into the secondary settler under gravity.

2. TUBE SETTLER: (AEROBIC PROCESS – SETTLING STAGE)-

From the FAB Reactor the sewage will be lead into Feed well of Tube settler in which settling of microbial floccules takes place as sludge and settle down at the bottom of the tank from where it will then be taken to sludge tank. The supernatant from top will over flow through launders into the Chlorine Contact Channel.

Swimming pool wastewater send directly to tube settler of STP for settling of solid particles, Hair, Suspended particles.



Process flow diagram showing the reduction of parameters: MBBR

CIVIL UNIT /TANKAGE

A. Civil Units

Sr. No.	Units	MOC	UNIT	Size
1.	Screen/Oil & grease Chamber Detention Time = 6.0 min	RCC- M25/ MSEP	1	1 m3
2	O & G Chamber	RCC M25/ MSEP		6 m3 & 15 m3 – Grit chamber
3.	Raw Sewage Collection Tank /	RCC-	1	70 m3

	Equalization Tank/Septic tank. waste water sump for Collection of sewage from various sources. Equalization tank shall be completed with inlet, outlet, drain arrangement Airflow pipes & valves. Tank fitted with disc type diffusers to mix the sewage.	M25/ or Bricks Work/ MSEP		
4.	Sludge Drying Construction of Sludge Dry Beds in Brickwork for collection of bio sludge	Bricks	2	1.0 m x 1.0 m x 1.25 m
5	MBBR Tank called as aeration tank comprises with floating media & diffused fine aeration .here Biological & chemical degradation takes place.	MSEP 5 mm	1	46 m3
6.	Tube Settler tank fitted with tube deck media with 45-60 degree for settling of suspended matter of sewage. And settled sludge will go into sludge bed which will be used as manure.	MSEP 5 mm	1	20 m3
7.	Filter Feed Tank fitted with filter feed pump for transfer the overflow water in filters for removal of suspended particle & color.	MSEP M25	1	15 m3

B. Mechanical Equipment's

Sr. No.	Units	MOC	UNIT	Size
1	Bar screen	MSEP	1	1000mm x 500 mm
2.	Raw Sewage Transfer Pump- Submersible Pump Sewage Cutter -Transfer Pumps (for Sewage) - From Equalization tank to MBBR/Aeration Tank. (2 Nos. -1W + 1S) Flow Rate (each) -4-5 m ³ / hr Head -10.00Mtr Solid Handling -30-40 mm Make - kirloskar/Toshio Rating -1 HP,3 Phase	CI	2 (1W+1 S)	4-5 m ³ /hr @ 10-12 m head
3.	Sludge Transfer Pump to transfer the sludge from tube settler to sludge drying bed.	CI	2	3 m ³ /hr @ 10 m head

	(2 Nos. -1 W+1S) Flow Rate (each) - 3 m3/hr Head - 10 Mtr Solid Handling – 30mm Make –Kirloskar Rating- 1 HP, 3 Phase			
4.	Filter feed Pump Providing, Fixing, Testing & Commissioning of horizontal, centrifugal pump. 2 Nos. -1 W+1S) Flow Rate (each) - 5 m3/hr Head - 25-30 Mtr Solid Handling – 30 mm Make –Kirloskar Rating- 1 HP, 3 Phase	CI	2	5m3/hr @ 30 m head
5.	Pressure Sand Filter (PSF) to transfer filter feed tank water into Sand filter Flow Rate: 8 Cum/hr Filtration Velocity: 15 cum/hr/sqm Max. operating pressure :3.5Kg/sq.cm Test pressure :5.5 kg/sq.cm Diameter: 900 mm HOS – 1800 mm MOC – FRP MAKE –Pentair/Starlite	FRP	1	900 mm dia x 1800 mm ht.
6.	Activated Carbon Filter (ACF)- to remove the color of treated water Flow Rate: 8 Cum/hr Filtration Velocity: 15cum/hr/sqm Max. operating pressure :3.5Kg/sq.cm Test pressure :5.5 kg/sq.cm Diameter: 900 mm HOS – 1800 mm MOC – FRP MAKE –Pentair/Starlite	FRP	1	900 mm dia x 1800 mm ht.
7.	Chlorine Dosing Tank PROAQUA For disinfection of treated water to kill the bacteria with provision of automatic dosing pump having capacity of 0-6 lph with proaqua.	FRP	1	1000 litres capacity
8.	Air Blower TMVT /Airvak Make Tri /Twin Lobe Air Cooled Blower (V - Belt Drive) with its Standard Accessories, including stand , belt, bearing etc	CI	2	140 m3/hr @4500 mm WC
9.	Motor for Air Blower	CI	2	HP /1450 RPM

10.	Air Diffusers Coarse			EPDM	1lot	DISC base 80 MM 5 m3/hr air flow & 63 mm OD & 610 MM Length EPDM Including all fitting & grid in CT & MBBR Tan
	TYPE	MEMBRANE OD	LENGTH			
	BI-63-610	63MM	610 MM	2.0 - 7.0 m3/hr		
11.	FAB media & Tube deck media (1 Lot) Supply, Installation, Testing & Commissioning of FAB bio deck media to be installed in FAB Tanks and PVC tube deck settling media to be installed in Tube Settler shall be provided.			PP/PVC	1lot	Size 16 x 22 MM
12.	Panel Design , Fabrication , Assembling, Wiring , supply, Installation, testing and commissioning fabricated out of 16 guage CRCA sheet steel .Cable gland plates shall be provided on top as well as at the bottom of the panels. Panel shall be packed with 2 coats of red oxide primer and final approved shade of powder coated paint .Electric Panel shall have starters, switches and MCB of L&T, C & S Wiring shall be of copper minimum 4 core Wiring shall be through PVC conduit pipe			CRCA	1	All material make will be C & S /L & T with cable make will polycab /equivalent. All wiring should be run through suitable gland & conduit pipe.
13	Providing and fixing all piping (as described below) and isolation control valves for making the system complete. All valves should have flanged joints. Flange connection shall be provided wherever required. UPVC/CPVC Epoxy (Schedule 40)-All Pipeline			UVPC/C PVC Pipe		Schedule 40
14	Canopy & Stand			MSEP	1 lot	All Blower , pump, sholud be covered by canopy , and stand to avavoid raining loss.
15	Flow Line marking			Sticker	1 Lot	All line sholud be marked with Red & blue sticker to indicate the water & backwash flowing .
16	Micron Filtraion System					As per Excel sheet
17	Filter presss & filter press feed pump					1 Lot with 1working & 1 Standby pumps

DETAIL OF MAKE/MOC FOR MECHANICAL EQUIPMENTS

DISINFECTION SYSTEM DETAIL	
Application	To disinfect treated effluent
Location	Outlet of Filter
Quantity	1 Nos.
Dosing Tank Capacity	1000 Liter
MOC of Dosing Tank	HDPE
DOSING PUMP	
Quantity	01 Nos
Operating Capacity of Dosing Pump	6 LPH
Drive	Suitable
Supporting Structure	MS Epoxy Coated
Make of Pump	Proaqua

FILTER FEED PUMP: 2 Nos

Application	To transfer clarified effluent from filter feed pump sump to multi-grade filter
Location	Filter feed pump sump
Quantity	02 Nos. 1 Operational & 1 Standby
Operating Capacity	5-6 m ³ /hr @ 30 m Head CRI
Type	Self-priming, non-clogg, centrifugal, sludge pump
Drive	Suitable
MOC	CI and MS
Make of Pump	Kirloskar/Weltech

TWIN/TRI LOBE ROOTS AIR BLOWER

Application	To supply air to diffusers
Location	Aeration tank& equalization Tank
Quantity	02Nos (1 W +1 S)
Air Discharge Capacity	140 m ³ /hr @ 4500 mm WG
Drive	Suitable
MOC	CI and MS
Make	Airvak

RAW EFFLUENT/SEWAGE TRANSFER PUMP- 2Nos

Application	To transfer clarified effluent from Building Chamber & From Collection Tank
Location	Raw effluent/Sewage at Piping starting point & from Collection tank submersible Pump
Quantity	02 Nos. (1 W + 1 S)
Operating Capacity	5 m ³ /hr @ 10 m Head
Type	Self-Priming cutter pump with auto level switch
Drive	Suitable
MOC	CI and MS
Make of Pump	Toshio

SLUDGE TRANSFER PUMP- 2 Nos

Application	To transfer Sludge from Tube setter to Sludge Drying Bed
Location	Filter feed pump sump
Quantity	02 Nos. (1 W + 1 S)
Operating Capacity	3 m ³ /hr @ 10 m head
Type	Self-priming, non-clogg, centrifugal
Drive	Suitable
MOC	CI and MS
Make of Pump	Kirloskar/Weltech

ELECTRICAL EQUIPMENTS MAKES

1.	Chlorine Dosing Pump With Tank	No.	01
	Make		Proaqua
	Type		Electronic Diaphragm Type
	Capacity	LPH	2-4
	Tank capacity	LTRS	1000
2.	Water Meter	No.	01
	Application		To measure flow rate of sewage at different location
	MOC		Gun Metal
	Make		Chmabal/Dashmesh/Eqvi
3.	Electrical Work		
	Location		Within battery limit of STP
			Electrical Panel shall have starters switches & MCB of L & T, C & S
			Connection to each motor and drive shall be through suitable gland

List of Electromechanical Items**1. Bar Screen**

No. of Units	1 No.
MOC	MSEP
Size	0.8 m X 0.8 m
Type	Perforated Plate Type

2. Anoxic Agitator

No. of Units	1 No.
MOC	SS 304

3. Raw Sewage Transfer Pumps (From Equalization Tank to Aeration Tank)

No. of Units	1W + 1S
Type of Pumps	Submersible
Require Flow Rate (m ³ /hr)	4
Require Head (m)	10-12
Make	Kiloskar/CNP/Lubi / Equivalent

4. Coarse Bubble Air Grid for Equalization Tank

Qty	1 Lot
MOC of Sleeves	EPDM
Make of Diffuser	RWT
Type of Diffuser	Disc/Tubular

5. Air Blower for Aeration Tank

Type	Fine Bubble Air Diffusion through Diffusers
Qty of Blowers	1W + 1S
Type of Blowers	Twine Lobe Rotary Or Tri Lobe Rotary
Capacity of Blowers	110 cum / hr @ 0.4 kg/cm ²
Make of Blowers	TMVT/Usha/Airzon / Equivalent

6. Fine Bubble Air Diffuser System for Aeration Tank

Qty of Diffusers	1 Lot
MOC of Sleeves	EPDM
Make of Diffuser	RWT
Type of Diffuser	Tubular

7. Aeration/MBBR Tank FAB Media

No. of Unit	1 No.
Qty. of Tube Deck Media	1 Lot
Size of Tube Deck Media	16 mm x 22 mm
MOC of Media	PVC
Type of Media	Cylindrical Type

8. Secondary Sedimentation Tank Tube Deck Media

No. of Unit	1 No.
Qty. of Tube Deck Media	1 Lot
Size of Tube Deck Media	750 mm lonog
MOC of Media	PVC
Type of Media	Hexagonal Chevrole Type

9. Sedimentation Tanks to SDB / Aeration Tank Sludge Transfer Pumps

No. of Units	1W + 1S
Type of Pumps	Centrifugal Mud Pumps
Require Flow Rate (m ³ /hr)	1
Require Head (m)	8-10
Make	Kiloskar/CNP/Lubi / Equivalent

10. Filter Feed Pumps

No. of Units	1W + 1S
Type of Pumps	Centrifugal Monoblock
Require Flow Rate (m ³ /hr)	4
Require Head (m)	20-25
Make	Kiloskar/CNP/Lubi / Equivalent

11. Pressure Sand Filter

Type	Verticle Down Flow
No. Require	1 No.
Flow Rate	4 cum/hr
Size of Filter	24" dia X 72" height
M.O.C.	FRP
Vessel Make	Starlite
Valves Type	Multiport
Valves Make	Initiative Make

12. Activated Carbon Filter

Type	Verticle Down Flow
No. Require	1 No.
Flow Rate	4 cum/hr
Size of Filter	24" dia X 72" height
M.O.C.	FRP
Vessel Make	Starlite
Valves Type	Multiport
Valves Make	Initiative Make

13. NaOCl Dosing System for Disinfection Treatment

No. of Units	1 No.
Tank Capacity	100 Liters
Make of Tank	Omtex/National
Qty. of Dosing Pumps	1
Capacity	0 – 6 LPH
Type of Dosing Pump	Online metering pumps
MOC of Pumps	PP
Make of Pumps	V-Dose/E-Dose/ Equivalent

14. UV System

No. of Units	1 No.
Capacity	4000 LPH
Make	Sukrut/Gaytri/Equivalent

15. Water Meter

No. of Units	1 No.
Capacity	4000 LPH
Make	Kranti/Equivalent

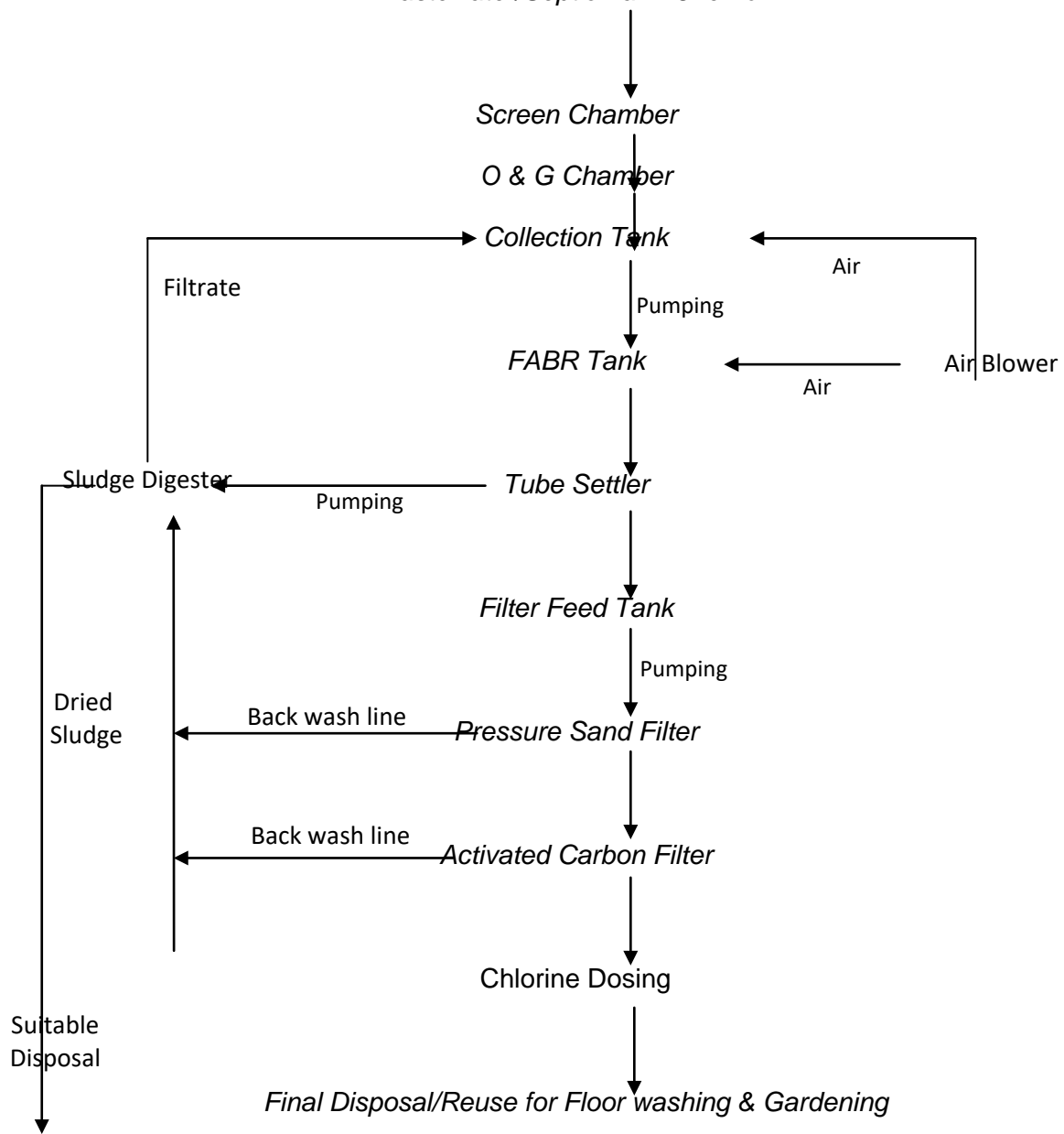
16. Upvc Piping & Fittings

No. of Units	1 Lot
Size	Suitable to plant capacity
Make	Ashirwad/Prince/Astral/Equivalent

17. Electrical Panel with Standard Relay, Contactors and Accessories

No. of Units	1 Lot
MOC	MS Powder Coated

Process Flow Chart
Wastewater/Septic Tank Overflow



Scope of Work of and Exclusions

A. Scope of Work

1. We shall supply, erect, install, test and commission the equipment as described in BID at your site.
2. Final "As Built" documents shall be furnished in two sets for records. In addition to this all the final documents shall be furnished in soft form on a CD as a part of final documentation.
3. We shall train your staff on operation and general maintenance of the system.
4. Preparation of layouts, hydraulic flow diagram, etc.
5. Erection and installation of mechanical equipment's.
6. To supply piping (UPVC) within battery limits of STP.
7. To supply media for filters (PSF & ACF).
8. Electrical Work within battery limits of STP.

B. Exclusions

1. Platform, Tank or any civil work related to STP.
2. Supply of power to Control Panel, earthing pit etc.
3. Interconnecting piping's and fittings up to the first unit of the system and from last unit of the system to different locations.
4. Any Government Liasioning

C. TERMINATION POINTS

- a. Inlet of equalization tank.
- b. Outlet of treated water storage tank and sludge holding tank.
- c. Overflow and drain pipe work of all vessels.
- d. Power control termination at Control panel

D. CLIENT TO PROVIDE

- a. Control supply: 415 Volts ± 10 , Three phase, 50Hz. For all instrumentations.
- b. Power supply: 220 Volts ± 10 , Three phase, 50 Hz. For all pumps
- c. Labor : As and when required.

E. Make of Package

MBBR package

No. of Units	1 No.
Capacity	80KLD
Make	1. RWT India PVT LTD. 2. JRK Corporation 3. Yasmin Enviro Engineers Private Limited or Equivalent manufacturing company approved by GMDC and Design consultancy

SCHEDULE-B5

Operation and Maintenance - 3 year

Item No.- 1

Operation and maintenance and repairing of GMDC Township at Rajpardi u/g Drainage Scheme in all respect i.e. all the components executed under this tender mainly pumping machinery, pumping station. Rising Main. Establishment charges and all materials on repairing of pipe line and other civil works and pumping machinery as per detailed specification & obligatory requirement for 36 months (thirty six).including disposing of sewage in STP & satisfactory maintaining the record for same excluding power cost. maintenance for all proposed and existing Pumping Station and Pumping machinery etc in the project.

All construction work done is in the project with existing sewage pumping station, machinery and DEWATS type STP including for O & M for 3 year.

- Connecting Pipe line in DI-K9-150mm Length – 50m
- Storage Sewage water sump having 50,000 litter capacity
- Platform for Package STP 9.00m x 6.00m
- MBBR type Package STP having capacity 80KLD
- Existing Two Pumping station
- Existing Pumping machinery for Both PS
- Existing Rising main from PS to STP
- Existing DEWATS type STP

GENERAL CONDITIONS FOR O & M

- A. The pumping machineries shall be run by the contractor as per the requirement (With full efficiency and as per GEB power Factor)
- B. If the pumping machinery fails due to any reason, the contractor has to repair or replace the pumping machinery at his own cost and pumping of sewage should be restored within next two hours of period The Record for disposal of sewage should be maintained by contractor and record should be maintained by the contractor.
- C. Pumping Machinery, Electrical items to be maintained as per requirement of manual.
- D. The Record for disposal of sewage should be maintained by contractor.
- E. The maintenance of rising main should be done by the contractor, if any leakage found it should be repaired within next 2 hours.
- F. If the sewage cannot be pumped due to failure of pipe line /pumping machinery and if pumping is not restore within time limit than the contractor has to pay penalty at the rate of Rs10 per 1000 lit. of average sewage not pumped and pay any compensation due to health Hazards.

G. Minimum Staff pattern required for O & M to run this scheme will be as per para 3.

Carry out regular and frequent sampling to be carried out and to be send to authorized laboratory for analysis and result recording of raw and treated sewage as per the procedure laid out by the owner and in conformity with standard method in comply with the GPCP norms.

H. The disposal of the foreign particle like sand, dead animal etc from all the unit to suitable place as shown by the employer is in the scope of contractor.

I. Employ appropriate and skilled man power; provide all tools, tackles, equipments, instruments etc required for effective implementation for services.

J. All building, bathroom, toilets, to be kept swept clean and washes daily. Consumable requirement for cleaning such as acid, harpic, phenyl, air freshener, washing powder, wire brush, duster, etc shall be provided and use as required.

K. All ventilators, door window to be clean and keep in good aesthetic condition.

To keep watch on overflowing of any unit if such over flow take place the agency shall have to bare the damages caused to surrounding properties.

L. Contactor shall submit five copies of O & M manual for approval of employer which may be modified if required by employer and two copies would be return by employer duly approved and sign.

M. The contractor shall hand over the project back to owner/employer/local body on expiry of this contract in fully working condition satisfying the requirement

2.1 GENERAL ROUTINE MAINTENANCE

To operate and maintain the sewage treatment plant and equipment in accordance with the aim and purpose of treatment. The plant and equipment covered under the above contract will be promptly attended by the contractor including any "Trouble shooting" to ensure smooth and trouble free operation. The contractor will be responsible for smooth and satisfactory operation and maintenance of the Drainage Project and Sewage Treatment Plant on the round the clock basis for years period from the date of taking over the plant after months trial run period is completed.

A Technical expert of the contractor shall visit the plant on every fortnight and will suggest if required, to improve the efficiency and working of the plant. The visit must be recorded at Employer's document and outcome of the visit/ minutes of meeting should be got signed by Employer's authorized representative without which the visit shall not be considered.

- 1) Regular cleaning of screens in all shifts depending upon load
- 2) Cleaning of screens by high pressure water jet (preferably between 11:00 hrs to 12:00 hrs) on daily basis
- 3) Cleaning of belt conveyer

- 4) Checking of all pumps, motors, gears etc. for it's proper operation.
- 5) Checking all the pipelines for preventing choking, water tightness etc.
- 6) Monitoring BOD and COD level in treated effluent.
- 7) Safe disposal of grit and dry sludge cake generated on daily basis.
- 8) Avoid strictly the accumulated sludge decomposing in the settling tanks P.S. and buoyed to the surface. Septic condition should not arise in the tanks/ P.S.
- 9) Watering of plants and trees
- 10) Regular cleaning of screens in all shifts depending upon load
- 11) Cleaning of screens by high pressure water jet (preferably between 11:00 hrs to 12:00 hrs) on daily basis
- 12) Cleaning of belt conveyor
- 13) Checking of all pumps, motors, gears etc.for it's proper operation.
- 14) Checking all the pipelines for preventing choking, water tightness etc.
- 15) Monitoring BOD and COD level in treated effluent.
- 16) Safe disposal of grit and dry sludge cake generated on daily basis.
- 17) Avoid strictly the accumulated sludge decomposing in the settling tanks P.S. and buoyed to the surface. Septic condition should not arise in the tanks/ P.S.
- 18) Watering of plants and trees

General routine maintenance schedules for various project units shall be adopted from O&M Manual. However, the general routine maintenance to be carried out by the Contractor's personnel will include but not limited to the following:

- a) If it is observed that power consumption per MLD of sewage treated is increased, the contractor has to trace out the fault and rectify the same to bring to the standard Value.
- b) De-weeding and cleaning of the Transformer yard and other places.
- c) Checking and refilling of silica-gel in the breather of the transformer and checking temperature gauge, vent pipe, voltage tap changing switch
- d) Regular watering in the earth-pits.
- e) Check for any oil leak in the transformer and intimating and repairing of the same.
- f) Opening of end cover & cleaning of dust by Air blowing of induction motors, PMCC and other panel & PCC
- g) Checking and replacement of bulbs, tubes, chokes, starters, switches, control etc. throughout the plant and including outdoor lights and high mast pole installation.
- h) Replacements of LT panel fuse base, links, fuse, relay, contactor kit (main and auxiliary) and timer.
- i) Replacement of HT panel C/T or PT whenever required.
- j) Check for any loose connection in electrical equipment and rectification of the same.

- k) Monitoring power factor, take corrective steps and ensure optimum power consumption.
- l) Replacement of gland packing for the pump, sluice valves etc. whenever required.
- m) Greasing of bearings and lubricating all moving parts as per the schedule
- n) Tightening of all loose nut-bolts and other fasteners
- o) Cleaning of sump tanks/ P.S./ **DEWATS/MBBR type STP** as per manual provision.
- p) Lubricating and test operation of the valves
- q) General cleaning of all equipment and building
- r) Replacement of pump rubber bush, gland packing, sleeve, bearing, oil seal, shaft, liquid ring and impeller.
- s) Replacement of motor bearings and terminal plate and rewinding of motor when needed.
- t) Replacement of non-return valve T bolt, hinge pin, flap/ gate.

2.2 PREVENTIVE MAINTENANCE CHECKS

2.2.1 The Contractor shall adopt a preventive maintenance check's schedule as agreed mutually between the Contractor and the Employer.

2.2.2 The following checks to be performed daily by the Contractor's personnel

2.2.3 Whether there is a change in the sound of a running pump, abrupt changes in bearing temperature and seal leakage?

- a) The pump capacity, pressure, power consumption and vibration level to check if outage is required to address deterioration of specified performance values.
- b) Rise in temperature of bearings in motor, in moving parts and other units, etc.
- c) Working of gauges, sensors and other flow measuring devices
- d) Average power factor, kVARH, kWH consumed

2.2.4 The following checks to be performed weekly by the Contractor's personnel

- a) Pipeline and valve leakage
- b) Functioning of non-return valve
- c) Tightness of all electrical connections of all unit panel etc.
- d) Tightness all cable connections
- e) Temperature rise due to loose connections
- f) Operation of valves and sluice gates.
- g) Current and voltages in all electrical equipment
- h) Average power factor, kVARH, kWH consumed

2.2.5 The following checks to be performed monthly by the Contractor's personnel

- a) Battery voltage, battery charger, topping of distilled water, tightness of terminations etc.
- b) Gland packing
- c) Wear and tear of moving parts

- d) Adoption of Electrical energy conservation methods and energy consumption
- e) Electrical contacts
- f) Motors
- g) Meggering of electrical equipment
- h) Watering of earthing pits

2.2.6 The following checks to be performed quarterly by the Contractor's personnel

- a) Relay testing and calibration if possible of meters, gauges, instruments
- b) Speed of motors
- c) Level gauges and flow meters signals
- d) Cleaning, checking/tightening of L.T. Circuit / Panel
- e) Tightening of PMCC components
- f) Auxiliary DB, Capacitor bank
- g) Battery and Battery charger

2.2.7 The following checks to be performed bi-annually by the Contractor's personnel

- a) Free movement of stuffing box glands, gland bolts to be cleaned & lubricated and packing to be inspected to determine whether it requires replacement.
- b) Pump and motor alignment should be checked and corrected if necessary.
- c) Grease lubricated bearings should be checked to see that they contain the correct amount of grease and that it is still of suitable consistency.

2.2.8 The following checks to be performed annually by the Contractor's personnel

- a) Vibration should be reviewed. If the pump is tending towards unacceptable vibration levels:
 - i. The bearing should be removed, cleaned and examined for flaws and wear.
 - ii. The bearing housing should be carefully cleaned.
 - iii. Rolling element bearings should be examined for scratches and wear.
 - iv. Immediately after cleaning, rolling element bearings that are considered acceptable for reinstallation should be coated with grease. If the bearings are damaged it shall be replaced with new bearing of the correct size and type as per O&M manual.
- b) Shaft sleeve and shaft should be examined for wear.
- c) When coupling halves are disconnected for an alignment check, the vertical shaft movement of a pump with sleeve (journal) bearing should be checked at both ends with packing or seals removed. Any movement exceeding the original design clearance should be investigated to determine the cause. Endplay allowed by bearings should also be checked. If it exceeds that recommended by the manufacturer, the cause should be determined and corrected.
- d) Stuffing boxes should be repacked and the pump & motor should be realigned and reconnected

- e) Overhauling requirement of all equipment
- f) Improvement required if any in operation of plant
- g) Testing and Calibration of all instruments
- h) Transformer cleaning, checking silica gel, oil checking filtering/replacing

2.2.9 This work is also inclusive of painting of plants as per following schedule and paint shall be of the same specification as described in respective unit/ mechanism as per original specification of the executed work.

Sr. No.	Item	Duration
1	Civil work	Once in three years i.e after the 2 nd year of O &M
2	Doors and windows	—do -
3	Shutters, grills, collapsible gate etc	—do—
4	All H.T./ L.T. panels	—do—
5	All process equipment with its accessories and GI railings etc.	—do—
6	Street / flood light pole	—do—
7	Pump sets, valves, C.I. fittings, sluice gate, etc.	—do—

Note: However, if any unit mechanism will found to have some defect in paint work at any time, the Contractor has to repaint the same under the instruction of City Employer.

2.3 MINOR REPAIR GENERALLY ENCOUNTERED IN THE PROJECT UNIT

2.3.1 The minor repairs which have been most often encountered are as given below:

Electrical works

a) For H.T. Installations

- i) Replacement of jumpers
- ii) Replacement of insulator (Porcelain)
- iii) Replacement of Air-Break Switch

b) For Both H.T. & L.T. Installations

- i) Replacement of no-volt coil for VCB
- ii) Replacement of Cable lugs including terminations
- iii) Replacement of burnt out HRC fuses
- iv) Replacement of moving and fixed contacts or contractors
- v) Repairs to isolators and switch fuse units and replacement of it and fuse base units.

Pump sets

- a) Replacement of coupling bolt and nuts including rubber bushes
- b) Replacement of worn out impeller nut
- c) Replacement of spindle nut in the sluice valve.
- d) Replacement of terminal plate in the motor

- e) Replacement of faulty/dead spares in the battery charger and battery control panel.
- f) Replacement of gland packing, graphite packing from the pump sets.

2.4 ADDITIONAL SCOPE OF WORK

For other incidental additional work, if any, the Contractor on authorization in writing from the Employer shall execute which is not specifically mentioned in the scope at present.

2.5 ELECTRIC POWER AND WATER

Employer shall directly pay all the power bills and same amount will be reimbursed by the client/owner but the Contractor will be required to furnish Electricity Consumption in the Schedules provided. If the average power factor in the PGVCL (GEB) BILL IS LESS THAN 0.96, the PENALTY /CHARGE FOR THE SAME WILL BE RECOVERED FROM CONTRACTOR/THEIR BILL.

3 MINIMUM STAFF PATTERNS FOR O & M.

A. Pump Operators: 2 No/Head works

Operator should run electric driven pumping machineries at various h/w sites & the operator should bear minimum second class wiremen certificate. He has to look after the pumping machinery to keep record of log book of P/M. water-meter reading etc as directed.

B. Linemen: 2 No. / Pumping station

The lineman should 7th std. pass & should have an experience of pipeline work. He has to look after the pipeline and repair the pipeline. He has to keep record of leakages in pipeline. There should be sufficient numbers of linemen for each distribution zone and each distribution zone should be headed by an experience fitter.

C. Helper /Sweeper 0 No/HW

The responsibility for any legal problem accident etc. is rest with the contractor.

The contractor has to obtain insurance of the staff engaged for the period of O & M of the scheme.

The payment to the staff engaged for O. & M. should be made as per minimum wages rate fixed by the Govt, by the bidder and Necessary labour license should be obtained by the bidder at his own cost.

(1) MATERIAL, TOOLS AND TEST EQUIPMENTS:

All materials required for the O&M of the project shall be new and of best quality and suitable for the purpose intended. These shall be got approved from the Engineer in charge before use.

VEHICLES:

Vehicles such as Mini trucks. tankers with tractor Jeep, Motor cycles, Rickshaw, cycles etc. required for maintenance and repairs of various components, and for conveyance of

message in respect of power or machinery failures or routine instructions etc. shall be arranged by the contractor to attend the site immediately for not to hamper the water supply indefinitely. All the required vehicles should be got available at head work sites in ready to use condition or to be hired as and when required

No extra payment shall be made for transportation required for maintenance and repairs from one site to another. or to repair work shop.

Contractor has to provide necessary accommodation to their labours & engineers at his own cost.

ELECTRICITY SUPPLY:

Contractor should keep good liaison with Gujarat State Electricity Board (GEB) for power supply in case of GEB power failure (break down/shut down) it will be the responsibility of the agency to inform all the concerns as well as to contact GEB authorities to restore the power supply. The vehicle kept at site by agency shall be provided for this purpose along with operation and maintenance staff in case of requirement as per direction of Engineer in charge or his representative without any claims.

Average power factor in Gujarat electricity bill must be greater than 0.96 and if any penalty/charge/levied due to low power factor, than it will be re covered from the contractor without any reason. All capacitor panels must be kept in working condition to keep GEB power factor more than 0.96 by the contractor any spares required to keep capacitor panel in working condition is in the scope of the contractor the spares required for LT capacitor panel must be procure and replace immediately if required. This include in the scope of contractor

POWER OF ATTORNEY:

In case the tenderer is a firm or a company, they should mention the names of partners and of the person who will hold the power of attorney, authorizing him to conduct the transactions on behalf of the firm or company and shall produce certified true copy of power of attorney and partnership deed along with the tender and original shall be produced for verification on demand.

The contractor shall have to maintain a register for day to day consumption of chemicals & materials used for the operations, break-down and repairs completed etc.

WORK ORDER BOOK:

A bound half sheet size work order book shall be provided by the contractor and handed over to the GUDC for maintaining at the work site. This shall be a permanent record. The contractor or his Resident engineer shall sign against instructions & orders recorded by the Engineer in charge or his representative for the maintenance work. He may take out a copy thereof if necessary. He should take prompt action as per the instruction/orders of

the department and necessary compliance should be recorded against each instruction/order.

ELECTRICAL INSTALLATIONS:

All electrical work shall be carried out as per the provisions of Indian Electricity Act, Indian Electricity Rules, Instructions and requirement of authority/authorities i.e. Electrical Inspector and Gujarat State Electricity Board.

ACCIDENT ON THE WORKS:

The contractor shall be fully responsible for any accident that may occur to the labour on his work on duty and report the same to the Engineer in charge and concerned Govt, labour department authority and shall pay all necessary compensation as per rules, failing which it may be paid by GUDC on behalf of the bidder from the amount payable to him. Contractor shall also be fully responsible for any loss to any individual or public property occurred due to his or his workers negligence under the scope of this contract.

USE OF SITE:

The contractor shall not unreasonably encumber the site with materials and equipment. The contractor should not use land for his private purpose.

COMPLIANCE:

The contractor shall be bound by all ordinance acts, codes, rules, regulations and orders of which in any way affects conduct of works, or workmen engaged for the work. The contractor shall be responsible for any violation of any govt, rules & regulations. It the responsibilities of the contractor against any claim or liability arising from violation of above.

HANDLING OF CHEMICALS:

Safety and facilities to the staff for handling of chemicals and equipments is an important consideration. Handling of chemicals needs special attention. Following instructions are for guidance of the contractor and observing them strictly at his cost.

ACCOMODATION FOR STAFF:

Contractor will have to make his own arrangement for accommodation for his employers/staff.

TRANSPORTATION:

Contractor will have to make his own arrangement for conveyance his staff at his own cost. No facility will be provided by the Deptt.

MEDICAL:

Contractor has to provide medical facility First-Aid Box to his staff at his own cost.

CONTRACTOR STAFF & THEIR CONDUCT ETC.:

NATIONLTY & ADDRESS:

All employees should be Indian Nationality and it will be contractor's responsibility to give temporary and permanent address. Convicted or penalized person should not be employed.

SALARY TO EMPLOYEES:

Contractor should strictly follow labour laws and should also ensure regular monthly salary payment to his staff. The department will not take any liability of any of his employees appointed for operation and maintenance under this contract. Contractor should submit monthly certification for full payment to his staff on or before 10th of every month. Department reserves the right to conform the contents of the certificate from contractor's employee for their last pay. The Department will not be responsible for any delayed payment/compensation/overtime or any other claims by employees of contractor during the tender period and after even the tender period.

IDENTIFICATION DRESS CODE WITH BADGE WITH IDENTITY CARD:

Contractor will have to provide special dress code with identification badge with title name plate strip to be displayed on shoulders or front pocket to each staff as approved by Engineer in charge along with Identity Card etc.

HOLIDAYS AND LEAVE:

Holidays and leaves should be given to staff as per relevant labour rules. During holidays/causal leave/earned leaves etc. and contractor shall arrange for the substitute. The board shall not make any separate payment of overtime for these substitutes provided by the contractor during above periods.

CONDUCT:

All employees of the contractor should follow the instruction of Engineer in charge. If any employee misbehaves with Engineer in charge he/she should be immediately removed from duty and substitute for that should be employed by the contractor. If contractor fails to do so, non refundable penalty of Rs. 200/- (Rupees Two hundred only.) per day per such case will be recovered from the bill.

VISITORS:

The plant is one of its own kinds. Visitors are expected to visit this plant. It is expected that all staff and Engineers be present and follow the directives of Engineer in charge.

MAINTENANCE AND SUBMISSION OF RECORD TO GUDC:

The contractor shall maintain various records as per prescribed format by Department and submit the same once in a week. The details are as below:

1. Log book of Sewage Pump
2. Daily power factor report at Pumping Stations sites.
3. Total MLD of Sewage Pump

4. Routine/Preventive Maintenance.
5. Breakdown maintenance.
6. Major Repairs.
7. Unit Cleaning
8. Complain attendance Register.

Loss or Damages and identity

The contractor shall be responsible during the progress as well as maintenance for any liability imposed by law for any damages to tile work or any part thereof or to any of the materials or other things used in performing the work of injury to any person or person or for any property damaged in or outside the works limit. The contractor shall indemnity and hold the owner and the Engineer harmless against any and all liability, claims, loss or injury including cost expenses and attorney's fees incurred in the defense of same arising from any allegations, whether groundless or not, or damage or injury to any person or property, resulting from the performance of the work or from any material used in the work or from any condition of the work site or from any causes whatever during the progress and maintenance of the work. The agency has to properly maintain all registers and other records as per labour act and factory act other Governing laws/rules by laws. The agency should produce all such records as and when required (even after within three years from the completion of work)

PUMPING MACHINERY:

Operation and maintenance of sewage pump with all other relevant electrical and mechanical equipments is as per data given para 1.5:

Contractor shall initiate and take adequate actions to ensure smooth & satisfactory performance / running the pumping machineries of the project on a 24 hours round the clock basis strictly in presence of pump operators.

EXTENT OF WORK:

Under this item the work of

- (1) Operation periodical maintenance,
- (2) Cleaning, check-up,
- (3) Testing for serviceability and
- (4) Routine rectification of the equipment under.

REPLACEMENT OF MATERIAL AT COMPLETION OF 3 YEAR O & M

MBBR type STP before hand over to Clint after 3 year O & M All material like memran, chlorine and other chemical and any other material require to run STP will replace at the time of O & M period completion.

Operational Schedule

A. Periodical maintenance schedule is included. The operation of sewage pumping should be in 3 shifts and maintenance, routine rectification, check-up, testing and repairs will be carried out in first shift (except in emergency).

B. The staff operation is prescribed at annexure

OPERATION SCHEDULE:

Pumping machinery shall be as per Scope of the Work

Principal and Procedure for operation should be as under:

- Pumps are operated in such a manner that operation hours for pumps are maintained in proportion 1:1 for Non Clog Sewage Submersible pumps.
- Starting and stopping shall be kept to minimum
- Running the number of pumps in three shifts for disposal of sewage water shall be as per requirement.
- Checking all operations of gantry shall be carried out at least once in a day during non-operation period.
- Maximum efficiency should be maintain.

A. PERIODICAL MAINTENANCE SCHEDULE:

The contractor shall carry out periodically maintenance as per maintenance schedule approved by the Engineer in charge. Periodically maintenance shall also include daily observation and cleaning of equipment.

Testing:

Tests should be carried out to ensure service utility and proper performance of the equipment

i. Pump Motor Sets :

Performance test shall be carried out once in 6 months. The tests include determination of discharge and efficiency of the pump motor set. The discharge shall be measured by increasing level in Wet Well and power by watt meter. The testes shall be conducted by running one pump or pumps in combination. All the test equipment required except watts meters and CTS shall be arranged by the contractor. The observations and results of test shall be submitted in triplicate to the department.

ii. Relays:

The Relays shall be tested for proper operation once in a month after isolating trip circuit.

The operation shall be checked for following conditions.

- I. Motor bearing temperatures

II. Motor winding temperatures

III. Short Circuit.

iii. Earthling System:

1. The earthling system shall be checked quarterly for following conditions values (A) Continuity (B) Earth Resistance

iv. Routine Rectification

1. Minor rectification works listed below and similar minor works shall be included in routine rectification.
2. Topping up of oil/lubricants of bearings gear box auto transformers etc.
3. Tightening of lugs and checking glands of 440 V Cable.
4. Rectifying loose connections.
5. Repairs/Replacement of pilot lamps, annunciation windows.
6. Replacement of fuses including D.O. Fuse.
7. Cleaning and replacement of contacts.
8. Cleaning and replacement of bearings...
9. Replacement of pressure gauge.
10. Replacement of coupling pin and bushes of flexible coupling.
11. Spot welding and brazing and soldering.
12. Replacement of limit switches of crane and valve actuator.

ADDITIONAL SPECIFICATION:

1. All meters such as volt meter, amp. Meter, frequency meter, power factor meter and all other such meters including the meters used as tools by the agency shall be calibrated once in six months and the calibration certificate shall be produced.
2. The relay testing shall be carried out from reputed professionals approved by the Engineer in charge once in a year and the test certificate shall be produced.
3. The agency shall submit the statement of machinery under repairs every month along with probable repairs required with his monthly bill.
4. The agency shall submit all works done as against work scheduled during the shutdown taken in the month.

MODE OF PAYMENT

1. It shall be paid based on schedule of payment; however, quantity of Sewage Pump.
2. If the sewage cannot be pumped due to failure or line/ pumping machinery or any other reason, the contractor has to pay penalty at the rate of Rs. 10.00 per 1000 liter of sewage not pumped.
3. Payment will be paid only after receipt of necessary daily/weekly/monthly report duly certified by Engineer in charge or his representatives.

4. If contractors fail to employ the minimum staff or if staff remains absent, penalty will be imposed at double rate than the wage paid.
5. The item also includes to calculate the daily power factor of head works site and to maintain the power factor as 0.95, which agency has to operate the capacitor provided by contractor where the pump are in running condition. If capacitor fails, then the agency should inform the same in writing to the dept. on the same day, otherwise in case of due to non maintenance the power factor, if GEB charges any penalty for the same will be recoverable from the operation and maintenance agency. Also GEB approved & certified make capacitors should be replaced within 24 hours.
6. The agency has to submit the license as per contract labour act within one month from the date of work order otherwise, a penalty of Rs. 5,000/- per month will be imposed.
7. The agency has to submit the documentary proof of CPF/ESIS contribution within one month from date of work order otherwise an amount of Rs. 5,000/- per month will be recovered.
8. The item includes all major and minor repairs such as replacement of machinery and spares, fuses etc. cleaning of electric components and keeping them neat and tidy, however major repairs requiring special attention services are also included in the scope of this item. Opening and refitting of these parts is to be assisted by the contractor at his cost.

Note: Any Item specification not including in the spec take As per the GWSSB, R & B specification or Relevant latest IS code consider for work done and as per Engineer in charge