

**Name of Work : Estimate of Lowering, Laying and Jointing of PVC Pipeline,  
Const. of RCC U.G.Sump Cap. 1.00 Lac Litre, Pump Cabin,  
Pumping Machinery and Electrification for Dalitvas (Dhori)  
Under SCSP Programme 2023-24**

**Taluka: Bhuj Dist: Kutch**

**SPECIFICATIONS**

**Item No. 1**

**Providing and supplying in standard length ISI mark rigid unplasticised PVC pipes suitable for potable water with ringfit joint including cost of rings, as per IS specification no. 4985/1988 including all local and central taxes, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to the departmental stores and including cost of jointing material etc. complete. Note :**

**1. One coupler / ring shall be provided with each full length pipe cost of which is included in rates below.**

**2. 3% (Three) Discounted rate to be considered for Coupler jointed pipe**

**3. Rate for PVC resin as Rs.134700/MT (Price without GST))**

Nominal	Min. outside diameter in mm	Outside diameter at any point in mm
---------	-----------------------------	-------------------------------------

**90 mm pvc pipe 6 kg / cm<sup>2</sup>  
UNPLASTICIZED PVC PIPES**

**STANDARDS:**

- The UPVC Pipes to be manufactured, supplied and delivered under the scope of this contract shall be manufactured in accordance and conforming to IS:4985-2000 or its latest revision or amendments or other authoritative standard that ensure at least a substantially equal quality to the IS:4985-2000 or its latest revision or amendments

Electrometric sealing ring shall be as per specification of IS – 5382-1985, and ISO: 4633-1996 or it shall be EPDM rubber ring. The dimensions, material compositions, tests etc. shall be as per IS: 4985-2000 or with its latest revision or amendments.

- The minimum wall thickness weight shall be as per Appendix I of the tender.
- The color of pipes shall be as per IS 4985-2000
- Bureau of Indian Specifications (BIS) / Indian Standard (IS) shall mean the Latest version issued by BIS.

The material from which the pipes are made shall consist substantially of unplasticized poly vinyl chloride conforming to IS: 10151, to which may be added only those additives that are absolutely needed to facilitate the manufacture of the polymer, and the production of sound, durable pipes of good surface, finish, mechanical strength and opacity.

	Minimum	Maximum	Minimum	Maximum
63	63	63.3	62.2	63.8
75	75	75.3	74.1	75.9
90	90	90.3	88.9	91.1
110	110	110.4	108.6	111.4
140	140	140.5	138.3	141.7
160	160	160.5	158.0	162.0
180	180	180.6	177.8	182.2
200	200	200.6	197.6	202.4
250	250	250.8	247.0	253.0
225	225	225.7	222.3	227.7
280	280	280.9	276.6	283.4
315	315	316	311.2	318.8

bulk density the UPVC compound shall be 0.50 to 0.53 and the density of UPVC pipe shall be 1.40 to 1.46 g / cm<sup>3</sup>.

The additional of the manufactures own rework material shall comply to clause 4.2 of IS: 4985.

PVC resin of suspension grade K-66/K-67 shall be used for extrusion of UPVC pipe. In line with BIS 4985-2000 the tolerance on outside diameter of the pipe shall be as under:

- “The pipes shall be transported to the store by flat floored trucks in pre packed wooden crate. The height of crate should not be exceeding more than 2 meters. The both ends of packaging unit (crate) shall be covered with plastic sheet to ensure adequate protection during transport. At the time of packing and stacking of pipes, the sockets shall be alternated within the pipe of pipes and shall project sufficiently for the pipes to be correctly supported along their whole length. The pipes shall rest uniformly on the vehicle bed over their whole length during transport to avoid sagging or deformation.
- The packing material like wooden crate, plastic sheet etc. shall be the properly of tendered and he is permitted to reuse the packing material for transporting next batch of pipes”.

- The pressure rating of pipes shall be in accordance with IS 4985 with a maximum continuous working pressure at 27<sup>0</sup> C. of 6 & 10 kg/cm<sup>2</sup>. This working pressure shall be downgraded for ambient underground soil temperature of 45<sup>0</sup> C. as per the figure given in IS 4985 for design purposes.
- The pipes when subjected to internal hydrostatic pressure in accordance with IS: 12235-1986 (part – 8) shall not burst during the prescribed test duration. The temperature, duration and test and induced internal stress shall conform to the parameters given below:

<b>Sr. No.</b>	<b>Test</b>	<b>Temp. (°C)</b>	<b>Min. duration (h)</b>	<b>Induced Stress (Mpa)</b>	<b>Requirements</b>
1	Type test	60	1000	10	No failure
2	Acceptance Test	27	1	36	No failure

The integral socket of the pipe shall be tested for internal hydrostatic pressure in accordance with ISO: 3603 and ISO 1167.

The UPVC pipe shall not contain vinyl chloride monomer (VCM) exceeding 1 ppm when determined by means of gas phase chromatography using the “headspace” method according to IS: 10151.

The wall of the socket and the wall of the plain pipe shall not transmit more than 0.2% of visible light falling on them when tested in accordance with IS:12235 (part -3).

The pipes shall be supplied in straight length of 6 mtr with tolerance of +20mm and -0mm. The effective length of socket pipe shall be considered as shown in figure 2 of IS 4985.

All plastic and non-plastic material for components of the UPVC piping system e.g. Electrometric sealing ring, lubricants, when in permanent or in temporary contact with water which is intended for human consumption, shall not adversely affect the quality of the drinking water.

Concentrations of chemicals, biological agents or other substance leached from pipe materials in contact with drinking water and the values of the relevant physical parameters, shall not exceed the maximum values recommended by IS: 10500.

The pipe material shall be in accordance with IS 4985, clause 6.3.

The quality control system and sampling model shall be as under:

<b>Quality Control System and Sampling Model</b>				
<b>Order of Tests to be conducted</b>	<b>By Manufacturer</b>	<b>By Third Party Inspection / PMC representative</b>	<b>Codes/Standards to be followed</b>	<b>Remark</b>
Raw Material 1) Resin K-valve Particle size dis. Bulk density 2) PVC compound density	Laboratory test certificates from the original manufacturer of resin and confirmation of the same by the pipe manufacturer in their laboratory. Both test certificates have to be presented during inspection	Verification of test certificates and witness of sample test at pipe manufacture's laboratory at discretion	IS: 4669	For every batch of PVC resin used prior to formulation of compound
Process Check Degree of fusion of extruded UPVC pipe by Acetone immersion test.	Minimum one specimen per extrusion condition or molding condition per day	May witness test during inspection	ASTM D 2152	Test shall be conducted on samples from each machine
On line Check Quality Outside diameter Wall thickness Length of pipe surface finish Socket dimensions	Each & every pipe shall be checked by the manufacturer during extrusion of pipe	Sample testing shall be done for acceptance of the lot as per sampling procedure given Appendix – A, Table -5 of IS 4985	IS: 4985 ISO: 2045 Specification	Wall thickness shall also be checked by cutting the pipe at any place by the inspector
Finished product check. Reversion test Stress relief test	Min. 2 samples per machine per shift shall be tested	Sample testing shall be done as per IS 4985, Table 6&7	IS: 4985 IS: 12235 Part 5&6	Test records shall be submitted to PMC on request

<b>Quality Control System and Sampling Model</b>				
<b>Order of Tests to be conducted</b>	<b>By Manufacturer</b>	<b>By Third Party Inspection / PMC representative</b>	<b>Codes/Standards to be followed</b>	<b>Remark</b>
Drop impact test Internal Hydrostatic pressure test. Pressure test for integral joint	Min. 1 samples per machine per shift	Sample testing shall be done as per IS 4985, Table-8	IS: 4985 IS: 12235 Part 8&9 ISO 3603 ISO 1167	Whenever the pipe is cut for hydrostatic test, the inspector will also verify the pipe thickness
Capacity Effect on water	Min. one sample for every change in compound formulation	One sample per 100 km of length of supply at the discretion of inspector	IS: 4985 IS: 12235 Part 3,4&10	Test records shall be submitted to PMC on request
Long term hydrostatic test	Min. 3 samples of different diameter from the regular production lot.	May witness test during inspection	IS: 4985 IS: 12235	Test records shall be submitted to PMC on request
Density	Min. one sample per machine per shift	Min 5 samples per lot	IS: 8543 part 1/sec 2	Reconfirmation may be done at store by checking the samples at the approved laboratory
Ash content	Min. one sample per machine per shift	Min 5 samples per lot	MTNL Standard/ISO: 3451-5	Reconfirmation may be done at store by checking the samples at the approved laboratory
Vicat softening temp.	Min. one sample per machine per shift	Min. one sample per lot.	ISO : 2507	

**TEMPERATURE VARIATIONS:**

All the pipes to be manufactured, supplied and delivered shall be subjected to weather conditions like sun, dust, rain, and wind as available in State of Gujarat. They shall be also subjected to carry and convey drinking water under variable temperature conditions ranging from 4 C<sup>0</sup> to 45 C<sup>0</sup>.

**MARKING:**

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

- i) Certification mark on each pipe.
  - ii) Manufacturers brand name and/or trademark.
  - iii) Purchasers mark as “ GWSSB ” is inscribed.
  - iv) The outside diameter and pressure rating.
  - iv) Batch number or lot number.
  - v) Inspector’s mark on each pipe
- Any other important matter that the manufacturer or purchaser deems fit to be inscribed.

**Elastomeric sealing ring**

This Sealing Ring Shall Be SturineButadinIn Red Color As Specified In Is. The Lubricant Applied For Jointing Of Elastomeric Rubber Ring Shall Be Of Good Quality And Comply The Following Specifications:

- a) Must have paste like consistency and be ready for use, preferably soap jelly.
- b) Has to adhere wet and dry surfaces of UPVC pipes and rubber ring.
- c) Must be non-toxic.
- d) Must be water-soluble.
- e) Must non-affecting physic-chemical and organoleptic properties of drinking water carried ion the pipe.
- f) Must not have an objectionable odor.
- g) Must not harmful to the skin.

Elastomeric sealing ring shall be in accordance with one of the types (Type - 1 to Type – 6) as per ISS 5382. These sealing rings shall be EPDM rubber ring. The sealing ring shall be with ISI mark.

In case of imported EPDM Ring, such rings shall conform to relevant International Standards or the Standards of country of origin, which are equivalent or higher than the Bureau of Indian Standard Specifications. In case of manufacturers who have applied for getting a BIS certification mark, it would be mandatory for such bidders to produce the BIS certification license on or before the date of opening of the price bids. An undertaking in this regard shall have to be provided along with the technical bid.

The rubber sealing rings shall be vulcanized from Ethylene Propylene (EPDM) with strengths as per table 2 of IS 5382-1985.

**TYPE TEST:**

- a) Type test capacity, test for effect on water, test for resistance to Sulfuric Acid, internal Hydrostatic pressure test for 1000 Hrs. shall be carried out at least once at any time during the contract. Or shall be taken at least once during every six months irrespective of the ordered quantity.
- b) The said type test shall be taken by the “GWSSB” representative or third party inspection agency at the in-house laboratory of the manufacturer.

**COLOR OF PIPES:**

- The color of the pipes shall be as per IS 4985-2000.
- The pipes shall bear ISI mark confirming to IS: 4985-2000 or its latest amendment/revision if any.

**TEST FOR PVC RESIN & PIPE:**

**Test for PVC Resin**

It shall be sufficient to show the certificate of chemical test (in accordance with IS 4669) to the inspecting authority to confirm the 'K' value to be 64 to 67 as per clause No. 6.1.2. of IS 4985-2000

Tests for PVC Pipes as per IS: 4985-2000

**A) Density**

These tests shall be carried out by the inspection agency as per the IS:4985-2000 OR its latest revision OR amendments. The value shall be between 1.40 and 1.46 as per the ISS clause No. 10.6

**B) Sulphate Ash Content**

When tested as per Annex B, of IS 4985-2000, the sulphate ash content in the pipe shall not exceed 11 percent.

**C) Reversion Test**

When tested by the immersion method a length of pipe 200 +/- 20 mm long shall not alter in length by more than 5 %. In case of socket end pipes this test shall be carried out on the plain portion of the pipe taken at least 100 mm away from the root of the socket.

D) Vicat softening temperature

When tested by the method prescribed in IS 6307, the Vicat softening temperature of the specimen shall not be less than 80 degree Celsius.

E) Resistance to external bows

When tested by method, the pipe shall have a true impact rate of not more than 10 %. In case of socket ended pipes this test shall be carried out on the plain portion of the pipe taken at least 100 mm away from the root of the socket.

F) Opacity

The wall of the plain pipe shall not transmit more than 0.2 % of the visible light falling on it when tested in accordance with IS 12235 Part-3

G) Effect on water

The pipe shall not have any detrimental effect on the composition of water flowing through them. When tested by the method described in IS 12235 part 4, toxic substances extracted from the internal wall of pipe shall not exceed the following concentrations in the solution.

H) Dimensions of pipe as per IS: 4985: 2000

Tolerance as per IS: 4985: 2000

**Quality Assurance**

The manufacturer shall have a laid down Quality Assurance Plan for the manufacture of the products offered which shall be submitted along with the tenders.

weight and minimum wall thickness of unplasticized ring fit type PVC pipes are as per IS 4985-2000.

**Inspection:**

Inspection of pipe will be carried out at factory site by inspecting agency to be fixed and authorised by GWSSB. The inspecting agency will inspect the material as per the specification and on satisfying itself will mark the inspecting mark on all pipe and issued inspection note to the supplier and concerned consignee.

The bidder shall have to arrange for random testing of pipes brought on site, in CIPET/GIRDA in the presence of GWSSB's representative and on satisfactorily report from the CIPET/GIRDA the payment of pipes will be made. Testing charges shall be borne by Agency.

Pipes supplied must be purchased from the latest vendors approved by GWSSB at the time of purchase of pipes.



The condition will be operative from the date of work order. No escalation shall be granted beyond stipulated time. However, in case of work carried after original time limit, only decrease in prices shall be adjusted.

**Mode of Measurement & Payment & As per P.V.C. Pipe Supply Payment Schedule.**

**PRICE VARIATION FOR uPVC PIPES:**

- i. The price variation will be based on Prime Grade 67 GER 01 (Formerly known as A Grade 67 GER 092) announced by IPCL from time to time.

For purpose of variation, 900Kgs of PVC resin will be considered for one tonne of PVC pipes. In the event of any variation, prices will be calculated as:

$$P = 0.90 (A-B) \times C$$

Where:

- P : Price Variation per tonne  
A : Current Price of PVC resin per tonne fixed by IPCL on the date of inspection of pipe offered. (Excluding GST)  
B : Price of PVC resin per tonner as per published on GWSSB website ( price without GST) on last date of online bid submission (i.e. last date of online submission as per the n-procure website log)  
C : Weight of pipe ( In this case value of C= 1 Tonne)  
\* : Means multiplication

Note: Price of PVC resin per tonne shall be considered after deducting regional subsidy if any declared by IPCL.

**Condition for variation in prices of uPVC PIPES**

1. No ceiling for escalation for difference in the cost of uPVC Pipe will be applicable.
2. This clause shall be operative from the date of Signing of Agreement and up to the expiry of original time limit of Tender.
3. The contractor shall have to give undertaking at the time of claiming their bills for price variation as under:

"We hereby certify that the uPVC resin of the uPVC Pipes for which the bill preferred is not purchased through any Government or Semi Government undertaking at the concession rate"

4.Price Variation (payable/Recoverable) on Extra and Excess Items shall be allowed upto increase of 10% (due to Excess+Extra) of overall total length of respective type of pipelines (PVC or DI or MS or HDPE) mentioned in BOQ of the tender.

5. If the time limit is extended without penalty, then in such case price variation (positive/negative) on the pipes shall be applicable restricted to the Bill of Quantities mentioned in tenders plus Excess and Extra Subject to Clause 4 above. For that part of the extended time for completion, wherein delay is attributable to contractor for the quantities procured during such time period, no positive price variation (Extra payable to contractor) shall be admissible but negative price variation (Recovery against quoted price) shall be admissible. For this purpose, days on which penalty is imposed shall be counted backwards from the actual date of completion.

6. Price Variation shall be calculated by concern Division office and shall be verified by paying Authority prior to making payment.

7. This formula shall be used only for uPVC Pipeline for calculating Price Variation.

8. This clause will be applied to the work irrespective of the cost of the work.

9. The final amount of variation payable/recoverable shall be calculated only on basis of final publication of resin rate announced by IPCL.

10. In case of any discrepancy/dispute regarding application of price variation clause, decision of Concerned Chief Engineer shall be final and binding to the contractor.

#### Mode of measurement and payments

**Payment will be paid as per Rmt.**

Sr. No.	Stage of works	Amount admissible payment
1	2	3
<b>1</b>	On Receipt of materials duly inspected on site or store with maximum limit of 5000 Rmt (for One supply) irrespective of  pipe dia.(size)	<b>65%</b>
<b>2</b>	<b>After lowering, laying &amp; jointing of Pipe line.</b>	<b>15%</b>
<b>3</b>	<b>On Hydraulic testing</b>	<b>10%</b>

<b>4</b>	<b>On refilling and disposal of surplus stuff</b>	<b>5%</b>
<b>5</b>	After Commissioning	5%
	Total....	100%

## **ITEM NO: 2**

**Providing and supplying ISI mark CI D/F Sluice Valves ,Butterfly Valves & Reflux Valves of following class and diameter including all taxes, insurance, transportation,freight charges, octroi, inspection charges, loading,unloading, conveyance to departmental store,stackingetc.complete.**

**80 mm Dia Sluice valves PN 1.0 with handwheel/cap operated(short body)**

### **1.0 GENERAL**

The contractor shall be covering manufacturing, supplying and delivery of Sluice valve conforming to IS: 2906-1984 & IS: 14846 or its latest revision (Specification for sluice valves (50 to 900 mm size) with ISI certification.

### **2.0 STANDARDS**

The C.I. sluice valves to be manufactured, supplied and delivered under the scope of this contract shall be manufactured in accordance with and conforming to Indian standard specifications as given below with ISI certification mark on each sluice valves.

### **3.0 TEMPERATURE VARIATION**

All sluice valves manufactured, supplied and delivered shall be subjected to drinking water under variable temperature condition ranging from 4<sup>0</sup> to 45<sup>0</sup> C.

### **4.0 MARKING**

The legible and in deniable marking upon each valve shall indicate the following:

- (1) ISI certification mark on each sluice valve only.
- (2) Manufacture's brand name and/or trade mark.
- (3) Size of valve and nominal pressure of valve.
- (4) Serial number of cast.
- (5) Serial number in punch
- (6) Where a valve has been tested for only open and test, it should be marked '0' distinctly and permanently.
- (7) Any other important matter that the manufacturer deems fit to be inscribed embossed.

### **5.0 TEST CERTIFICATE**

**5.1** The contractor shall always provide manufacture's test certificate in accordance with every batch/ lot as valves so manufactured and supplied.

### **6.0 NOMINAL PRESSURE**

**6.1** Sluice valves shall be designed by nominal pressure (PN) defined as the maximum permissible gauge working pressure in Mpa as "PN-II" ( Mpa= 10 kgf/m<sup>2</sup> approx)

**6.2** The nominal size shall refer to the nominal bore at any point, shall not be less than the nominal size required.

## 7.0 MATERIAL:

Class of Valve	Working pressure of body	Working pressure for seat
PN 0.6	5 kg/sq.cm	9 kg/sq.cm
PN 1.0	10 kg/sq.cm	15 kg/sq.cm
PN 1.6	16 kg/sq.cm	24 kg/sq.cm

7.1 The materials for the different component parts of the sluice valve shall confirm to requirements given in Table

**Materials for components parts of sluice valve**

Sr.No	Component	Material	Ref.to	Grade of designation
1	Body, bonnet wedge stuffing box, gland thrust plate, cap.	Grey cast iron	210-2009	
2	Steam	High tensile brass	320-1980	Ally 1 of 2
3	Wedge nut	Leaded tin bronze	318-1981(3)	2
4	Body seat ring, wedge facing ring	Leaded tin bronze	318-1981(3)	2
5	Bolts	Carbon steel	1367-1967(4)	Class 4.6
6	Nuts	Carbon steel	1367-1967(4)	Class 4
7	Bonnet gasket	Compressed fiber Board	2712-1998(5)	C
8	Gland packing	Jute & hemp	5414-1995(6)	--

- (1) Specification for grey iron castings (third revision).
- (2) Specification for high tensile brass rods and sections (revised).
- (3) Specification for leaded tin bronze ingots and casting (revised).
- (4) Specification for technical supply condition threaded fasteners (first revision)
- (5) Specification for compressed asbestos fiber jointing (first revision)
- (6) Specification for gland packing, jute and hemp.

## 8.0 MANUFACTURE

Sluice valve bodies for 80 mm to 900 mm size valves shall be provided with double flanged ends connection.

## 9.0 FLANGES

The flanges and their dimensions of drilling shall be in accordance with part IV and VI of I.S. 1538 (Part I to XXII) 1993 (Specification for cast Iron fittings for pressure pipes for water gas and sewage) or its latest revision.

## 10.0 TESTING:

10.1 Hydraulic test:

Each valve shall be subjected to hydraulic tests as described in Appendix – B of IS: 2906-1984 to the test pressure for a duration as specified in table – 7 of IS: 2906 and shall show no sign of leakage under these tests.

**10.2 Liquid Penetration Test:**

The forged steel stems shall not show any sign of flaw when subjected to liquid penetration flaw detection test in accordance with IS: 3658-1981.

**11.0 Measurement and payment:**

The rate shall be paid per number of valves fixed and tested as directed.

**Item No. 3**

**Excavation for pipe line trenches for water supply, sewerage line, manhole etc. all with shoring and strutting if required as per required gradient and line including safety provisions using site rails and stacking excavated stuff including up to all required lead cleaning the site etc. complete for all lifts and strata as specified. Upto 1.50 mt depth**

**For 90 mm pvc pipeline 6kg/cm<sup>2</sup>**

**(a) In all sorts of soil and soft murram (75%)**

**(b) Hard murram (25%)**

**1.0 General**

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

**2.0 Clearing of Sites**

**2.1** The site on which the pipelines are to be laid a

nd 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.

**2.2** The products of the clearing to restacked in such a place and in such a manner, as directed by the engineer in charge

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

**2.4** The agency has to obtain necessary permission for diverting the traffic or public as per requirement from competent authority for carrying out the work.

**3.0 Setting Out**

The centre lines of all pipe trenches 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 labour, 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 include 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 the angle of repose or both approved by the Engineer-in-charge. 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 levelled 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, ramming etc. as directed, by the Engineer and at the cost of the contractor. Other hard excavation shall be cleared of all sorts including loose materials and cut to firm surface, either level, stepped as directed by the Engineer. The Engineer may order such changes 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 or 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 be laid until Engineer has approved the depth and dimensions of trenches, level and measurements.

## **5.0 Shoring and Strutting**

**5.1** Shoring & strutting if required shall have to be carried out by the contractor, for which any extra charge will not be paid.

**5.2** 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 cost.

## **6.0 Protection**

**6.1** 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 and 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.

## **8 Disposal of Excavated Stuff**

**8.1** 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 owner. The rate of excavation includes sorting out of useful materials and stacking them 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 way shall be disposed 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**

**9.1** 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 slope 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 rods 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 testing) for safety of pedestrian and/or vehicular traffic as found necessary by the engineer-in-charge without any extra cost. If found necessary and 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 diversion 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 road.

**9.2** The contractor shall break the road surface only after prior permission form competent authority by chiselling or method specified by competent authority 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.

## **10 Measurement and Payment**

**10.1** The mode of measurement shall be made for a unit of one Cu.M.

**10.2** The rate for the item of excavation shall include the following 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 soak pits 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. 4**

**Lowering laying and jointing PVC/UPVC/CPVC pipes and 'special of following class and diametar incl. Cost of conveyance from stores to sites of work incl. 'cost of labour materials except cement solvant 'givingsatisfactory hydraulic testing as per ISI code.**

#### **90 mm pvc pipe 6 kg / cm**

The Pipes shall be supplied by the Agency as per schedule 'B'. Every care shall be taken in carting them to site. Contractor shall have to pay for any damage to the pipes carting, loading,unloading etc. or in laying. They are to be laid and tested as per specification given below.

#### **LAYING AND JOINTING:**

These items for laying and jointing pipe line and do not include the work of excavation. Every pipes and specials shall be cleared properly and examined for any cracks or defects. The rejected pipes and fitting shall have to be removed from site by the contractor immediately and stacked as directed at his own cost. Before lowering laying the pipe into the trenches, the excavation shall be got checked and approved. Necessary solvent cement for P.V.C. Pipes shall be applied with brush inside the fittings and outside the end of pipe after using the pipes sand comb with sand paper the coupler shall then be pressed till there remains no recess between the ends of pipes. The joints shall be protected from direct sun as they finished.



The refilling shall be done after necessary hydraulic testing carried out according to the instruction of Engineer-in-Charge.

The interior of the pipe already laid must be kept clean as the work under process. The ends of pipe shall be closed with a wooden plug the temporary stop of the work.

#### TESTING :

The Contractor shall give at his own cost necessary hydraulic testing section by section. Minimum length of 500 Rmt per section pipe line should with stand the required highest pressure in the section without showing leakage anywhere in the pipe joints specials valves etc. if any defects are found the contractor shall be made good the same at his own cost.

The contractor shall have to make necessary arrangement for pressure meter and plugging all ends of pipes without claiming extra cost. If the pipes are broken during testing due to test pressure, the contractor shall be responsible to replace the pipe without any extra claim however the pipes shall be supplied by the Department Free of Cost. The pressure water shall be installed at appropriate place as directed by Engineer-in-Charge. Before actual testing, the pipe section shall be filled with water for a period of at least 24 hours. The required pressure subject to class of pipe shall be maintained for at least

30 minutes in presence of Engineer-in-Charge. No extra claim shall be made to contractor for pumping and pressure arrangement and plugging the pipe section.

The payment for untested section part rate at 70% of the tendered rate for the item shall be paid in R.A. Bill.

Balance amount will be paid after the satisfactory test of the pipes line is given by the contractor as prescribed above.

The rate shall be paid per R.Mt. of complete work in all respect.

#### **Item No.5**

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

The contractor shall do refilling in a systematic manner. Before refilling, the trenches the contractor shall get checked the trenches, ready for refilling.

All space between pipeline and the sites of excavation shall be refilled to the original surface with earth or selected materials in layers of 20 cm. well rammed.

Each layer shall be completed before the upper layer is laid till the final level is reached to form a thoroughly compacted base.

Trenches for pipeline shall be back filled after the pipeline is laid to a depth of 30 cm. above the pipe accepted the joint portion. The ramming filling shall be done after hydraulic testing of pipeline.

Refilling on top of pipe shall be carried out carefully with selected soft stuff out of the excavated stuff. The filling shall be raised about 5 cm. to take care of subsequent settlement.

The contractor shall be responsible for any settlement during passage of time or during monsoon and the same shall be refilled with stuff brought from the outside, if necessary.

The process of refilling trenches, ramming, shall be carried out in such a way as not to endanger the pipeline already laid.

The contractor shall carry out refilling 15 cm above road surface to take care of any settlement till completion of work and handing over to local body.

Surplus earth after refilling at the trenches shall be removed from the site within a radius of 3 km as directed by engineer in charged. No extra payment shall be made for clearance the site.

## **Mode of Measurement and Payment**

The rate shall be per Cubic Meter of refilled volume. The Payment as per schedule B.

### **Item No.6**

**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.**

**(1) 80 mm Dia Sluice valves PN 1.0 with handwheel/cap operated( PD Type short body)**

**(2) 25 mm Dia Double Air valve**

#### **1.0 GENERAL**

The valves shall be supplied by the agency as per schedule 'B'. Every care shall be taken in carting them to site. Contractor shall have to pay for any damage to the valves carting, loading, unloading etc. or in fixing.

#### **2.0 JOINTING MATERIAL**

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

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

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

#### **4.0 INSTALLATION**

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

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

4.3 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.

4.4 The flange faces thoroughly greased.

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

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

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

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

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

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

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

#### **5.0 TESTING**

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.

#### **6.0 MODE OF PAYMENT**

The rate shall be for a unit of one number. The payment shall be made only for satisfactorily work done with all respect.

**Item No.7**

**Providing and supplying 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.**

**For 25 mm Dia Double Air valve**

**GENERAL**

**1.0 SCOPE OF CONTRACT:**

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

**2.0 CLASSIFICATION**

**2.1** Air valve shall be of two types

- (a) Single Air valve
- (b) Double Air valve

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

**3.0 MATERIALS**

**3.1 CAST IRON**

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

**3.2 GUN METAL**

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

**3.3 FOREGED BROZNE**

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

**3.4 MILD STEEL**

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

**3.5 MATERIALS FOR BALLS**

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

### **3.6 FLANGE JOINTING MATERIALS**

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

### **4.0 DIMENSION**

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

### **5.0 CHARACTERISTICS**

**5.1** Small orifice valves shall have rubber covered balls and nipples of forged bronze or special alloy in to brass plug.

**5.2** Large orifice valve shall have vulcanite-covered ball closing on rubber sealing backed with leather and gunmetal outlet bushes. They shall be screwed or flanged. The flanged shall be faces and drilled to I.S.S.

**5.3** For sewage mains, the air valves shall be actuated by mild steel floats bronze spindles and shall be fitted with synthetic rubber seals.

**5.4** Air valves shall be sound in all respect and uniformly forged so as to have uniform bore. They shall be free from any defects such as unwanted projection, holes or roughness and shall have inner and outer surface perfectly smooth.

### **6.0 COATING**

**6.1** Immediately after casting and before machining, all cast iron parts shall be thoroughly cleaned and before rusting commences shall be coated by dipping in a bath containing a composition having a tar base.

**6.2** The coating shall be such that it shall not impose any test of small to water. The coating shall be smoothing glossy and sufficiently hard. It shall not chip when scratched lightly with the point of penknife.

### **7.0 MANUFACTURERS GUARANTEE**

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

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

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

### **9.0 TENDER PRICE:**

The tender price shall include all labour, material and machinery cost necessitated to be utilized for;

- a) Proper manufacturing of the valves.
- b) Transportation of the valves either by Rail and/or Road services with all the covers duly and appropriately insured.
- c) Delivery of specials with proper loading, unloading, stacking at GWSSB, Mandvi store or Site of place as indicated by Engineer-in-charge.
  - a) Further towards proper discharge of all contractual obligations. The storage of all specials to be manufactured, supplied and delivered under the scope of contracts shall be in general be made as described in Technical specification document.
  - b) Cost of Required GI /CI air raises Flanged pipe (3.0 meter above GL) Foundation block and Column in CC M-150.

#### **10.0 DELIVERY SCHEDULE:**

The delivery schedule shall be governed by the Executive Engineer of GWSSB, Mandvi store or Site of place.

#### **11.0 MARKING**

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

- i) Manufactures brand name and/or trademark.
- ii) Purchasers mark as “GWSSB, Mandvi store or Site of place” is inscribed.
- iii) Diameter and class of valves.
- iv) Any other important matter that the manufacturer or purchase or deems fit to be inscribed.

#### **12.0 PACKING AND HANDLING:**

**12.1** The materials shall always be packed separately dispatched from manufacturer’s works with adequate protective measures to prevent damages deterioration while in transport or stored at any place. The packing shall always be so neat and tidy that may withstand any robust and rough handling.

**12.2** When the materials are transported at railway risk, special packing as per IRCA rules are absolutely necessary for which the extra cost, if any, shall be borne in total by supplier only.

**12.3** The supplier shall use proper handling instruments/equipment’s and shall follow to a suitable method of handling pipes as may be approved by Engineer, while unloading and stacking material in the stores.

#### **13.0 MATERIALS AND WORKMANSHIP:**

**13.1** General requirements of materials and workmanship shall mean any material or article either raw or finished one is required to be used in the manufacturing process of tanks.

**13.2** All the material shall be new and of high quality.

**13.3** In case, if material is not specified by relevant ISS for manufacturing part or the whole as item, the supplier shall prepare specifications in concurrence with manufacturer and shall seek an approval of Engineer prior to its use in the manufacturer.

**14.0 TEST CERTIFICATE:**

**14.1** The supplier shall always provide manufacturer's test certificate in accordance with every batch/lot of goods so manufactured and supplied.

**15.0 MODE OF MEASUREMENT AND PAYMENT**

Measurement shall be paid on number basis as per relevant dia of the item in schedule of the tender and as per payment schedule.

**Item No.8**

**Erection of air valve riser by installing new M.S. pipe of 6mm thick and 3.2mt length with necessary fittings such as flange of appropriate size, nut bolt and embedded the pipe in RCC M:15 with offset of 10 cm around pipe with necessary steel etc. complete**

**For 25 mm Dia Double Air valve**

**General:**

Item includes cost of required excavation, MS clamps, GI Pipe medium duty of 50 mm dia, PCC of foundation block in CC 1:3:6, RCC work in CC 1:1.5:3 for riser foundation block and cover to riser pipe including reinforcement, formwork, filling, fitting of Air valve of size mentioned in schedule – B etc complete.

**Material:**

G.I. Pipe shall be confirming to IS:1239 (Part-I) 1990 or its latest revision or amendments. The pipe shall be Medium duty with required all fittings.

1. Air valve shall be self purchased at Contractors Own Cost..

**Workmanship**

1. The materials shall be carted to store or site of work including all freight, loading, unloading including all taxes, insurance, including necessary jointing materials such as G.I Nipple saddle pieces shall be brought by the contractor for fixing of air valve.
2. Work shall be carried out as per drawing of this work.
3. Necessary excavation shall be carried out.
4. PCC in CC 1:3:6 shall be carried out for foundation block.
5. A suitable hole shall be drilled on the pipeline. The pipeline shall be of any type such as AC, PVC or CI pipes. A clamp shall be got prepared with a nipple welded on it. The clamp shall be fixed on pipe with bolts and nuts in such a way that the part of nipple fixed in the clamp shall remain in the hole drilled in pipe. The rubber packing shall be provided between the clamps and the pipe. White zinc spun yarn shall be used for fixing the nipple of air valve.

6. Bolt holes shall be drilled according to centre- lines. Bolt heads and nuts shall be hexagonal and shall conform to IS: 1363 (specification for black hexagonal bolts, nuts and lock nuts and black hexagonal screws).
7. The neoprene seat ring shall be held security in place under the low pressure cover by jointing support ring to prevent it from sagging when the ball is not soaking the orifice.
8. Riser pipe shall be erected as shown in drawing. Reinforcement bars shall be placed for foundation and riser pipe as shown in drawing. Reinforcement Cement concrete in CC 1:1.5:3 shall be carried out for foundation block of size shown in drawing and for cover to riser pipe for the dimension shown in drawing including necessary formwork, centring, etc.
9. Air valve shall be fixed to riser pipe with necessary joining material such as nuts-bolts, rubber packing etc.
10. Water proofing cement paint shall be applied on rise pipe in two coats.
11. Entire work for construction of Air valve riser shall be carried out as directed by engineer-in-charge of this work.

**Mode of Payment:**

The rate includes all required materials and labours for work as described above and as laid item in schedule-B of this work. The rate shall be for a unit of one number of works satisfactorily completed.

**Item No. 9**

**Construction of valves chambers in brick or bela stone masonry, locally available in C. M. 1:6. Foundation concrete 150 mm thick in C. C. 1:4:8 of trap metal size 25 mm to 40 mm thick, inside cement plaster in C. M. 1:3 and cement pointing outside in C. M. 1:3 and top cover of precast RCC slab 100mm thick (with key hole in two parts, each with handles or MS bar etc. complete as given size) up to 1mt depth from GL to pipe invert level incl. complete civil work excl. cost of excavation & refilling. with cast in situ RCC slab in one single piece with fixing of CI-MH frame and cover (excl. cost of CI-MH frame and cover) with 23mm thick brick masonry wall in C.M. 1:6. with single piece 10cm with fixing M.H. cover  
size 0.60 x 0.60 x 1.00 mt. depth**

**Scope of work:**

The Brick or Bella masonry valve chambers of size mentioned in schedule-B shall be constructed at various places including all materials and labours.

**1. Location**

Valve chambers shall be constructed at places as shown on relevant drawings or as directed by the Engineer-in-charge.

**2. Excavation**

Excavation, shoring, dewatering etc. for the pits of chamber, laying of pipes and fittings/specials shall be done as requirement of work or directed by engineer in charged.

**3. Plain Cement Concrete (1:4:8):**

The water, sand, cement & stone aggregate of 25mm to 40 mm nominal size shall be used of approved quality as per standard specification in I.S. 456.

**3.1 Workmanship:** Before starting concrete the bed of foundation trenches shall be cleared of all loose materials, levelled, watered and rammed as directed.

**3.2 Mixing:** The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quality of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case of breakdown of machineries and in the interest of the work, it shall be carried out on a water tight platform and 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 of 1.5 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose.

**3.3 Transporting and placing the concrete:** The concrete shall be handed 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 the 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 cm to 20 cm.

**3.4 Compacting:** The concrete shall be rammed rapidly with heavy iron rammers to get the required compaction and to allow all the interstices to be filled with mortar.

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

**4. Cement Mortar**

Valve chamber shall be constructed in brick masonry/bella stone masonry with cement mortar (1:6) unless otherwise specified.

**5. Brick Masonry**

The valve chamber shall be constructed by locally available brick or bella stone. Brick or Bella stone shall conform to its standard specification. 230 mm thick masonry work shall be carried out for valve chamber of size mentioned in schedule – B in cement mortar CM 1:6. Workmanship for masonry work shall conform to its standard specification.

**6. 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/bella stone masonry in cement mortar 1:3 and 20 mm thick unless otherwise specified.

Plastering work shall be carried out in two layers, to the inner face 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 an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise approved by the Employer's Representative.

**7. Scaffolding**

For masonry work in chamber, necessary scaffolding shall be carried out.

**8. Precast Manhole Frame & cover shall be fixed on cast in situ slab.**

**9. Deformed / TMT bars confirming to relevant IS of grade Fe 415 shall be used with RCC work for fixing M.H. frame & cover on M.H.**

**10. Top slab concrete**

Precast reinforced concrete slab / cast in situ RCC Slab shall be casted on top of valve chambers in two parts with locking arrangement.

**11. Measurement**

The payment for valve chamber will be made on No. basis of relative item mentioned in Scheduled-B.

**Item No. – 10**

**Providing C.C.M 1:100 for encasing pipes using trap metal size 12 mm to 50 mm incl. form work curing consolidation etc. complete. In river porstion using trap metal 40 mm nominal size**

1.The course and fine aggregates for the concrete shall be hard, clean angular and most durable trap stoneavailable and sand shall be free from all deleterious materials such as dust, lumps of clays soft andflaky pieces, organic matter loam etc. The Executive Engineer or his representative before use

shall pass the materials. The sand shall be well graded up to a size of 6mm. and shall be screened properly washed and dried before being used. The coarse aggregate shall be properly washed and shall be such as all the aggregates will pass through 25cm. size sieve.

1. Cement used shall be Indian Portland Cement for approved brand confirming to the latest specifications. All the cement shall be stored water tight sheds on raised floor prevent from dampness.
2. The proportion of concrete shall be 1:3:6 That is one part of cement 3 part of Sand and 6 part of coarse aggregate by Volume.
3. The Mixing shall be done by mechanical mixture of hand mixing as directed. After the materials incl. water put in the drum, mixing shall be continued for at least two minutes before the contents are discharged. The drums shall be removed at a speed of less than 14 and not more than 18 revolutions per minute. the drums shall be completely emptied before receiving the materials of the next charge. The concrete must be used immediately after it is prepared and within 10 minutes and in no case shall be used after the cement has attained an initial set. The contractor has to make his own arrangements for concrete mixtures and no extra payment shall be made for machine mixing. The concrete shall be laid gently that is not dumped from a height so as not to permit the segregation of aggregate. The whole concreting must be done as per level given and finished to the slopes directed by the Executive Engineer or his representative before laying concrete the sub grade shall be completely trenched with water.
4. Consolidation shall be rapidly carried out sufficient labour being employed to permit of light ramming, rolling and spreading etc. and the work operation completed within a short time as possible and using the concrete to cream up. In no case the ramming be prolonged after the cement has begun to take an initial set.
5. As soon as concrete has sufficiently set that is after about an hour of laying the surface must be protected. From drying out by keeping wet, either by wet gunny cloth or ponding. The work shall be kept at least for 7 Days. The entire work is to be carried out to the satisfaction of the Executive Engineer or his representative.

The rate shall be paid per one cum. of work done

#### **Item No. – 11**

**Preparing structural design of RCC Under Ground / Partially under ground / above high ground level Reservoir of required capacity as per relevant I.S.s and constructing the same, including excavation in all types of soil strata (including rock) including shoring strutting if required, for loose soil / to protect from collapse due to near by traffic load, casting 100 mm thick P.C.C. leveling course in M-10, Refilling the pit with proper soil and disposing of the surplus stuff within a lead of 50 meters. Including cement plaster in CM 1:2 with approved water proofing compound to inside water touching surface to container. Including all types of labour and material charges of lowering, laying, erecting / hosting and jointing of pipe assembly to inlet, outlet overflow, washout and bye pass arrangement as per hydraulic design.**

**Providing and fixing accessories like MS / GI Ladder, CI Manhole frame and cover, water level indicator, adequate cowl type ventilators or lantern type ventilator with stainless steel jail.**

**RCC chambers for valves. Providing and applying three coats of cement paint / snowcem to the out side face of structure. It also includes satisfactory water tightness test as per relevant I.S. code and painting name of scheme and capacity on the tank as per direction of engineer in charge.**

List of Indian Standards for Design of GSR / SUMP:-
The structural design of GSR shall be in accordance with provisions relevant I.Ss.
(1) I.S. 3370, Part – 1 & 2 2009 or latest revised.
(1.1) I.S. 3370, Part – 3 & 4 1965 or latest revised.
(2) I.S. 456 – 2000 or latest revised.
(3) I.S. 1893 – 2000 – 1984 or latest revised.
(4) I.S. 875, Part – 1 to 3, 1987 or latest revised.
General Specifications:-
(1) Water depth in container shall be adopted as per data of tender. Capacity Shall be calculated excluding free board of the reservoir. If water depth is not specified the suitable water depth / acceptable to field engineer in accordance with hydraulic requirement shall be adopted for capacity.
(2) Shape of container (in plan) specified by in data shall be adopted in absence circular shape shall be adopted.
(3) Size shall be fixed as per availability of space (land area) at site / acceptable engineer in charge.
(4) Effect of overlapping of pressure bulbs on soil due near by structure and proposed sump should be considered.
(5) Care shall be taken that no damage should occur to nearby existing structure. Compensation shall be paid for the same by agency.
(6) The minimum concrete grade for RCC shall be M-30.
(7) HYSD Fe 415 / 500 grade reinforcing bars confirming to I.S. 1786 / 1139 shall be considered in design. CRS / TMT bars shall be provided. In saline atmosphere corrosion resistance stainless steel / HCR rebar shall be provided. Any other steel can be used with approval of C.E./ in situation of non availability in market without extra cost.
(8) Minimum size (or thickness) of various components shall be provided as per tender criteria / specifications in absence as per I.S./ Std. practice of G.W.S.S.B. Minimum dimensions specified for various components in tender data / specifications shall be provided without fail.
(9) The safe bearing capacity (SBC) shall be referred from SBC test report. In absence of report it shall be referred from data sheet. If poor soil is found / water table is met with during excavation SBC shall be scientifically ascertained and design shall be revise. No extra shall be paid for increase in quantity.
(10) DI pipes and special shall only be used if type is not specified in tender.
(11) The rate shall include cost of dewatering during excavation making all arrangement when water table meets within depth.
(12) The structure shall be designed properly to resist uplift due to ground water table specified in data or actual ground water table meets with during excavation. No extra shall be paid. If GWT / Uplift is mentioned in tender and during excavation it dose not meet 7.5% rate shall be reduced.
(13) SS pipes ralling shall be provided over sump periphery when sump height is $\geq 1.5$ meter above ground level

(14.a) RCC Staircase/RCC steps should be provided from GL to Sump top slab based on the height of the GSR above/below the ground
(14.b) RCC Staircase with SS railing to be provided inside reservoir container. BB masonry stair cabin to be provided to cover the same with MS Safety door having locking arrangement
(15) Appearance of structure should be aesthetically good looking acceptable to authority.
(16) Any change in size, shape, depth below GL, height above GL, water depth, F.B., size of member etc can be permitted in exceptional case due to site condition or hydraulic design requirement by C.E. No extra shall be paid for change.
(17) Any change in data, dimensions, shape, water depth, reduction in size if permitted by competent authority and if it reduces quantity then payment shall be reduced prorata.
(18) When capacity of GSR / Sump is > 20 lakh liters two or suitable compartments acceptable to executive engineer shall be designed and provided.
(19) Agency shall engage qualified (at least graduate) consulting engineer for designing the structure and he / she shall visit the site for guidance of work.
(20) 75% part rate shall be payable for concrete, reinforcement and plastering items of container until satisfactory hydraulic testing for water tightness is performed as per tender condition. Till the work shall be treated as incomplete.
Above conditions / general specifications Sr. No. 1 to 20 are part and parcel of tender (contract) and prevail over other provisions in tender.
A) U.G. Sump 100000 liter 1 No.
For GSR (U/G Sump) with cover slab to be constructed at site situated in seismic Zone V: the above rate shall increase by 2%

## Design Requirement

### (A) Design requirements of U/ G Sump

U/ G Sump 1.00 Lacs Lits Capacity	
Location	Capacity in lacs lit
At Dalitvas (Dhori village)	1.00 Lacs Lits Capacity

<b><u>DATA SHEET FOR RCC U/G WATER SUMP</u></b>		
Sr. No.	Details	Parameter / Requirement
1.	<b>GENERAL</b>	
1.1	Item	RCC Under Ground Sump at various locations
1.2	Location / Capacity	As per Tender Documents

**DATA SHEET FOR RCC U/G WATER SUMP**

<b>Sr. No.</b>	<b>Details</b>	<b>Parameter / Requirement</b>
1.3	Type	Shape of sump shall be circular or as directed by the E.I.C.
<b>2.0</b>	<b>Design DATA</b>	
2.1	Ground Level	Consider As per actual site survey
2.2	Bottom Level	If any under Ground storage existing nearby proposed new under Ground storage structure than Bottom level should be same of existing otherwise bottom level should be consider 2 mt below average ground level
2.3	F.S.L.	It should be exactly matched to F.S.L of existing sump otherwise it should be considered 1mt above average ground level. But It should be minimum 3.0 Mtrdepth but not more than 4.0 Mtr depth.
2.4	Free Board	0.30 meter minimum (below Bottom beam of top dome/slab) or As per design
2.5	SBC at site	Contractor must have to carry out SBC test from government approved Laboratory at proposed Location of structure for structural design purpose.
2.6	Water Table	To be decided on basis of soil investigation Report of government approved Laboratory
2.7	Seismic Zone	Zone V or as per latest revision of IS:1893
<b>3.0</b>	<b>DESIGN REQUIREMENT</b>	
3.1	Standard Codes	The design of RCC Sumps shall be in accordance with IS-1893-(Part-I) " Criteria for Earthquake Resistant Design as per Seismic Zone – III of Structures" Part-I General provisions and Buildings and IS - 1893-(Part-II

**DATA SHEET FOR RCC U/G WATER SUMP**

<b>Sr. No.</b>	<b>Details</b>	<b>Parameter / Requirement</b>
		(2002) " Liquid Retaining Tanks (Elevated and Ground supported " and IS 875 Part-III,  3) IS 3370 Part I to II 2009 or latest revised 4) IS 456-2000 or latest revised 5) IS 875 Part i to iii or latest revised 6) IS 10262-2009 or latest revised 7) IS 13920-1993 or latest revised 8) IS 1893-200-1984 or Its latest revision 9) IS 875,PART-1 TO 3,1987 OR Its latest revision
3.2	Grade of Concrete	RCC (As per Mix design)- M-30 minimum
3.3	Grade of Steel	TMT Fe – 415or above to be used
3.4	Minimum Reinforcement	Design requires elements asset out in relevant codes in respect of steel shall be fully satisfied.
3.5	Water Density	9.81kN/M <sup>3</sup>
3.6	Foundation depth below G.L.	> The foundation shall be designed for actual S.B.C. of strata confirmed by plate load bearing test.  > The total depth shall not be less than 2.0m for individual footing.  > Minimum thickness of 100 mm to be considered for levelling concrete. (CC Grade M-15)
3.7	Container Wall	As per design

**DATA SHEET FOR RCC U/G WATER SUMP**

<b>Sr. No.</b>	<b>Details</b>	<b>Parameter / Requirement</b>
3.8	Bottom Slab	Minimum of 200mm thickness
3.9	Top Slab	Minimum of 125mm thickness (If domes provided at the top the thickness shall not be less than 100 mm)
3.10	Clear cover	As per IS Code
3.11	Dia of DI pipe vertically Double flange	<p>Only DI pipe shall be used as per relevant IS code. The Dimensions of Inlet, Outlet, Overflow &amp; Washout pipes are to be considered as per design</p> <p>In general Diameter of pipe for inlet and outlet pipe shall be considered same diameter of water main pipeline or as directed by EIC.</p> <p>Diameter of overflow pipe shall be considered one size higher of inlet diameter or as directed by EIC.</p> <p>Diameter of washout pipe shall be considered same size of outlet pipe diameter or as directed by EIC.</p>
3.12	Length of pipes	From Free board level to Duct foot bend minimum 5.0 meter along Ground after edge of Outer (vertically) and Face of Structure (Horizontally)
3.13	<b>Size of Sluice valve chamber as per IS 15486</b>	Same size for inlet, Outlet & Washout pipe
	i) Internal Dimension	0.60 Mt X 0.60 Mt X Depth shall be consider as actual site Requirement for valve size upto 150 mm Dia and 1.30X1.30X Depth shall be consider as actual site Requirement for other size

**DATA SHEET FOR RCC U/G WATER SUMP**

Sr. No.	Details	Parameter / Requirement
	ii) Thickness of Masonry	23 cm
	iii) Type of Masonry	Brick Masonry in C.M. 1:6
	iv) Plaster and pointing	15 mm thick C.M. 1:3
	v) Foundation	As Per Design
	vi) Manhole Frame and Cover for chamber	R.C.C Precast 100 mm thick
	vii) RCC Slab or Precast slab	M-15 : 10 cm thick
3.14	Cowl type ventilator	100 mm dia. 2 Nos minimum or as per design (Minimum vent should be provided as per design criteria) 15Kg/No
3.15	CI MH Frame and cover at top of Container	0.90 x 0.60 m (54 Kg) 2 Nos
3.16	Inside Plaster	20 mm thick CM 1:2 niru finished water proofing compound for all over inside container I.E. bottom slab, vertical wall top slab/dome bottom
3.17	Outside plaster	12 mm thick CM 1:3 cement plaster for vertical wall from bottom level to top level of sump, top of dome/slab and beam etc.
3.18	Colour	Approved 3 Coats of Weather Proof Exterior (Apex) paint with Primer coats should be applied of Approved Brand.
3.19	Other Requirement	<ul style="list-style-type: none"> <li>SS pipes railing shall be provided over sump periphery when sump height is <math>\geq 1.5</math> meter above ground level.</li> <li>RCC staircase/RCC Steps should be provided from GL to sump top slab based</li> </ul>



**DATA SHEET FOR RCC U/G WATER SUMP**

Sr. No.	Details	Parameter / Requirement
		<p>on the height of the GSR above/below the ground.</p> <ul style="list-style-type: none"> <li>RCC stair case with SS railing to be provided inside reservoir container. BB Masonry stair cabin with MS safety door having locking arrangement to be provided for GSR, Sump and HGLR of capacity more than 7.5 lakhs liter with top slab. If dome is constructed as top slab then provide minimum opening of 900 mm x 2000 mm with curbing and SS railing around.</li> <li>All other Requirement as per Price bid &amp; specifications Including all obligatory requirement of department.</li> <li>When capacity of GSR/Sump is more than 20 Lakh Litter Two or Suitable compartments Required as per schedule B</li> <li>Sump shall be constructed considering the connectivity of existing storage and existing pipeline network of rwss and invillage distribution network. New sump shall be interconnect with exsiting near sump.</li> </ul>

**Contractor Signature**

**Dy. Executive Engineer  
P H Sub. Division No.1**

**Mode of Payment:**

1	GROUND (UNDERGROUND) LEVEL SERVICE RESERVOIRS/SUMPS	
a.	On approval of designs	2 % of Quoted rate
b.	On completion of excavation and base slab	18 % of Quoted rate
c.	On completion of vertical wall and braces	20 % of Quoted rate
d.	Full supporting structure including column, ring beam and completion of top slab / dome	15 % of Quoted rate
e.	Plastering inside & outside with epoxy etc.	10 % of Quoted rate

	complete	
f.	Procurement and fixing of inlet, outlet, washout, overflow pipes, valves, specials, chambers, lighting arrester conductor and specials at site	10 % of Quoted rate
g.	Water level indicator, painting of letters, M.S ladder, pipes, railing and all miscellaneous items such as snowcem paint in three coats etc (Completed with all respect) including water tightness test	15 % of Quoted rate
h.	On hydraulic testing	10 % of Quoted rate
	Total	100%

## 1. Employer's Drawings

1.1. The drawings listed in the Tender document are the Employer's drawings and are provided by the Employer as illustrative of the Specification.

1.2. All data and information furnished in the drawings by the Employer is given in good faith but the Employer does not accept the responsibility for the completeness and accuracy thereof. The same shall be verified by the Contractor promptly pointing out errors or discrepancies thereof to the Engineer.

## 2. Drawing Sheet Format

2.1. All drawings provided by the Contractor shall be on standard size sheets, prepared on computer with AutoCAD 14 and shall show the following particulars in a title block located in the lower right hand corner, in addition to the name of Contractor and equipment manufacturer, date, scale, drawing number, revision number (R0 for drawings submitted initially, R1, R2, etc. for drawings submitted subsequently) and title.

### Executive Engineer

P H Works Division, GWSSB,  
Bhuj – Kutch.

Name of Work:

A blank space of 90 mm X 100 mm shall be provided for the Engineer's approval stamp and provision shall be made for details of revisions to be recorded.

2.2. All drawings submitted by the Tenderer/Contractor shall use the English language and SI units. All drawings shall be clearly and fully cross-referenced to the other drawings as relevant.

## 3. Tender / Contract Drawings

3.1. Drawings submitted by the Tenderer shall show all the essential items of the Plant offered

together with sufficient details to enable the general arrangement of the Plant to be determined.

- 3.2. The drawings and documents to be provided by the Tenderer / Contractor shall be as per the schedules of price but shall not be limited to those listed:

#### **4. Submissions and Approval of Drawings**

- 4.1. The following shall be the procedure for submission and approval of drawings:

- 4.1.1. The Contractor shall submit 4 copies of the drawings to the Employer. All the drawings are to be signed by the Contractor or his authorized representatives
- 4.1.2. The Engineer's Representative will review the drawings and, if found fit for approval, the Employer will return 2 copies to the Contractor duly approved.
- 4.1.3. In case the drawings/documents are not fit for approval but worth for review, the Engineer's Representative will mark the comments on the drawings and return 2 copies to the Contractor. In such case, the Contractor shall resubmit the revised drawings within two weeks as per sub-clause 4.1.1 above and the same shall be repeated till the drawings are finally approved as per sub-clause 4.1.2 above.
- 4.1.4. If the submitted drawings/documents are not worth for review, the Contractor will be informed accordingly.
- 4.1.5. On receipt of the approved drawings as per sub-clause 5.1.2 above, the Contractor shall submit floppy and documents to the employer.
- 4.1.6. After tests on completion, the Contractor shall submit, within 15 days of the conclusion of the tests, floppies of the "As Built Drawings" to the Employer.
- 4.2. When the drawings are received by the Engineer's Representative after revision by the Contractor, he will only review the revision made and hence the Contractor shall carefully identify all the revised details / dimensions and also describe the revisions in the revision block.
- 4.3. No drawings, with corrections made after taking the prints, will be accepted.
- 4.4. Approval of drawings by the Engineer shall not relieve the Contractor of his responsibility in terms of the Contract.

#### **5. Delivery, Unloading and Storing at Site**

- 5.1. The Contractor shall be responsible for checking all materials delivered to Site and shall keep the Engineer's Representative fully informed of the state of deliveries. The Contractor shall carry out, at his cost, all instructions of Engineer or his Representative for proper unloading, preservation, maintenance, storage and security of materials delivered to Site until he fulfills all his obligations under the Contract.
- 5.2. The Contractor shall erect and maintain on the Site any temporary storage facility as required and approved by the Engineer.
- 5.3. Multiple handling and movement of materials during storage and retrieval shall be avoided.

#### **6. Spare Parts:**

- 6.1. Spare Parts required after the taking over the Plant shall be filled up by the bidder in the price schedule.

- 6.2. Spares during pre-commissioning trials, commissioning tests/ maintenance, guarantee etc. shall be provided by the Contractor. The necessary spares shall be brought by the Contractor prior to the pre-commissioning test so as to avoid the downtime of equipment due to non-availability of them. All these spares have to be provided as required, by Contractor free of cost.
- 6.3. All spare parts shall be new, unused and strictly interchangeable with the parts for which they are intended to be replacements and shall be treated and packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be clearly marked or labeled on the outside of its packing with its description, number and purpose. When more than one spare is packed in a single case or other container, a general description of its contents shall be shown on the outside of such case or container and a detailed list enclosed. All cases, containers and other packages shall be marked and numbered in an approved manner for the purpose of identification. Spares shall be delivered to Site after the completion of erection but before start of commissioning of Plant along with technical leaflets and details. Spare parts shall be indicated in the assembly drawing showing clearly the part numbers.
- 6.4. All cases, containers or other packages are liable to be opened for such examination as the Engineer's Representative may require and packing shall be designed to facilitate opening and thereafter re-packing. In the event of the some specific spares offered in the Contract being withdrawn from manufacture owing to changes in design of equipment or similar reasons viz., model being obsolete etc., the Contractor shall inform the Employer before such withdrawal so that the Employer can take timely alternative steps.

## **7. Tools:**

- 7.1. Tools shall be delivered to site just prior to Tests on Completion.
- 7.2. The specified tools shall not be used for the erection of the Plant being supplied and except that the Engineer may call upon the Contractor to demonstrate their use or effectiveness, they must be handed over to the Employer in a completely new and unused condition. Should the Contractor require any such tools at site for erection, he shall provide his own.

The test equipment shall include special purpose items essential to the testing or re-calibration of related items of Facilities.

## **MATERIALS AND WORKMANSHIP**

### **1. Introduction**

- 1.1. This part of the Specification sets out the general standards of materials to be supplied and the workmanship required to be ensured by the Contractor. All component parts of the Works shall, unless otherwise specified, comply with the provisions of employer's

requirement or be subject to the approval of the Employer. Particular attention shall be paid to a neat, orderly and well-arranged installation carried out in a methodical competent manner.

## **2. Reference Specifications and Standards**

- 2.1. Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to 'B.S') issued by the British Standards Institution of 2, Park street, London W.I., or to an Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standard Institution), ManakBhavan, 9 Bahadur shah Zafar Marg, New Delhi 110 002, or American Society for Testing and materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American national Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or Japanese Industrial Standards (JIS) issued by Japanese Standards Association, 4-1-24, Akasaka, Minato-Ku, Tokyo 107, Japan or to any other equivalent Standard it shall be to the latest revision of that Standard at the Tender opening date.
- 2.2. The Contractor may propose at no extra cost to the Employer, the use of any relevant authoritative internationally recognised Reference Standard.
- 2.3. All details, materials and equipment supplied and workmanship performed shall comply with the specified Standards. If Tenderer offers equipment to other Standards, the equipment/material should be equal or superior to those specified and full details of the difference shall be supplied.
- 2.4. In the event of conflict between this Specification and the Codes for equipment, provisions of this Specification shall govern. Certain specifications issued by national or other widely recognised bodies are referred to in this Specification. In referring to the Standard Specifications the following abbreviations are used:

IS	:	Indian Standard
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
AWS	:	American Welding Society
AWWA	:	American Water Works Association
ISO	:	International Organization for Standardization
DIN	:	Detaches Institute fur Normans
BS	:	British Standard
IEC	:	International Electro technical Commission
IEE	:	Institution of Electrical Engineers
IEEE	:	Institute of Electrical and Electronic Engineers

NEMA	:	National Electrical Manufacturers Association
AGMA	:	American Gear Manufacturer's Association

### **3. Materials - General**

- 3.1. All materials incorporated in the Works shall be the most suitable for the duty concerned and shall be new and of reputed make/approved quality, free from imperfections and selected for long life and minimum maintenance. Non-destructive tests, if called for in the Specification, shall be carried out. All submerged moving parts of the Plant, or shafts and spindles or faces etc. in contact with them shall be of corrosion resistant materials. All parts in direct contact with various chemicals, shall be completely resistant to corrosion, or abrasion by these chemicals, and shall maintain their properties without aging due to the passages of time, exposure to light or any other cause.

### **4. Workmanship - General**

- 4.1. Workmanship and general finish shall be of first class quality and in accordance with best workshop practice.
- 4.2. All similar items of the Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items.
- 4.3. All parts, which can be worn or damaged by dust, shall be totally enclosed in dust proof housings. All materials incorporated in the Works shall be the most suitable for the duty concerned, free from imperfections and selected for long life and minimum maintenance. All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope. Suitable provision by means of eyebolts or other means are to be provided to facilitate handling of all items that are too heavy or bulky for lifting and carrying by two men.

### **5. Welding**

- 5.1. Welding shall comply with the latest revision of the BS 5135 Code.
- 5.2. Welders shall be qualified in accordance with the requirement of the appropriate section of BS 4871. The Engineer shall have the right to call for further qualification from time to time from any welder who in the opinion of the Engineer does not produce weld in accordance with the qualification. Each welder shall be assigned a number and letter. Each weldments shall clearly be identified as to its welder marking the welder's Code adjacent to the welds. A record chart shall be maintained for each welder showing the procedures for which he has qualified, the date of such qualification, the type of defects produced and their frequency. The Engineer shall disqualify the welder whose Work requires a disproportionate amount of repairs. All procedures where required shall be qualified as per BS EN 283-3.

- 5.3. Inspection and quality of surveillance shall not be limited to the examination of finished welds. The techniques employed shall be based on methods which are known to produce good results and which have been verified at Site by actual demonstration.
- 5.4. Haphazard striking of the electrodes for establishing an arc shall not be permitted. The arc shall be struck either on the joint or on a starting tag. The starting tag shall be of the same material or a material compatible with the base metal being welded. In case of any inadvertent strike on place other than the welding, the area affected shall be ground flushed and examined by liquid penetration method.
- 5.5. Generally, a stringer bead technique shall be used with a slight oscillation of necessary to avoid slag and to minimize the number of beads needed to fill exceed 3 times the wire diameter. Vertical welds shall be made in upward direction. For all pipes above 300 mm dia., welding shall be done whenever possible, by 2 welders working simultaneously along both sides of the pipe.
- 5.6. The root pass shall have less than 1.5 mm internal reinforcement. Defects like icicles, burn through and excessive “such back”, etc. shall be cause for rejection of welds.
- 5.7. Final welds shall be suitable for appropriate fabrication of the non-destructive examination of the weld. If grinding is necessary, the weld shall be blended into the parent metal without gouging or thinning of the parent metal in any way. Uneven and excessive grinding may be a cause for rejection. Fillet weld shall preferably be convex and free from undercutting and overlap at the toe of weld. Convexity and concavity shall not exceed 1.5 mm. The leg lengths shall not exceed the specified size by more than 1.5 mm.
- 5.8. All attachments such as lugs, brackets and other non-pressure parts shall also be done by qualified welders in accordance with the design details and materials specifications. Temporary attachments shall be removed in a manner that will not damage the parent metal. Areas of temporary attachments shall be dressed smooth and examined by ultrasonic or liquid penetration methods.
- 5.9. All tack welds shall be made using qualified procedure and welders, the number of size of tack welds shall be kept as small as to consist of adequate strength and joint alignments. All tack welds shall be examined visually for defects and if found defective shall be completely removed. As welding proceeds, tack welds shall be either removed completely or shall be properly prepared by grinding or filling their starting ends so that they may be satisfactorily incorporated in the welds. Unacceptable defects shall be removed by grinding machine or chipping or gouging. Flame gouging may be permitted provided gouged surfaces are ground at least by 1.0 mm below the deepest indentation.
- 5.10. All weld repairs shall be carried out using the approved welding procedures and welders. Re-welded areas shall be re-examined by the methods specified for the original welds and the Engineer’s Representative shall duly qualify repair procedures.

## **6. Pre-heating and Post-heating Treatment**

- 6.1. Pre-heating and post heating treatment shall conform to the relevant application Codes. Pre-heating not exceeding 121 deg. C for all carbon steel construction above 25 mm thickness

would be mandatory. Such pre-heating would be maintained during flame cutting, flame or arc gouging, welding and repairs and may be done by gas heating by gas torches/gas rings with neutral flame. The temperature shall be checked by temperature indicating crayons. However, such pre-heating will not be necessary for welds less than 6 mm size. In large diameter pipe fabricated out of plate materials, production control test plates in accordance with the BS 4870 part 1 Table 6 to represent 30% of the long seams and each welder's performance would be mandatory.

## **7. Electrodes**

- 7.1. All electrodes shall be stored in their original sealed containers under dry conditions. Electrodes shall remain identified until consumed. All electrodes shall be dried before use. Drying ovens shall be provided in Work areas for drying purposes. Electrodes withdrawn from oven shall be promptly used and excess unused electrodes shall be promptly returned to oven.

## **8. Examination/NDT/Radiography**

- 8.1. The various stages of examination and types shall be as stipulated in the respective fabrication Codes. Radiographic examination shall be carried out as per provisions of BS 2600 or BS 2910; Ultrasonic tests where called for shall be carried out as per provisions of BS 3926; magnetic particle tests shall be carried out as per BS 6072. Liquid penetration tests shall be carried out as per BS 6443.

## **9. Stainless Steel Welding**

- 9.1. All welding consumable such as electrodes, filler weirs, argon gas for shielding and purging shall be of high quality and the proposed brand shall be furnished for approval of the Engineer. Weld deposits shall have similar or higher physical properties and similar chemical composition to the members joined.
- 9.2. All electrodes shall be purchased in sealed containers only and stored in their packing intact. The packets opened shall be consumed as early as possible. The electrodes removed from the containers shall be kept in holding ovens at temperatures recommended by electrode manufacturer. Special care shall be taken in avoiding mixing of electrodes in the oven. The electrodes and filling wires shall be free from rust, oil, grease, earth and other foreign matter.
- 9.3. Argon gas with purity 99.5% shall be used for shielding and purging. The purity of gas shall be certified by the gas manufacturers.
- 9.4. Non-destructive examination of the welds shall be carried out to ensure quality of weld.
- 9.5. The electric current for welding shall be direct current, straight polarity (electrode negative). The welding current shall be kept minimum possible to ensure minimum heat affected zone in the parent material. Other side of the weld joint shall be periodically flushed with argon gas.

## **10. Castings**

- 10.1. Cast iron shall be of standard grey close-grained quality. The structure of the castings shall be homogeneous and free from non-metallic inclusions and other injurious defects. All surfaces of castings, which are not machined, shall be smooth and shall be carefully fettled to remove



all foundry irregularities.

- 10.2. Minor defects in depth not exceeding 12.5 percent of total metal thickness and which will not ultimately affect the strength and serviceability of the casting may be repaired by approved welding techniques. The Engineer shall be notified of large defects and no repair welding of such defects shall be carried out without prior approval of the Engineer. If the removal of metal for repair should reduce the stress resisting cross section of the casting by more than 25 percent, or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then casting shall be rejected. Test coupons cast simultaneously with the main castings shall be identified to check physical, chemical analysis of casting. Major defects on casting are not acceptable. Castings repaired by welding for minor defects shall be stress-relieved after such welding. Non-destructive tests as directed by the Engineer will be required for any casting containing defects whose extent cannot otherwise be judged, or to determine where repair welds have been properly made.

## **11. Forging**

- 11.1. All major stress-bearing forging shall be made to a Standard Specification. Forging shall be subjected to magnetic particle testing or dye penetration test at the areas of fillets and change in section. The testing shall be conducted after rough machining (10 microns). Any defect, which will not machine out during the final machining, will be gouged out fully, inspected by dye penetration or magnetic particle inspection to ensure that the defect is fully removed and repaired using an approved repair procedure. Any indication, which proves to penetrate deeper than 2.5% of the finished thickness of the component, shall be reported to the Engineer giving the details like location, length, width and depth. For the magnetic particle inspection the choice of wet or dry particles shall be at the Contractor's discretion.
- 11.2. All forging shall be demagnetized after test and shall be heat-treated for the relief of residual stresses.

## **12. Design Life**

- 12.1. The Works as a whole shall be new, of sound workmanship, robustly designed for a long reliable operating life and shall be capable of 24 hours per day continuous operation for prolonged period in the climatic and working conditions prevailing at the Site, and with the minimum of maintenance. Particular attention shall be given to temperature changes, the stability of paint finish for high temperatures, the rating of engines, electrical machinery, thermal overload services, cooling systems and the choice of lubricants for possible high and prolonged operating temperatures. The Contractor shall be called upon to demonstrate this for any component part either by service records, or evidence of similar equipment already installed elsewhere or relevant type tests. Routine maintenance and repair shall as far as possible not requires the services of highly skilled personnel.
- 12.2. The Plant shall be designed to provide easy access to and replacement of component parts, which are subject to wear, without the need to replace whole units. No parts in contact with water shall have a life from new to replacement or repair of less than five years.
- 12.3. Design features shall include the protection of Plant against damage caused by vermin, dirt, dust and dampness and to reduce risk of fire. Plant shall operate without undue vibration,

and parts shall be designed to withstand the maximum stresses under the most severe condition of normal service. Materials shall have a high resistance to change in their properties due to the passage of time, exposure to light, temperature and any other cause, which may have a detrimental effect upon the performance or life of the Works.

- 12.4. Plant located outside lockable areas/building shall have additional features to prevent unauthorized operation.

### **13. Name Plate**

- 13.1. Each item of the Plant shall have permanently attached to it in a conspicuous position, a nameplate and rating plate. Upon these shall be engraved or stamped, the manufacturer's name, type and serial number of Plant, details of the loading and duty at which the item of Plant has been designed to operate, and such diagrams as may be required by the Engineer. All indicating and operating devices shall have securely attached to them or marked upon them designations as to their function and proper manner of use.
- 13.2. Nameplates, rating plates and labels shall be of a non-flame propagating materials, either on-hygroscopic or transparent plastic with engraved lettering of a contrasting colour. Fixing shall be by means of non-corrosive screws; drive rivets or adhesives shall not be used.
- 13.3. Warning labels shall be provided where necessary to warn of dangerous circumstances or substances. Inscriptions or graphic symbols shall be black on a yellow background.
- 13.4. Instruction labels shall be provided where safety procedures such as wearing of protective clothing are essential to protect personnel from hazardous or potentially hazardous conditions. These labels shall have inscriptions or graphic symbols in white on a blue background.

### **14. Nuts, Bolts, Studs and Washers**

- 14.1. Nuts, bolts, studs and washers for incorporation in the Plant shall conform to the requirements of the appropriate standard. Nuts and bolts shall be of the best quality of specified grade, machined on the shank and under the head and nut
- 14.2. Fitted bolts shall be a light driving fit in the reamed holes they occupy, shall have the screwed portion of such a diameter that it will not be damaged in driving and shall be marked in a conspicuous position to ensure correct assembly at Site.
- 14.3. Washers, locking devices and anti-vibration arrangements shall be provided where necessary. Jointing hardware for the entire Plant shall be provided with sufficient spares to cater for site losses.
- 14.4. Where bolts pass through structural members taper washers shall be fitted, where necessary, to ensure that no bending stress is caused in the bolt. Where there is a risk of corrosion, bolts, nuts and studs shall be designed so that the maximum stress does not exceed half the yield stress of the material under any conditions. All bolts, nuts and washers that are subject to frequent adjustment or removal in the course of maintenance and repair shall be made of nickel-bearing stainless steel.
- 14.5. The Contractor shall supply all holding down, alignment and leveling bolts complete with

anchorage, nuts, washers and packing required to attach the Plant to its foundations, and all bed plates, frames and other structural parts necessary to spread the loads transmitted by the Plant to concrete foundations without exceeding the design stresses.

**15. Allowances for Wastage**

- 15.1. The Contractor shall supply reasonable excess quantities to cover wastage of those consumable, which will be normally subject to waste during erection, commissioning and setting to Work.

**16. Painting – General**

- 16.1. The Contractor shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting, as specified, all parts of the Plant at the place of manufacture prior to packing.
- 16.2. Parts may be cleaned but surface defects may not be filled in before testing at the manufacturer's works. Parts subject to hydraulic test shall be tested before any surface treatment. After test, all surfaces shall be thoroughly cleaned and dried out, if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the specification provides to the contrary all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.
- 16.3. All protective coatings shall be suitable for use in warm humid climates. All primers, under coats and finishes shall be applied by brush or airless spray, except where otherwise specified. Consecutive coats shall be in distinct but appropriate shades. All paints shall be supplied from the store to the painters, ready for application, and addition of thinners or any other material shall be prohibited.

**17. Painting at Place of Manufacture**

- 17.1. Steel and cast iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp corners etc. shall be ground to a curve before sand blasting. A primer coat of a zinc rich epoxy resin based coating with at least 75 microns dry film thickness is to be provided. In addition the parts are to be provided with adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns including primer coating.

**18. Painting at Site**

- 18.1. Immediately on arrival at the site, all items of Plant shall be examined for damage to the paint coat applied at the manufacturer's works, and any damaged portions shall be cleaned down to the bare metal, all rust removed, and the paint coat made good with similar paint.
- 18.2. After erection, such items, which are not finish painted, shall be done so and, items that have been finish painted at the manufacturer's works shall be touched up for any damaged paintwork. For finish painting, two coats of synthetic enamel conforming to IS: 2932 shall be applied. Dry film thickness of each coat shall be at least 25 microns.
- 18.3. The dry paint film thickness shall be measured by Electrometer or other instruments approved by the Employer. In order to obtain the dry film thickness specified the Contractor should ensure that the coverage rate given by the paint manufacturer would enable this thickness to be obtained. Strength of adhesion shall be measured with an adhesion tester

and this value shall not be less than 10 kg/cm<sup>2</sup>. Painted fabricated steel work which is to be stored prior to erection shall be kept clear of the ground and shall be laid out or stacked in an orderly manner that will ensure that no water or dirt can accumulate on the surface. Suitable packing shall be laid between the stacked materials. Where cover is provided, it shall be ventilated.

## **19. Galvanizing**

19.1. Wherever galvanizing has been specified the hot dip process shall be used. The galvanized coating shall be of uniform thickness. Weight of zinc coatings for various applications shall not be less than those indicated below:

a) Fabricated steel

Thickness less than 2 mm but not less than 1.2 mm 340 gms/sq.m

Thickness 2 mm and above 460 gms/sq.m

b) Fasteners

Up to nominal size M10 270 gms/sq.m

Over M10 300 gms/sq.m

19.2 Galvanizing shall be carried out after all drilling; punching, cutting, bending and welding operations have been carried out. Burrs shall be removed before galvanizing. Any Site modification of galvanized parts should be covered well by zinc rich primer and aluminum paint.

## **20. Support for Pipe work & Valves**

20.1 All necessary supports, saddles, sling, fixing bolts & foundation bolts shall be supplied to support the pipe work. Valve and other facilities mounted in the pipe work shall be supported independent of the pipes to which they connect.

## **INSPECTION AND TESTING AT MANUFACTURER'S PREMISES**

1. Inspection and Tests

1.1. Valve

1.1.1. During testing there shall be no visible evidence of structural damage to any of the valve component.

1.1.2. Motorized valves shall be tested with their actuators, with a differential head equivalent to their maximum working pressure, to prove that the actuators are capable of opening and closing the valves under maximum unbalanced head condition within the specified opening or closing period.

1.1.3. The following test shall be carried out for butterfly valves:

a) Seat leakage test at rated pressure

b) Body hydrostatic test at 1.5 times the rated pressure

c) Disc strength test at body test pressure

d) Valve operation with and without actuator

e) Crack opening test under tension

1.1.4. The following test shall be carried out for sluice valves:

- a) Seat leakage test at rated pressure
- b) Hydrostatic test at 1.5 times the rated pressure
- c) Valve operation

1.1.5. The following test shall be carried out for non-return valves:

- a) Seat leakage test at rated pressure
- b) Body hydrostatic test at 1.5 times rated pressure
- c) Operation

1.2. Pipe work

1.2.1. Testing of pipes and fitting shall be carried out in accordance with relevant Indian Standard and internationally approved standard. Pipes, fittings and expansion bellows shall be hydrostatically tested for 1.5 times the rated pressure.

1.3. E.O.T. Crane

1.3.1. The cranes shall be completely assembled in the Contractor's or subcontractor's Works and shall be subjected to the tests as specified in IS 807/IS 3177 or relevant internationally approved standard. The Contractor shall provide the test weights.

Equipment for testing

Equipment required for testing CC cubes and testing of steel bars are installed at main H/W site.

## **CRITERIA FOR PREPARATION OF DESIGNS OF RCC SUMP/ESR BY PRIVATE AGENCY**

### **1.0 GENERAL:**

#### **LIST OF QUALIFIED STRUCTURAL CONSULTANTS**

1	To, The Consultant Sthapati Designers & consultant Pvt Ltd "Ohm"Chamber" Station Road Navsari-396445 Ph No. (02637) 250330,280330	5	To, The Consultant Stup Consultant Pvt Ltd. 2 <sup>nd</sup> Floor, Shoopers Plaza-2 Opp. Telephone Bhavan C.G. Road, Navrangpura Ahmedabad-380009 Ph No. (079) 26468495,26468496
2	To, The Consultant Ashirwad Engineering Consultant 2 <sup>nd</sup> Floor, Induchacha House, above Prakash Group Opp. ChhaniJakatnaka Baroda-390002	6	To, The Consultant Deesh Civil Engineering Design 17,Sarohi-III, NarodaNikol-Road, Nikol, Ahmedabad. Ph No. (079) 22893839, (M) 9426067039

	Ph No. (0265) 2761977,2781753		
3	To, The Consultant SaurachnaStruconPvt Ltd 330,Akshar Arcade Opp: Memnagar Fire Station, Vijay Cross Road,Navrangpura Ahmedabad-380014 Ph No. (079) 26562119,26562120	7	To, The Consultant Shri Manish V.Doshi, 507, Hem Arcade, Dr. Yagnik road, Opp. Swami Vivekanand Statue, Rajkot-360001 Ph No. (0281) 2466303
4	To, The Consultant Dr. H.J.Shah B-9,Sai Krupa Society Vibhag-2, Besides Sai Temple,Water tank Road, Harni Road, Baroda-390006 Ph No.(0265) 2483407	8	To, The Consultant Mars Planning & Engineering Service Pvt Ltd., 601, Sun Mount Building, Opp. Iscon Mega Mall, S.G. Highway, Ahmedabad-15 Ph No.(079) 40026333

- 1.1.0 Capacity of the container of the tank shall be the volume of the water it can store between the designed full supply level (F.S.L) and lowest supply level (L.S.L) i.e. the level of the lip of the outlet pipe. Due allowance shall be made for 20 mm. thick plastering the tank from inside, while calculating the capacity of the tank.
- 1.2.0 Freeboard is the vertical distance between F.S.L. and Soffit of covering slab or dome or beam supporting the cover. In any case the free board shall not be less than 300 mm form bottom of beam.
- 1.3.0 Height of the staging or height of the tower shall be the vertical difference between L.S.L. of the tank and the average ground level at the site of tank.
- 1.4.0 Dead storage shall be the storage capacity of water below L.S.L. depth of dead storage shall be the vertical distance between the top outlet level and wash out level. The washout pipe level shall be at the lowest portion of the container.
  - 1.4.1 Minimum depth of water for dead storage shall be 100 mm even for flat bottom slab and not more than 300 mm for inlet i.e. bottom dome slab type tank.
- 1.5.0 Water depth in the tank shall be the vertical distance between L.S.L. and F.S.L. of tank.
- 1.6.0 The allowable bearing pressure or the safe bearing pressure on the strata as specified in table of IS 1004-1978 or its latest revision, whichever is less shall be considered and design of foundation shall be based on this unit pressure unless specified.
- 1.6.1 Notwithstanding anything mentioned above regarding S.B.C. whenever the Engineer-in charge of design directs that bearing capacity shall be determined by carrying out actual soil exploration and tests due to conditions as mentioned in para 2.0 of IS 1992-1969. The same shall be carried out by a Government laboratory or any other approved laboratory and allowable bearing capacity so arrived shall be taken as the basis of design. The factor of safety adopted in case of

- actual test shall be as per clause 6.1 (A) of IS 6403-1971.
- 1.6.2 IS:1893 (Part-I&II): 2202, IS-875(Part-III):2002, IS:13920 and IS:4326 or its latest revision shall be followed.
- 1.7 As per IS:11682-1985 Page-25 typical reinforcement details "The" Ties or "Links" jointing to vertical bars of shaft is highly needed.
- 1.8 The Min. concrete grade for RCC shall be M: 30. Proportion of concrete ingredients shall be as per Mix design using weigh batching.
- 1.9 TMT( Fe 415)or higher grade reinforcing bars confirming to IS 1786-1139/1139-1986 TMT bars shall be used as per detailed specification.
- 1.10 Maximum spacing between horizontal bracings shall be 5 m (storey height).
- 1.11 Water level indicator shall be provided and fixed float type /electronic (as specified).
- 1.12 The rate shall include providing and fixing pipes, specials, and valves required for inlet, outlet, wash out, over flow and bye pass arrangement. The scope of work includes constructing supporting RCC pillars, erecting, laying, fixing and joining pipes and specials etc up to 5m length from face of staging (outer most column).
- 1.13 CI pipes & specials shall only be used.
- 1.14 The rate shall include cost of dewatering during execution making all arrangement and any dewatering technique.
- 1.15 The structure shall be designed properly for uplift due to Groundwater table specified in data or GWT met with during execution. No extra shall be paid.
- 1.16 Effective curing shall be carried out as per specifications.
- 1.17 Agency shall engage qualified (at least graduate) consulting engineer for designing the structure and he/she shall visit the site for guidance of work at least 3 times .
- 1.18 75 % part rate shall be payable for Concrete, Reinforcement and Plastering items of container until satisfactory hydraulic testing for water tightness is performed as per tender condition . Till then the work shall be treated as incomplete.
- 1.19 TMT Fe 415 grade reinforcing bars confirming to I.S. 1786 -1985 1139-1986 shall be considered in design. TMT bars shall be provided. Any other steel can be used with approval of C.E./ in situation of non-availability in market without extra cost.
- 2.0 GENERAL REQUIREMENTS:
- 2.1.0 Cement concrete shall be in accordance with IS 456-2000 fine and coarse aggregates shall be confirming to IS 383-1963 or its latest revision. The selection of the type of fine and coarse aggregate to be actually used shall be as directed by the Engineer-in-charge.
- 2.2.0 For parts of the tank in contact with stored water and closing vapour above FSL shall be in concrete grade M250 or in richer grade.
- 2.3.0 Inlet, Outlet, Overflow and Washout pipe:  
Materials: Cast iron flanged pipe of appropriate class shall only be used.  
Inlet Pipe: The size of inlet pipe shall be same that of rising main to proposed HGLR

Outlet Pipe: As per data sheet attached separately.

Overflow pipe: The size of overflow pipe shall be one diameter higher than that of inlet pipe.

Washout Pipes: As per data sheet attached separately.

#### 2.4.0 Water Level Indicator:

A water level indicator shall be provided for the tank reading depth of water in meters with least count of 10 cm. The system shall consist of uncorrodable material and shall be simple and easy to maintain. The water level indicator shall be provided and fixed as approved and directed by the Engineer-in-charge.

2.4.1 Access to roof for an entry to the inside of the tanks shall be provided. At roof level of the tank the access to roof manhole from the ladder or stair shall be properly provided with parapet or railing. At ground level or at walkway level the access forgoing up shall be provided with a door and locking arrangement. Railing at roof level and at gallery level shall be provided.

2.4.2 At least two manhole with frame and cover of CI medium type shall be provided with ladder for entering into the container for maintenance purpose. The size of manhole frame shall be 0.9 x 0.6 meter 75 kg.

#### 2.5.0 Lightning Arrestor:

Lightening arrestors shall be provided on the roof of the tank as per IS 2309-1969. Position and height of lighting arrestors shall be such that the whole structure shall be enclosed within dome having its apex at top and of the arrestors and generated by a line inclines at 60° to the vertical. The arrestors shall be suitably earthed. Copper strip shall be covered with GI pipe 25-mm dia up to 4-meter height from GL. The copper lighting arrestor incl. copper strip & earthing plate etc comp.

The roof of the tank shall be ventilated by providing cowls or ventilators with mosquito proof net for ventilators. They shall be fixed with proper framing. Ventilation area shall not be less than of (A) 0.04% of the free water surface when cowl type ventilators are provided. (B) Cross sectional area of the inlet pipe. (C) Cross sectional area of the outlet pipe.

2.7.1 All tanks shall be checked for seismic forces confirming to IS 1893-1975 or its latest revision and wind forces also.

2.7.2 Water tank in vicinity of mines, galleries and blasting sites or in areas which may be subjected to blasting sites or in areas which may be subjected to blast or shock, shall be designed for the dynamic forces developed due to blast equipment.

2.8 Following shall be the minimum thickness of various members of the tank container.

Roof slab	100 mm
Bottom slab	200 mm
Roof Dome	100 mm
Container Dome	150 mm
Vertical wall	150 mm

2.9.0 Error up to 2 % in weights, forces, moments etc. in the design calculations may be neglected.

#### 3.0 LOADS:



- 3.1.0 For all RCC and PCC component unit weight shall be taken as 25000 N/m<sup>3</sup>, 24000n/m<sup>3</sup> respectively, allowance of platter up to 20 mm. Inside surface of container shall be taken in to consideration of in normal circumstances.
- 3.2.0 Water load shall be taken as 10000n/m<sup>3</sup>.
- 3.3.0 Live load and snow load shall be taken as per IS: 875-1964 or its latest revision.
- 3.3.1 No live load may be assumed while designing the staggering (or tower) and foundation for seismic loads.
- 3.3.2 Live load on gallery all round the elevated tank shall be considered as 1500 n/m<sup>2</sup>.
- 3.4.0 Wind load as per Fig. i.e. basis maximum wind pressure or Indian including winds of short duration as per IS 875(Part-III)/2002 or its latest revision shall be considered.
- 3.5.0 Seismic forces on the tower shall be as per IS 1893(Part-I&II)/2002 or its latest revision.  
Wind and seismic forces shall not be assumed to act simultaneously.

#### INCREASES IN PERMISSIBLE STRESSES:

Where stresses due to wind or earth quack temperature & shrinkage effects are combined with those due to dead, live and impact loads the stresses specified in table 13, 16 & 17 of 456-1978 may be increased up to a limit of 33.50%.

#### DESIGN:

- 4.1.0 General:
  - 4.1.1 Shape of the structure shall be as directed by Engineer-in-charge and shall be selected depending upon site condition from the standard shape
  - 4.1.2 General description and salient feature as mentioned below of the design shall be not approved by the Engineer-in-charge and shall be mentioned in the design before detail design calculations starts.
- 4.2 Sketch showing dimensional section, elevation with plan shall be given.
- 4.3.1 The safety against over turning of structure shall be computed quite accurately.
- 4.3.2 Design shall be based on the worst possible combination of various loads, moments, shears and resultant stress in the tank for the following two cases.
  - (i) Tank Full 'A'
  - (ii) Tank EmptyTank full means depth of water inside the container up to full height of the container without consideration of free board.

Or safe bearing capacity of soil based on actual soil investigation report of the laboratory.

Position of sub soil water level.

Chemical analysis if sub soil water and soil where possibility of brackish/saline water is ascertained.

Location of site on index plan with respect to latitude and longitude.

- 4.3.3 Design shall be based on accepted basis and methods of design as well as the provision of IS 3370-1965, IS 456-1978, IS 1343-1960, IS 2210-1962, IS 2204-1962 etc. and their latest revision. However methods based on experimental investigation as mentioned in para 18.2 % "C" in IS 456-1978 shall not be entertained.

- 4.4.0 The parts of the structure neither in contact with the liquid on any face more enclosing the space above the liquid as in the case of stages of a tower shall be designed on working stress method on accordance with the requirement of IS 456-1978. Staging may be designed on limit method as per IS 456-1978.

- 4.5.0 Design of members other than these excluded by above (i.e. roof, walls, floor etc. of the container) shall be based on consolidation of adequate resistance of cracking as well as adequate strength calculation of stresses shall be para s per 3.2.2 of IS 3370 (part-II) 1965 or its latest revision.

- 4.5.1 PERMISSIBLE STRESS IN CONCRETE FOR RESISTANCE TO CRACKING:

For calculations relating to the resistance of members to cracking the permissible stresses in tension (direct and due to bending) and shear shall confirm the values specified in Table-I of IS 3370 (part-II 1965)

The permissible tensile stresses due to bending apply to the fact of the member in contact with the liquid. In members less than 225 mm thick and in contact with the liquid on one side, these permissible stress in bending apply to the face remote from liquid.

- 4.5.2 FOR STRENGTH CALCULATION:

In strength calculation, the permissible concrete stresses shall be in accordance with para-44 of IS 456-1978. Where the calculated shear stress in concrete alone exceeds the permissible value reinforcement acting in conjunction with diagonal compression in the concrete shall be provided to take the whole of the shear.

- 4.5.3 Permissible compressive stress (Directly only) insheels (i.e. Top Dome, Conical Wall and shall be reduced by 43% for 10 cm thick walls. For thickness more than 30 cm, the compressive stress shall be reduced by 50% and for inter media thickness 10 cm. to 30 cm. linear interpolation shall be done.

- 4.6 PERMISSIBLE STRESSES IN STEEL:

- 4.6.1 For resistance to cracking the steel and the concrete are assumed to act together. For checking the tensile stresses in un cracked concrete for avoidance of cracks, the tensile stress in the steel shall be the product of the modular ratio and the corresponding allowable tensile stress in concrete as per IS 3370(part-II) 1965 or its latest revision. Modular ratio "M" for different concrete mix shall be taken as under:

Grade of Concrete	Modular Ratio "M"
M-15	19
M-20	13
M-25	11

- 4.6.2 For strength calculation (concrete assumed to be cracked), the permissible stresses in reinforcement shall be as per Table -2 of IS 3370(part-II) 1965 or its latest revision. For steel, the stresses shall be as per IS 1966 or its latest revision.
- 4.7.1 Modules of elasticity of concrete MEC shall be taken as  $5700/F_c$  where equal to characteristic cube strength of concrete in N/m<sup>2</sup> as per IS 456-1976.
- 4.8.2 Columns shall be checked for tensile stress for both the conditions as mentioned in para 4.3.2 in combination with axial tension and bending due to wind or seismic loads, and shall be checked for bond for maximum tensile stress arrived.
- 4.8.3 Columns may be assumed to be fixed at the top of footing.
- 4.8.4 Water Tower in seismic zone (V) of IS 1393-1975 twin diagonal (crossed) backing of steel in vertical plane in addition to the horizontal bracing may be provided.
- 4.9 COLUMNS:
- 4.9.2 Reinforcement shall be provided on both faces of the load-bearing shaft. Minimum vertical reinforcement in the shaft shall be of 0.4% of the gross concrete area required; Minimum horizontal reinforcement shall be 0.3% of the gross concrete area. Required in ease, for tower in high seismic zone (IV & V) minimum horizontal reinforced shall be 0.4% of the gross concrete area; for before bars of medium tensile or height tensile steel the above steel requirements may be reduced by 20 %.
- 4.9.3 Shaft/Retaining walls shall be checked for combined axial load and bending due to earth, wind or seismic loads and shall satisfy the provision of IS 456-1978 in tank full and tank empty condition.
- 4.9.4 Age factor for increasing strength shall not be considered.
- 5.0 FOUNDATION:
- 5.1 The permissible increase in bearing pressure for different types of foundation shall be as per table -I of IS 1893-1965 or its latest revision. When seismic forces are considered and for wind forces it shall be as per IS 1904-1966 or its latest revision.
- 5.2 For the purpose of the design of foundation the loading data shall be given the magnitude of vertical load, lateral load and moments at top of footing (Foundation) level. The data shall be made available, for both the cases as per para 4.3.2.
- 5.4.1 The foundation area, door, individual column footings, combined footings, angular rafts and solid rafts shall be worked out on the basis of lower most value of the safe bearing capacity or allowable bearing pressure values as derived from IS 1904-1978, IS 9403-1971, IS 8009-1976 or their latest revision.
- 5.4.2 In case of purely cohesive and CI pipe of soil particulars attention should be given to IS 1903-

1978 clause 6 & 7. Settlement shall be calculated as per IS 8009 (part-I) 1976 for foundation.

- 5.4.3 In case of purely cohesion less soil, foundation shall be design for safe bearing capacity and shall be checked for permissible total as well as differential settlement values as given in relevant IS.
- 5.4.4 If the foundation consists of individual columns footing, minimum clear distance between center of column shall be equal to twice the width of footing and clear distance between the edge of footing shall be not less than width of footings.
- 5.4.5 In case of soil beneath the footings are not of the same characteristics the footing shall be designed for the soil having lowest SNC or ANP as the case may be. In such conditions the permissible limits of total as well as differential settlement shall be limited to 75% of the permissible limit given in ISS.
- 5.4.6 For special type of foundations like well foundation under beam pipe foundation etc., decision of Superintending Engineer, Public health Design Circle shall be final and binding to the designer.
- 5.4.7 Classification of soil and all characteristics of soil relevance to BSBC and APB shall be as per the soil in irrigation reports of Government stipulation. Government approved investigators.
- 5.5 For the design of foundation angular or solid raft type, the "PLACE THEORY" shall be adopted.
- 5.6 In normal circumstances minimum 100-mm thick plain cement concrete with 100 mm projection around in Grade M 100 with coarse aggregate as metal shall be provided as leveling course. Where injurious soil progressive water is expected the leveling course shall be grade not weaker than M 15 and if necessary Sulphate resisting or the special cement shall be used. The ground level within the foundation area of the structure shall be consolidated properly with a suitable slope to drain out rainwater outside the foundation.
- 6.0 DETAILING:
- 6.1 MINIMUM REINFORCEMENT FOR WATER RETAINING MEMBER:
  - 6.1.1 The minimum reinforcement in walls, floors, roofs, in each of two directions at right angle shall have an area of 0.3% of the concrete selection in that direction for sections up to 100.00 mm thick. For section for thickness greater than 100 mm and less than 450 mm thick, minimum reinforcement each of two directions shall be nearly deducted from at 0.3% for 100 mm thick sections or greater two layers of reinforcing steel shall be place one near each face of the section to make up to minimum reinforcement specified in this clause.
  - 6.1.1 The minimum reinforcement specified in this 6.1 above may be decrease by 20 % in case of high yield strength bars confirming to IS 1786-1976 or IS 139-1966.
  - 6.2.1 Minimum clear cover to reinforcement under normal conditions shall be as per para 25.4 of IS 456-1978.
  - 6.2.2 For liquid faces of parts of members either in contact with the liquid or enclosing the space above the liquid shall be as per para 7.2 IS 3370 (part-I 1965).
  - 6.2.3 In case of Raft Foundation, the cover to reinforcement shall be as per 4.6.2 of IS 295 (part-I) 1973.
- 6.3 For members of structure in contact with water, effective cover shall not be more than 60 mm. Even bars subjected to bending stress, or bars subjected to tension due pure tension in the member the effective cover shall not more than 75 mm.

- 6.4.1 Spacing of reinforcement shall be as per para 25.3 IS 456-1978.
- 6.4.2 Spacing of lateral ties for column shall satisfying provision of para 25.3.2 'C' of IS 456-1978.
- 6.4.3 The additional suggested criteria for reinforcing steel which accounts for existing moments, tension etc. i.e. other than temperature or binding steel shall comprise of minimum 8 mm for deformed or 10 mm mild steel bars.
- 6.4.4 The spacing between two para in main reinforcement shall distribution steel, stirrups, links etc. shall not exceed 30 cm.
- 6.5 For members of the container, the maximum diameter of reinforcement in tension shall not exceed as given below depending upon the geometrical percentage of reinforcement. (Ratio of tensile steel to gross is concrete.)
 

Up to 1.0%	16 mm dia
Up to 1.5%	22 mm dia
Up to 2.0%	25 mm dia

Note: Min. 10 mm dia. Reinforcement shall be used as main reinforcement.
- 1.0 In case of dispute regarding interpretation any above clause, the decision of the Superintending Engineer, Public Health Circle, Concerned will be binding to the Designer.
- 2.0 In case of any clauses not included in the above criteria the decision of the Superintending Engineer, Public Health Design Circle will be final and binding to the Designer.

**INSTRUCTION FOR PREPARATION OF DESIGN OF RCC SUMP/ESR (ONLY FOR SELFDESIGNING BY CONTRACTOR)**

- 1.0 The design of RCC Sump/ESR shall be in accordance with IS-1893-( Part-I ) “ Criteria for Earthquake Resistant Design of Structures” Part –I General provisions and Buildings and IS-1893-( Part-II (2002) “ Liquid Retaining Tanks ( Elevated and Ground supported “ and IS 875 Part-III, IS13920, IS 4326. IS 11682-1985 page-25 Typical Reinforcement details of Shaft.
- 2.0 The design of SUMP shall be got prepared by the any consultants, who have experience to design water retaining structures. The design and drawing supplied by contractor should be accepted after the approval by the competent authority from the departments or by approved structural consultants of GWSSB. The contractor should mention the name, qualification, experience etc. of the design engineer who will be the necessary for design scrutiny work etc. The design Engineer should attend the office of the Department if required at any stage prior to the acceptance of design or drawing construction with reference books etc. It will be the duty of designer to submit the design drawings and compliance of remarks by the Department.
- 3.0 PAYMENT AS PER PAYMENT SCHEDULE
- 4.0 COMMON CONDITIONS:

- 4.1 All petty items occurring if the work shall be carried out in workman like manner as per specification published by G.W.S. & S. Board and as per general specification current in the Division and as per instruction of the Engineer-in-charge from time to time.
- 4.2 Extra charge of claims in respect of extra work shall not be allowed unless such works are ordered in written by the Engineer-in-charge and are claimed for in specified manner before the work is taken in Hand.
- 4.3 The contractor shall engage on in experience and qualified supervisor as his authorized agent for the work. He shall be responsible to take from time to time such orders as may be given by the Engineer-in-charge to carry them.
- 4.4 As order book shall be maintained on the work site and the contractor shall sign the orders given by the Engineer-in-charge and he shall carry out them promptly. The order books shall be surrendered to the Department on completion of Work.
- 4.5 The contractor shall have to clear the site of work before it commences and after the work is completed for which separate claim shall not be entertained.
- 4.6 In addition in the required stores the contractor shall provide at his own cost the suitable temporary office shed with a covered area of about 20 sqmt. with necessary furniture for the use of Government staff while in works. The shed and furniture on completion of the work shall be removed by the contractor at his own cost.
- 4.7 The contractor shall provide at his own cost all labour charges setting out the as may be required for lining and setting out the as may be required for lining and setting up the works satisfactory and adequate facilities site scaffolding etc. for facility of checking his work or taking measurements etc.
- 4.8 Department shall give reasonable facilities to the contractor to enable him to obtain controlled materials at controlled rates as may be fixed from time to time. The contractor shall however not be entitled to time. The contractor shall however not be entitled to claim any compensation extra time limit to account of non-supply at controlled rates. The materials obtained shall be only used for the work in question. Any materials remaining surplus shall be neither disposed nor removed by the contractor without obtaining written permission of Department to that effect. Government shall have the right to take delivery of the surplus materials at the original purchase price of the receipt contractor shall be sue of such materials to the satisfaction of Engineer-in-charge and submit in monthly statement thereof.
- 4.9.1 The contractor at his own cost expense shall provide necessary housing accommodation and the sanitary
- 4.9.2 Arrangement for his staff and labour and shall pay direct of the authorities concerned all rates. Taxes royalties and other charges.  
The contractor shall also comply with the requirement of the Health Department as regards anti malarial measures etc.
- 4.10 Water require for the execution of work and for the water tightness test of the reservoir shall be supplied by the contractor at his own cost in manner satisfactory to the Engineer-in-charge of work.

- 4.11 The contractor shall not be entitled to claim compensation from the Government. For works suffered on account of delay where such delay is caused either by (i) Difficulties relating to the supply of Railway Wagons, (ii) Force majeure, (iii) Acts of the God, (iv) Any other reasonable caused beyond the control of the Department. In case of delay Govt. shall however grant such extension of time limit for the completion as may appear reasonable to the Engineer-in-charge and his decision shall be final.
- 4.12 The contractor shall be responsible to pay complete compensation to his staff and to his labours according to the labour compensation rules, on account of accidents and loss of life or loss of the life due to accident.

5.0 DECLARATION:

The contractor shall make declaration as under:-

"I have made myself thoroughly conversant with conditions as regards the availabilities or otherwise of all construction materials skilled and unskilled labour on which. I have quoted my rates for this work. The specifications, drawing and design of this work have been carefully studied and are understood by me before the submission of this tender.

DETAILED SPECIFICATION

Detailed specification given here shall be treated as extension or partial modifications to the specifications of respective items given in the volume of specification published by Gujarat Water Supply and Sewerage Board.

1.0 EXCAVATION FOR FOUNDATION:

- 1.0 When the rates are to be quoted for a work based on "contractor's own design" the word excavation for foundation shall mean excavation for foundation in all types of strata such as soil, soft mud, as well as hard rocks up to the designed depth at which foundation is to rest. No extra payment will be given for any change in strata at the same place. The rate shall also include dewatering and shoring strength if and where found necessary.
- 1.1 Excavation shall be carried out as per approved drawing. The excavation made deeper or wider than that required as per drawing shall not be paid, but such deeper excavation if carried out shall have to be filled up using C.C. 1:3:6 by the contractor without extra cost. If the type of strata require wider excavation at top (GL) then contractor shall excavate the trench accordingly but no extra payment for such wider excavation shall be made.
- 1.2 The rate shall include providing cured warnings lights during night time providing barricading consisting of metal ropes and bamboo for which no extra payment will be made.
- 1.3 The contractor shall make his own arrangements to obtain prior permission directly from relevant authorities for staking of excavated stuff near work side. If he fails to obtain such permission, then he will have to make his own arrangement without claiming extra cost to transport and stack the excavated stuff at a suitable place approved by the Engineer-in-charge of work.

- 1.4 The excavated stuff shall be stacked at least 3.0 meter away from the edge of excavated trench, If enough space is not available at work site then the excavated stuff shall be stacked at suitable place situated away from site. Similarly the surplus stuff shall have to be disposed off at a suitable place for which contractor shall have to obtain permission directly from relevant authorities. No extra payment for transportation of excavated stuff or surplus stuff shall be made.
- 1.5 No excavated stuff shall be disposed off or used for any purpose other than refilling without prior permission of Engineer-in-charge of work.
- 1.6 Details shown in the data sheet regarding water table are approximate. The contractor should make his own arrangements for taking trial pots at his own cost more quoting his rates for as certain type of strata water table, quantity of seepage water etc.
- 1.7 Work at nighttime shall be carried out only with written permission of Engineer-in-charge.
- 1.8 Bottom of the excavated foundation trench shall be sprinkles with water (If water table is not above foundation level) and wall rammed to obtain a reasonably firm and level bedding.
- 1.9 The rates shall include continuous dewatering of seepage water or rainwater from, trenches to keep the trench dry particularly during casting of base concrete, Concrete for footing and columns of shaft etc. till concrete fully cures etc.
- 1.10 Whenever collapsible types of strata are encountered pucca shoring and strutting shall be invariably claim shall be entertained.

## 2.0 C.C. M 100 BASE CONCRETE FOR LEVELLING COARSE:

- 2.1 For all practical purpose and in absence of proportioning of concrete on base of preliminarily tests, C.C. 1:3:6 may be provided as a leveling course i.e. one part of cement three parts of sand and six parts of black trap kapachi. Specification for various ingredients of concrete such as sand, cement, kapachi, water shall be as these given in specification for C.C.M. 15.
- 2.2 While laying base concrete for leveling course the concrete shall not be dumped from above but shall be carried out to the bottom and gently placed from a height not exceeding 1.5 meter. If concrete is transported by chutes, then the same shall be remixed at bottom of chutes to overcome any segregation that might have occurred.

## 3.0 C.C. M 150:

- 3.1 As far as possible the preparation of various ingredients of concrete shall be determined on the bases of preliminary tests as per ISS using the actual materials to be used on site. However in absence of such preliminary tests the volumetric proportion of 1:2:4 may be adopted i.e. one part of cement, two parts of sand and four parts of kapachi, water just sufficient to attain desired workability may be added. However the aim while proportioning should be to fix the proportion of aggregation and water cement ratio shall be always sufficiently low enough to get desired strength.
- 3.2 Materials:



- 3.2.1 Coarse aggregate shall consist of tough angular black trap kapachi. The kapachi shall be obtained from approved source only. Normally at least two stock piles of different size of 12 to 20 mm and 25 mm to 40 mm shall be maintained. It will however, be preferably to maintain third stock pile of 6 mm to 12 mm also for better control on mix of concrete.
- 3.2.2 The maximum size of coarse aggregate to be used shall be as large as possible within the limits of requirements, based on size of member and spacing of reinforcement. But aggregate exceeding 40 mm shall not be used in concrete for Sump.
- 3.2.3 Depending up on the size of member, spacing of reinforcement and degree of workability desired, the coarse aggregates from different stockpiles may be mixed in a suitable proportion to get a uniform mix that does not segregate.
- 3.2.4 The coarse aggregate shall not contain dust, clay or other such harmful material. If directed by the Engineer the same shall be washed with water and dried before being used.
- 3.3.0 Fine Aggregates:  
Fine aggregates shall consist of coarse, angular river sand free dirt and other harmful organic materials. If directed the same shall be screened and washed before being used. Sand brought from approved source shall only be used.
- 3.4.0 Cement:  
Contractor shall provide a temporary store with double lock arrangement for storage of this cement on work site without extra cost. Cement shall be stored in such a way that it is not affected by moisture.
- 3.5.0 Water:  
Water to be used in concrete work shall be potable, free from injurious elements such as chloride or sulphate etc. and shall be obtained from approved source only. Contractor shall make his own arrangements to obtain and store sufficient quantity of water at all times.
- 3.6.0 Reinforcement Steel:  
The reinforcing bars to be provided with TMT Steel Fe-415 and shall confirm to the Tender specifications and relevant IS specifications.
- 4.0 FORM WORK:  
Form work shall consist of steel plates or smooth timber planks to be joined by nuts, bolts, nails or pegs so as to have a reasonably water tight joints. Sufficient number of vertical and horizontal supports shall be provide when completed. Formwork shall be sufficiently sturdy & strong to absorb all stresses and movements. Before concrete is placed in position the formwork and steel shall be got checked through Engineer-in-charge of work. Advance intimation shall be given to the Engineer-in-charge for this purpose. The ultimate responsibility for safety and of lives of workmen and that of forms etc. from beginning of work till its completions shall always rest with the contractor proper ladders and plant forms for easy access shall be provided by the contractor without extra cost.  
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.

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 the Engineer In charge. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

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

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 swelling, rust staining or allowing the passage of moisture.

For liquid retaining structures, sleeves shall not be provided for through bolts nor 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.

The striking time for formwork shall be determined based on the 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 temperatures; and
- g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20°C) forms may be struck after expiry of the time period given in IS:456 unless approved otherwise by the Engineer In charge. For Portland Pozzolana/slag cement the stripping time shall be suitably modified as approved by the Engineer In charge. It's 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 stresses arising during the construction period.

## 5.0 MIXING, TRANSPORTATION AND LAYING:

- 5.1 For important works like SUMP and sumps mixing of concrete shall be invariably done in approved machine mixer only. The mix obtained from the mixer shall be a uniform mass consisting of all aggregates coated with cement paste.

- 5.2 Fresh concrete shall be transported horizontally in ghamellas or wheelbarrows. Vertical transportation shall be done either by manual labour or using mechanical vertical lifts. When chutes are used for transportation, care should be exercised to avoid segregation and concrete may be remixed at bottom of chutes to get uniform mix. Before any concrete is placed in position all loose materials such as dirt, chips of stones, wood, steel etc. should be removed. Inner side of forms should be coated with thin layer of oil to get a good finished surface.

Concrete should not be dumped from above in which case aggregate will segregates, but placed gently from a height not exceeding 1.5 meter. Compaction of concrete shall be done by vibrators till cream appears at top. Over vibration shall be avoided to avoid segregation.

#### 6.0 CURING:

After concrete is set in position it shall be kept continuously wet with water for 7 days either by using gunny begs (column and walls) by ponding (slab) or as directed by spraying of water.

Unless otherwise specified the rate shall include finishing the exposed surface to get good finished surface.

The forms shall be kept in position for period given below:-

1)	Vertical sides of walls, beams, columns	2	Days
2)	Slabs (props left under.)	4	"
3)	Bottom of beam (props left under)	7	"
4)	Removal of prop to slab spanning up to 4.5 superious over 4.5 m.	7	"
5)	Removal of props to fearus spanning up to 6.0 m.	14	"
6)	Spanning over 6.0 m.	21	"

#### C.C. M-300:

Specification for C.C.M. 300 shall be same as those for C.C.M 150 except that grade of concrete to be produced shall be M300. Since M - 300 mixes is normally used in water retaining parts of container where the aim is not to get dense, strong and watertight concrete, special care shall be exercised in controlling proportion of aggregate, water cement ratio, compaction and curing.

#### 7.0 PROVIDING AND PLACING IN POSITION STEEL REINFORCEMENT:

- 7.1 Reinforcement bars to be used in RCC work shall have to be supplied by the contractor. The rates include providing, cutting, bending, binding, hooking and placing in position including cost of binding wire. The bars shall be fusion bonded and epoxy coated.
- 7.2 Depending upon the type of reinforcement steel proposed in design (i.e. M.S. or deformed etc.) the steel shall confirm to relevant ISS codes in practice. Contractor shall produce necessary test certificate in absence of which the steel bars shall be get tested by the Department at the contractor's cost.

- 7.3 Steel bars shall be cut, bent up, hooked bound with wires and then placed in position as per approved drawing. The steel shall be got checked through Engineer-in-charge. Before any concrete is placed in formwork advance intimation shall be given to the Engineer-in-charge for this purpose. The steel shall be cleared of any dust or rust that might have been deposited on bars.
- 7.4 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 the Executive 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 scaling of the concrete cover.
- Binding wire shall be 16 gauge soft annealed wires. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.
- Substitution of reinforcement, laps/splices not shown on drawing shall be subject to Executive Engineer's approval.
- 8.0 WOODEN WATER LEVEL INDICATOR:
- 8.1 A wooden water level indicator of approved size and type shall be provided and fixed by the contractor. It shall consist of wooden plank of 250 mm x 40 mm.
- 8.2 The divisions on water level indicators shall show distance of 10 cm. clearly. A copper or PVC float of 500-mm dia and 50 mm height shall be provided along with steel wires pulleys etc. The entire arrangement shall be first got approved by the Engineer-in-charge of work. Letter and marking shall be painted with approved enamel paint.
- 9.0 Providing and fixing CI flanged pipes and special such as duck foot bends, crippling flanges bell mouthpiece etc. for inlet outlet overflow and wash out.
- 9.1 Diameter and length of above pipes shall be as given in Appendix - A. CI flanged pipes shall be vertically cast double flanges and shall be confirm to relevant ISS. They shall be first get approved by the Engineer-in-charge of work.
- 9.2 Item shall include providing all specials such as crippling flanges, and duck feet bends etc. as may be required on site.
- 9.3 The Item shall also include cost of all jointing materials such as nuts, bolts, rubber packing, white zinc or pig lead or lead wool if required.
- 9.4 Pipes shall be fixed perfectly vertical and straight.
- 9.5 Before fixing in position pipes shall be coated with two coats of anticorrosive paint.
- 9.6 The pipes and specials shall be tested hydraulically. Leakage if found shall be repaired without extra cost.
- 10.0 PROVIDING AND FIXING CI SLUICE VALVE:
- 10.1 Diameter of CI sluice valve shall be as shown in Appendix - A. CI sluice valve shall be of class - I confirming to IS - 780-1980.

- 10.2 The rate includes providing and fixing CI sluice valves with tailpieces including jointing materials such as nuts, bolts rubber packing zinc etc.
- 10.3 The rate includes giving hydraulic test to the satisfaction of Engineer-in-charge of work.
- 10.4 Sluice valve shall be supplied with necessary spindle or wheel for operating the same.
- 11.0 PROVIDING AND FIXING C I M H FRAME AND COVER:  
One number of C I M H frame and cover shall be provide and fixed in top slab of container. The dimensions and weight shall be as shown in Appendix - A. The C I M H frame and cover shall be first got approved by the Engineer-in-charge. Two coats of anticorrosive paints shall be applied before fixing them in position.
- 12.0 C I COWL TYPE VENTILATORS:  
The C I Cowl type ventilator should be of 100 mm dia shape with flanged and roughing screen shall be as per Appendix - A. The rate includes providing and fixing C I Cowl type ventilator as per Appendix - A including cost of all jointing materials such as nuts, bolts, white zinc rubber packing etc. Two coats of anticorrosive paints shall be applied to the surface before they are fixed in position. They shall be first for approved by the Engineer-in-charge.
- 13.0 PROVIDING & FIXING M.S. LADDER INSIDE CONTAINER:  
Contractor shall have to fabricate and fixed M.S. ladder. The ladder to be fixed shall be fabricated from M.S. flat of 10 mm x 65 mm or M.S. angle having equivalent modular of selection 20 mm dia. Bars shall be fixed at 30 mm c/c. to act as steps. The ladder shall be 45 cm. wide if length of ladder is more than 8.0 m. Three coats of approved anticorrosive paint shall be applied to the ladder. The design of M.S. ladder shall be got approved by the Engineer-in-charge before it is fabricated and fixed in position. Rate includes providing and fabricating, painting and fixing in position of M.S. ladder as above.
- 14.0 CONSTRUCTION OF VALVE CHAMBER:  
Number and size of valve chamber shall be as per Appendix - A. Specification of various items such as B.B. masonry cement plaster, C.M. (1:3) and C.C. (1:3:6) at bottom. RCC 1:2:4 etc. shall be as these given in column of specification published by G W S & S Board and as those prevailing in Division.
- 15.0 PAINTING LETTER:  
Following words shall be painted on the container 40,000 liters capacity. The letters shall be 45 cm high and the black ground of suitable color shall be provided. Approved enameled paint shall only be used for painting letters and background. Entire work shall be carried out as per instruction of Engineer-in-charge.

16.0 PROVIDING & FIXING GI PIPE RAILING AROUND TOP SLAB:

Railing shall consist of 3 raw of 25 mm dia GI pipes fixed in M.S. angles of 60 mm x 60 mm x 6 mm 0.9 m. height fixed at 2 m c/c. The materials shall be got approved by Engineer-in-charge before fabrication. Three coats of approved anticorrosive paint shall be applied to M.S. angle before they are fixed in position.

17.0 CEMENT PAINT:

The work shall be carried out as per instruction of the Engineer-in-charge. The snowcem paint shall be waterproof cement paint and best quality shall be got approved before use.

The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fiber brush or and suitable means and washing the surface. All loose pieces shall be scrapped out and hole shall be stopped with mortar. After cleaning the surface the watering hole surface and applied snowcem paint in three coats.

18.0 WATERPROOF CEMENT PLASTER:

The cement mortar shall consist of two parts of fine river sand free from any dust and other organic matter and one part of approved quality of cement. The mortar shall be properly mixed on watertight platform. The mortar shall be used within half an hour after mixing. The water proofing materials weighting 1.5 kg of powder in one bag of cement shall be added.

The plaster shall be applied in uniform thickness of 20 mm and shall be properly smoothened with wooden & finished with cement finishing of required. The curing shall be done at least for week by sprinkling the water over the wall. The wall shall be tested for waterproof ness. The rate includes the cost of waterproofing materials. The test for waterproof ness shall be carried out by the contractor at his own cost by filling the contractor with water and it shall be checked out that there is no percolation of water from the wall. Payment shall be made per sq. m. of plaster done.

After completion & testing of work the contractor shall have provide & fix the Marble 'Takti' of required size with necessary writings, as directed by the Engineer-in-charge.

19.0 RCC work of shaft, container and staircase should be of well finished condition if the same is not satisfactory than contractor since have to finish the surface with 12 mm thick plaster C.M. without any extra cost.

20 The contractor shall have to make arrangement for testing of steel bars brought on site and concrete cubes, for different mix at different stage like foundation, shaft, column, cube should be cast on site and send Govt. approved laboratory for compressive strength at 28 days. Results must be produced in office before taking payment of work done. Testing charge must bear by contractor.

21.0 Conditions: The paint is supplied in two packs, fine zinc dust mixed with epoxy resin as base and liquid hardener. They are to be mixed in following ratio.

	By Volume	By Weight
Base	1.5	4.0
Hardener	1.0	1.0

#### Mixed Paint Properties

i)	Viscosity	20+3% seconds by flow
		Cup No.4 @ 30 0 C
ii)	Specific Gravity	1.70+3%
iii)	Post life of mixture	6-8 hrs.
iv)	Zinc dust content on DFT basis	92+/-3%
v)	Finish	Smooth and Matt.
vi)	Drying time	
	Surface dry	5 minutes
	Hard Dry	Less than 1 hr.
vii)	Over coating after	Minimum 24 hrs.
		Maximum No limit
viii)	Flash point	Above 23 o C
ix)	D.F.T.	20-25 microns depending on blasting profile
x)	Compatibility	Compatible with all systems of paints like Bituminous, conventional, chlorubber vinyl and epoxy paints.
xi)	Toxicity	Non toxic

- 3) Application: By Brush/Spray (Air and Airless)
- 4) Thinner: Epoxy thinner shall be used if required.
- 5) Coverage: 10 Sq. m./liter at 25 microns.
- 6) High build black paint.

1)	Dry time	Surface dry not more than 4 hours Hard dry not more than 18 hours Film thickness per coat 75 micron.
2)	Consistency	Thixotropic liquid
3)	Covering Capacity	5 Sq.m./liter
4)	Color	Black/Brown/Black in alternative layer

#### Characteristics:

The coating shall be non-phenolic, non-toxic. It shall afford a highly durable protective air tight coating to prevent corrosion or rusting of iron and steel against air moisture/water and shall be of sufficient elasticity to prevent racing, blistering or peeling. It shall retain its consistency at the ordinary atmospheric temperatures when packed in suitable containers. After application of drying, the coating shall not show any surface cracks due to drying, weathering action or expansion and contraction. Its resistance to water must be perfect. It shall also be resistant to weak acid and alkalis, natural salts and to dry heat up to 150 centigrade. It should have good brush ability.

The primer as well as paint shall have to be applied as per the manufacturer's specification. The paints shall be tested in the laboratory by the owner at the cost of the contractor if found necessary. The manufacturer shall accompany each lot of primer and paint supplied. The entire procedure of applying the coating as specified shall be rigidly inspected right from cleaning stage to application of final coat.

#### CONCRETE

##### **Applicable Codes**

#### Materials

1. IS.269 Specification for 33 grade ordinary Portland cement.
2. IS.455 Specification for Portland slag cement.
3. IS.1489 Specification for Portland-Pozzolanacement (Part 1&2).
4. IS: 8112 Specification for 43 grade ordinary Portland cement.
5. IS: 12269 Specification for 53 grade ordinary Portland cement.
6. IS: 12330 Specification for sulphate resisting Portland cement.
7. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.
8. IS: 432 Specification for mild steel and medium (tensile steel bars and hard-drawn steel) wires for concrete reinforcement. (Part 1&2)
9. IS: 1786 Specification for high strength deformed steel bars and wires for concrete reinforcement.
10. IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement.
11. IS: 9103 Specification for admixtures for concrete.
12. IS: 2645 Specification for integral cement water- proofing compounds



13. IS: 4990 Specification for plywood for concrete shuttering work.

#### Material Testing

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

#### Material Storage

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

#### Concrete Mix Design

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

#### Concrete Testing

- 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.

#### Equipments

- 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 weighs batchers for concrete (single and

double bucket type).

- 14) IS: 2750 Specification for steel scaffoldings.

#### Codes Of Practice

- 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 Code of practice for concrete structures for storage of liquids (Parts 1 to 4)
- 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 Code of practice for steel tubular scaffolding (Parts 1 & 2)
- 15) IS: 2571 Code of practice for laying inset cement concrete flooring.
- 16) IS: 7861 Code of practice for extreme weather concreting: Part 1  
Recommended practice for hot weather concreting.

#### Construction Safety

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

#### General

The ENGINEER INCHARGE 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 the ENGINEER INCHARGE's approval obtained, prior to starting of concrete work. This shall, however, not relieve the Contractor of any of his responsibilities. All materials, which do not conform to the Specifications, shall be rejected.

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 INCHARGE and after establishing their performance suitability based on

previous data, experience or tests.

## Materials

### Cement:

Unless otherwise called for by the ENGINEER INCHARGE, cement shall be ordinary Portland cement conforming to IS: 269, IS: 8112 or IS: 12269.

Where Portland pozzolana or slag cements 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.

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 the ENGINEER INCHARGE.

Cement, which is not used within 90 days from its date of manufacture, shall be tested at a laboratory approved by the ENGINEER INCHARGE and until the results of such tests are found satisfactory, it shall not be used in any work.

### Aggregates (General):

Aggregates shall consist of naturally occurring stones (crushed or uncrushed), gravel and sand. They shall be chemically inert, strong, hard, clean, durable against weathering, of limited porosity, free from dust/silt/ organic impurities/deleterious materials and conform to IS: 383. Aggregates such as slag, crushed over burnt bricks, bloated clay ash, sintered fly ash and tiles shall not be used.

Aggregates shall be washed and screened before use where necessary or if directed by the ENGINEER INCHARGE.

Aggregates containing reactive materials shall be used only after tests conclusively prove that there will be no adverse effect on strength, durability and finish, including long-term effects, on the concrete.

The fineness modulus of sand shall neither be less than 2.2 nor more than 3.2.

The maximum size of coarse aggregate shall be as stated on the drawings but in no case greater than 1/4 of the minimum thickness of the member.

Plums 160 mm and above of a reasonable size may be used in mass concrete fill where directed. Plums shall not constitute more than 20% by volume of the concrete.

### Water

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

### Reinforcement

All reinforcement steel shall be TMT steel grade – Fe415 conforming to relevant I.S. for water

retaining structure

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

#### Admixtures

Accelerating, retarding, water reducing and air entraining admixtures shall conform to IS: 9103 and integral water proofing admixtures to IS: 2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of the ENGINEER INCHARGE. An admixture's suitability and effectiveness shall be verified by trial mixes with the other materials 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.

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.

#### Wastage

Wastage allowance for cement and steel shall be considered in the item rate and no extra payment shall become payable to the Contractor on any account.

#### Samples and Tests

All materials used for the works shall be tested before use.

Manufacturer's test certificate shall be furnished for each batch of cement/steel and when directed by the ENGINEER INCHARGE samples shall also be got tested by the Contractor in a laboratory approved by the ENGINEER INCHARGE at no extra cost to Employer. ENGINEER INCHARGE may appoint separate third party inspection for the material testing to ensure the quality of the work. The Contractor shall replace the defective material as an outcome of these tests. Sampling and testing shall be as per IS: 2386 under the supervision of the ENGINEER INCHARGE.

Water to be used shall be tested to comply with requirements of IS: 456.

The 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 at an approved laboratory at no extra cost.

## Storing of Materials

All materials 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.

The Contractor will have to make his own arrangements for the storage of adequate quantity of cement. If such cement is not stored properly and has deteriorated, the material shall be rejected. 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 the ENGINEER INCHARGE. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order of receipt.

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.

The Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground/water. Each type and size shall be stacked separately.

## Concrete

### General

Concrete grade shall be as designated on drawings. In concrete grade M15, 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 "NOMINAL MIX CONCRETE". All concrete works of grade M5, M7.5 and M10 shall be NOMINAL MIX CONCRETE whereas all other grades, M15 and above, shall be DESIGN MIX CONCRETE.

## Design Mix Concrete

### (a) *Mix Design & Testing*

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 characteristic strength not less than appropriate values given in IS: 456. The design mix shall be cohesive and does not segregate and should result in a dense and durable concrete and also capable of giving the finish as specified. For liquid retaining structures, the mix shall also result in watertight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

The minimum cement content for Design Mix Concrete shall be as per Appendix-A of IS: 456 or as given below, whichever is higher.

<b>Grade of Concrete</b>	<b>Minimum Cement Content in Kg/Cu. m of Concrete</b>
M15	260
M20	315
M25	360
M30	425

The minimum cement content stipulated above should 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 eventuality 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.

It shall be the Contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to the ENGINEER INCHARGE 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.

<b>Grade of Concrete</b>	<b>Minimum Compressive Strength N/sq.mm at 7 days</b>	<b>Specified Characteristic Compressive Strength N/sq.mm at 28 days</b>
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

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

Structure/Member	Slump in millimeters	
	Maximum	Minimum
Reinforced foundation walls and footings		
Plain footings, caissons and substructure walls	75	25
Slabs, Beams and reinforced walls	100	25
Pump & miscellaneous Equipment Foundations	75	25
Building columns	100	25
Pavements	50	25
Heavy mass construction	50	25
	50	25

**(b) *Batching & Mixing of Concrete:***

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.

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 for use by the ENGINEER INCHARGE 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.

Arrangement should be made by the Contractor to have the cubes tested in an approved laboratory or in field with prior consent of the ENGINEER INCHARGE. Sampling and testing of strength and workability of concrete shall be as per IS: 1199, IS: 516 and IS: 456, IS 3370.

**Nominal Mix Concrete**

**(a) *Mix Design & Testing***

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 w/c ratio may be adopted as per Table 3 of IS: 456. However it will be the Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

**(b) *Batching & Mixing of Concrete***

Based on the adopted nominal mixes, aggregates shall be measured by volume. However cement shall be by weight only.

**Formwork**

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

The design and engineering of the formwork as well as its construction shall be the responsibility of the Contractor. However, if so desired by the ENGINEER INCHARGE, the drawings and calculations for the design of the formwork shall be submitted to the ENGINEER INCHARGE for approval.

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 finishes 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 easy striking out 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.

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 the ENGINEER INCHARGE. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, worm 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.

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.

.

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 the ENGINEER INCHARGE. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.



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

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 insitu shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.

For liquid retaining structures, sleeves shall not be provided for through bolts nor 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.

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

Forms for substructure may be omitted when, in the opinion of the ENGINEER INCHARGE, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations shall be larger, as approved by the ENGINEER INCHARGE, than that required as per drawing to compensate for irregularities in excavation.

The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.

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 to limit the drop of concrete to 1.0m or as approved by the ENGINEER INCHARGE. The Contractor shall temporarily and securely fix items to be cast (embedment/ inserts) in a manner that will not hinder the striking of forms or permit loss of grout.

Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty formwork, shall be entirely removed and formwork corrected prior to placement of new concrete at Contractor's cost.

The striking time for formwork shall be determined based on the 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 temperatures; and
- (g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20°C) forms may be struck after expiry of the time period given in IS: 456 unless approved otherwise by the ENGINEER INCHARGE. For Portland Pozzolana/slag cement the stripping time shall be suitably modified as approved by the ENGINEER INCHARGE. 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 stresses arising during the construction period.

### **Reinforcement Workmanship**

Reinforcing bars supplied bent or in coils shall be straightened cold without damage. No bending shall be done when ambient temperature is below 5°C. Local warming may be permitted if steel is kept below 10° C.

All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings/ schedules or as directed by ENGINEER INCHARGE.

Re-bending or straightening incorrectly bent bars shall not be done without the approval of the ENGINEER INCHARGE.

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 the ENGINEER INCHARGE 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.

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.

Substitution of reinforcement, laps/splices not shown on drawing shall be subject to ENGINEER INCHARGE's approval.

### **Tolerances**

Tolerance for formwork and concrete dimensions shall be as per IS: 456 unless specified otherwise.

Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

The formwork shall be designed and constructed to the shapes, lines and dimensions shown on the drawings within the tolerances given below:

(a)	Deviation from specified dimensions of cross section of columns and beams	- 6 mm + 12 mm
(b)	Deviations from dimensions of footings (Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel or dowels)	
1)	Dimension in plan	- 12 mm + 50 mm
2)	Eccentricity	0.02 times the width of the footing in the direction of deviation but not more than 50 mm
3)	Thickness	$\pm$ 0.05 times the specified thickness

#### Preparation Prior to Concrete Placement

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.

All arrangements-formwork, equipment and proposed procedure, shall be approved by the ENGINEER INCHARGE. Contractor shall maintain separate Pour Card for each pour as per the format enclosed.

#### Transporting, Placing and Compacting Concrete

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.

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 1.0m.

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.

While placing concrete the Contractor shall proceed as specified below and also ensure the following:

- (a) Continuously between construction joints and pre- determined 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 linings 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.

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 the 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.

Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by the ENGINEER INCHARGE. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped, the concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

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 approved by the ENGINEER INCHARGE. Concrete shall be protected against damage until final acceptance.

### **Mass Concrete Works**

Sequence of pouring for mass concrete works shall be as approved by the ENGINEER INCHARGE. The Contractor shall exercise great care to prevent shrinkage cracks and shall

monitor the temperature of the placed concrete if directed.

### **Curing**

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 or frost;
- (f) Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless approved otherwise by the ENGINEER INCHARGE, 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.

Where a curing membrane is approved to be used by the ENGINEER INCHARGE, 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 approved by the ENGINEER INCHARGE before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

### **Construction Joints and Keys**

Construction joints will be as shown on the drawing or as approved by the ENGINEER INCHARGE. 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 approval of the ENGINEER INCHARGE.

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 approved by the ENGINEER INCHARGE.

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 horizontal layers.

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.

### **Foundation Bedding**

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 areas shall be cleaned out and back filled with either soil-cement mixture, lean concrete or clean sand compacted as approved by the ENGINEER INCHARGE. The surfaces of absorptive soils shall be moistened.

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.

## **Finishes**

### **General**

The formwork for concrete works shall be such as to give the finish as specified. The Contractor shall make good any unavoidable defects as approved 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.

### **Surface Finish Type F1**

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 would interfere with proper and effective application of waterproofing material specified for use.

### **Surface Finish Type F2**

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.

### **Surface Finish Type F3**

This finish shall give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discolouration, blemishes, arises, airholes 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 the Contractor.

### **Integral Cement Finish on Concrete Floor**

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screeded 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 INCHARGE shall be supplied and used as recommended by the manufacturer.

## **Repair and Replacement of Unsatisfactory Concrete**

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 inspected by the ENGINEER INCHARGE who may permit patching of the defective areas or reject the concrete work.

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

Rejected concrete shall be removed and replaced by the Contractor at no additional cost to the Employer.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as approved by the ENGINEER INCHARGE.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the ENGINEER INCHARGE as to the method of repairs to be adopted shall be final and binding on the Contractor. 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 approved by the ENGINEER INCHARGE.

### **Vacuum Dewatering of Slabs**

Where specified floor slabs, either 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 the ENGINEER IN CHARGE's approval.

### **Hot Weather Requirements**

Concreting during hot weather shall be carried out as per IS: 7861 (Part I).

Adequate provisions shall be made to lower concrete temperatures, which shall not exceed 40°C at the time of placement of fresh concrete.

Where directed by the ENGINEER INCHARGE, the Contractor shall spray non-wax based curing compound on unformed concrete surfaces at no extra costs.

### **Cold Weather Requirements**

Concreting during cold weather shall be carried out as per is: 7861 (Part II).

The ambient temperature during placement and up to final set shall not fall below 5 Deg.C. Approved antifreeze/accelerating additives shall be used where directed.

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.

### **Liquid Retaining Structures**

The Contractor shall take special care for concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

The minimum level of surface finish for liquid retaining structures shall be Type F2. All such structures shall be hydro-tested.

The Contractor shall make all arrangements for hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipe lines etc.

The Contractor shall also make all temporary arrangements that may have to be made to ensure stability of the structures during construction.

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 INCHARGE. All such rectification shall be done by the CONTRACTOR to the entire satisfaction of the ENGINEER INCHARGE at no extra cost to the EMPLOYER.

### **Testing Concrete Structures for Leakage**

Hydrostatic test for water tightness shall be done at full storage level or soffit of cover slab, as may be directed by the ENGINEER INCHARGE, as described below:

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.

In the case of structures whose external faces are buried 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 days shall be taken as an indication of the water tightness of the structure. The ENGINEER INCHARGE shall decide on the actual permissible nature of this drop in the surface level, taking into account whether 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.

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

For structures such as pipes, tunnels etc. the hydrostatic 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.

### **Optional Tests**

If the ENGINEER INCHARGE 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 INCHARGE, as per relevant IS Codes. Contractor shall have to pay for these tests.

In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, the ENGINEER INCHARGE 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. The ENGINEER INCHARGE also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work, at no cost to the Employer. Alternately ENGINEER INCHARGE also reserves the right to ask the CONTRACTOR to dismantle and re-do such unacceptable work at the cost of CONTRACTOR.

## Grouting

### Standard Grout

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. Surfaces 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 the ENGINEER INCHARGE. The grout proportions shall be limited as follows:

Use	Grout Thickness	Mix Proportions	W/C Ratio (max)
a) Fluid mix	Under 25mm	One part Portland Cement to one part sand	0.44
b) General mix	25mm and over but less than 50mm	One part Portland Cement to 2 parts of sand	0.53
c) Stiff mix	50mm and over	One part Portland Cement to 3 parts of sand	0.53

Non-Shrink Grout: **Non –shrink grout where required shall be provided in strict accordance with the manufacturer’s instructions / specifications on the drawings**

## General

**Inspection:** All materials, workmanship and finished construction shall be subject to continuous inspection and approval of ENGINEER INCHARGE. Materials rejected by ENGINEER INCHARGE shall be expressly removed from site and shall be replaced by Contractor immediately.

**Clean-Up:** 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.

**Acceptance Criteria:** 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

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

For work not accepted, the ENGINEER INCHARGE may review and decide whether remedial measures are feasible so as to render the work acceptable. The ENGINEER INCHARGE 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 by the Employer for executing the remedial measures.

**Water stops**

**Material: The material for the PVC waterstops shall be a plastic compound with the basic resin of polyvinyl chloride and additional resins, plasticizers, inhibitors, which satisfies the performance characteristics specified below as per IS:12200. Testing shall be in accordance with IS:8543.**

- |     |                         |   |                                 |
|-----|-------------------------|---|---------------------------------|
| a)  | Tensile strength        | : | 3.6 N/mm <sup>2</sup> minimum   |
| b)  | Ultimate elongation     | : | 300% minimum                    |
| c)  | Tear resistance         | : | 4.9 N/mm <sup>2</sup> minimum   |
| d)  | Stiffness in flexure    | : | 2.46 N/mm <sup>2</sup> minimum  |
| e)  | Accelerated extraction  |   |                                 |
|     | i) Tensile strength     | : | 10.50 N/mm <sup>2</sup> minimum |
|     | ii) Ultimate elongation | : | 250% minimum                    |
| (f) | Effect of Alkali        | : | 7 days                          |
|     | i) Weight increase      | : | 0.10% maximum                   |
|     | ii) Weight decrease     | : | 0.10% maximum                   |
|     | iii) Hardness change    | : | ± 5 points                      |
| (g) | Effect of Alkali        | : | 28 days                         |
|     | i) Weight increase      | : | 0.40% maximum                   |
|     | ii) Weight decrease     | : | 0.30% maximum                   |
|     | iii) Dimension change   | : | ±1%                             |

PVC water stops shall be either of the bar type, serrated with centre bulb and end grips for use within the concrete elements or of the surface (kicker) type for external use.

PVC water stops shall be of approved manufacture. Samples and the test certificate shall be got approved by the ENGINEER INCHARGE before procurement for incorporation in the works. Alternatively G.I. sheet of 18 gage (1.3mm) thick and 200mm wide can be used by the contractor as construction joints.

### **Workmanship**

Water stops shall be cleaned before placing them in position. Oil or grease shall be removed thoroughly using water and suitable detergents.

Water stops shall be procured in long lengths as manufactured to avoid joints as far as possible. Standard L or T type of intersection pieces shall be procured for use depending on their requirement. Any non-standard junctions shall be made by cutting the pieces to profile for jointing. Lapping of water stops shall not be permitted. All jointing shall be of fusion welded type as per manufacturer's instructions.

Water stops shall be placed at the correct location/level and suitably supported at intervals with

the reinforcement to ensure that it does not deviate from its intended position during concreting and vibrating. Care shall also be taken to ensure that no honey-combing occurs because of the serrations/end grips, by placing concrete with smaller size aggregates in this region. Projecting portions of the water stops embedded in concrete shall be thoroughly cleaned of all mortar/concrete coating before resuming further concreting operations. The projecting water stop shall also be suitably supported at intervals with the reinforcement to maintain its intended position during concreting so as to ensure that it does not bend leading to formation of pockets. In addition, smaller size aggregates shall be used for concreting in this region also.

### **Preformed Fillers and Joint Sealing Compound**

**Materials: Preformed filler for expansion/isolation joints shall be non-extruding and resilient type of bitumen impregnated fibres conforming to IS:1838 (Part I).**

Bitumen coat to concrete/masonry surfaces for fixing the preformed bitumen filler strip shall conform to IS:702. Bitumen primer shall conform to IS:3384. Sealing compound for filling the joints above the preformed bitumen filler shall conform to Grade 'A' as per IS:1834.

### **Workmanship**

The thickness of the preformed bitumen filler shall be 25mm for expansion joints and 50mm for isolation joints around foundation supporting rotatory equipment's. Contractor shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.

The concrete/masonry surface shall be cleaned free from dust and any loose particles. When the surface is dry, one coat of industrial blown type bitumen of grade 85/25 conforming to IS:702 shall be applied hot by brushing at the rate of 1.20 kg/sq.m. When the bitumen is still hot the preformed bitumen filler shall be pressed and held in position till it completely adheres. The surface of the filler against which further concreting/masonry work is to be done shall similarly be applied with one coat of hot bitumen at the rate of 1.20 kg/sq.m.

Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the joint. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied hot with a coat of bitumen primer conforming to IS: 3384 in order to improve the adhesive quality of the sealing compound.

Expansion joints between beams/slabs shall be provided with 100mm wide x 4mm thick mild steel plate at the soffit of RCC beams/slabs to support and prevent the preformed joint filler from dislodging. This plate shall be welded to an edge angle of ISA 50 x 50 x 6mm provided at the bottom corner, adjacent to the expansion joint of one of the beams/slabs, by intermittent fillet welding. Steel surfaces shall be provided with 2 coats of red oxide zinc chrome primer and 3 coats of synthetic enamel paint finish.

CONCRETE POUR CARD					
POUR NO. :			DATE :		
DRG. NO. :			STRUCTURE :		
CONCRETE GRADE/QUANTITY/ :			MAX. AGGREGATE SIZE /		
SLUMP :			START / COMPLETION		
TIME :					
SL. NO.	ITEM				Remarks If Any
1.	BEFORE CONCRETING	CENTRELINES CHECKED	YES/NO		
2.		FORMWORK AND STAGING CHECKED FOR ACCURACY, STRENGTH & FINISH	YES/NO		
3.		REINFORCEMENT CHECKED	YES/NO		
4.		COVER TO REINFORCEMENT CHECKED	YES/NO		
5.		VERIFIED TEST CERTIFICATE FOR CEMENT/STEEL	YES / NO		
6.		ADEQUACY OF MATERIALS / EQUIPMENT FOR POUR	YES / NO		
7.		EMBEDDED PARTS (LOCATION & PLUMB) CHECKED	YES/NO		
8.	SOFFIT(S) & POUR TOP(T) LEVELS CHECKED BEFORE (B) & AFTER (A) FORM REMOVAL (ONLY OF BEAMS OF OVER 10 M SPAN & IMPORTANT STRUCTURE LIKE T.G. ETC.)		S(B) T(B)  S(A) T(A)		
9.	CONSTRUCTION JOINTS LOCATION & TIME (IF NOT AS PER DRAWING)				
10.	CEMENT CONSUMPTION IN KGS.				
11.	NUMBER OF CUBES AND IDENTIFICATION MARKS				
12.	TEST CUBE RESULTS (7 DAYS / 28 DAYS)				
13.	CONCRETE CONDITION ON FORM REMOVAL		V.GOOD/GOOD/F AIR/POOR		

Contractor's Representative

GWSSB's Representative

**NOTES:** 1. EACH POUR TO HAVE SEPARATE CARDS, IN TRIPLICATE ONE EACH FOR CLIENT, CONTRACTOR & SITE OFFICE.

UNDER REMARKS INDICATE DEVIATIONS FROM DWGS. & SPECIFICATIONS, CONGESTION IN REINFORCEMENT IF ANY, UNUSUAL OCCURRENCES SUCH AS FAILURE OF EQUIPMENTS, SINKING OF SUPPORTS / PROPS. HEAVY RAINS AFFECTING CONCRETING, POOR COMPACTION, IMPROPER CURING, OTHER DEFICIENCIES, OBSERVATIONS ETC.

## STRUCTURAL STEEL WORK

### Applicable Codes and Specifications

The supply, fabrication, erection and painting of structural steel works shall comply with the following specifications, standards and codes unless otherwise specified herein. All standards, specifications and codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions.

IS : 808	Dimensions for Hot Rolled Steel sections
IS : 814	Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon Maganese Steel
IS : 800	Code of Practice for General Construction in Steel
IS : 801	Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members in General Building Construction
IS : 806	Code of Practice for Use of Steel Tubes in General Building Construction
IS : 7205	Safety Code for Erection of Structural Steel Work
IS : 7215	Tolerances for Fabrication of Steel Structures
IS : 4000	High Strength Bolts in Steel Structure – Code of Practice

AISC	Specifications for Design, Fabrication and Erection of Buildings
IS : 1161	Steel Tubes for structural purposes
IS:10 IS:102	Ready Mixed paint, Brushing, Red Lead, Non-setting, Priming.
IS:110	Ready Mixed paint, brushing, grey filler for enamels for use over primers.
IS:117	Ready Mixed paint, Brushing, Finishing, and Exterior Semigloss for general purposes, to Indian Standard colours.
IS:158	Ready Mixed paint, Brushing, Bituminous, Black, Lead free, Acid, Alkali and heat resisting.
IS:159	Ready Mixed paint, Brushing, Acid resisting for protection against acid fumes, colour as required.
IS:341	Black Japan, Types A, B and C
IS:2339	Aluminum paint for general purposes, in Dual container
IS:2932	Specification for enamel, synthetic, exterior, type 1, (a) Undercoating, (b) finishing
IS:2933	Specification for enamel, exterior, type 2, (a) Undercoating, (b) finishing
IS:5905	Sprayed aluminum and zinc coatings on Iron and Steel.
IS:6005	Code of practice for phosphating of Iron and Steel.
IS:9862	Specification for ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water & chlorine resisting.
IS:13183	Aluminum paint, Heat resistant.
SIS-05-5900	(Swedish Standard)
IS : 1239	Mild steel tubes, tubulars and other Wrought steel fittings
	Part 1 – Mild steel tubes

	Part 2 – Mild steel tubulars and other wrought steel pipe fittings
IS : 1363 (Parts 1 to 3)	Hexagon Head Bolts, Screws and Nuts of product Grade C (Size range M5 to M64)
IS : 1367 (All parts)	Technical Supply Conditions for Threaded Fasteners
IS : 1852	Rolling and Cutting Tolerances for Hot Rolled Steel Products
IS : 1977	Structural Steel (Ordinary Quality)
IS : 2062	Steel for General Structural Purposes
IS : 2074	Ready Mixed Paint, Air drying, Red Oxide Zinc Chrome and Priming
IS : 3502	Steel Chequered Plate
IS : 3757	High Strength Structural Bolts
IS : 5369	General Requirements for Plain Washers and Lock Washers
IS : 5372	Taper Washers for Channels
IS : 5374	Taper Washer for 1 Beams
IS : 6610	Heavy Washers for Steel Structures
IS : 8500	Structural Steel-microalloyed (medium and high strength qualities)
IS : 803	Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded storage tanks
IS : 816	Code of Practice for use of Metal Arc Welding for General construction in Mild Steel
IS : 822	Code of Procedure for Inspection of Welds
IS : 1182	Recommended Practice for Radiographic examination of Fusion – Welded Butt Joints in Steel Plates
IS : 1200	Method of Measurement in Building Civil Works
IS : 1477	Code of Practice for Painting of (Parts 1&2) Ferrous Metals in Buildings



IS : 2595	Code of Practice for Radiographic Testing
IS : 3658	Code of Practice for Liquid Penetrant Flaw Detection
IS : 5334	Code of Practice for Magnetic Particle Flaw Detection of Welds
IS : 9595	Recommendations for Metal Arc Welding of Carbon and Carbon Manganese Steel

## Steel Materials

Steel materials shall comply with the referred to in **Sub-Clause 4.1**.

All materials used shall be new, unused and free from defects.

Steel conforming to IS: 1977 shall be used only for the following:

Fe310-0 (St 32-0)	For general purposes such as door/window frames, grills, steel gates, handrails, fence posts, tee bars and other non-structural use.
Fe410-0 (St 42-0)	For structures not subjected to dynamic loading other than wind loads such as: Platform roofs, foot over bridges, building, factory sheds etc.
Fe510-0 (St 42-0)	Grade steel shall not be used
	<ul style="list-style-type: none"> <li>a) If welding is to be employed for fabrication</li> <li>b) If site is in severe earthquake zone</li> <li>c) If plastic theory of design is used</li> </ul>

## Drawings prepared by the **VENDOR/CONTRACTOR**

The **VENDOR/CONTRACTOR** shall prepare all fabrication and erection drawings for the entire work. All the drawings for the entire work shall be prepared in metric units. The drawings shall preferably be of one standard size and the details shown there in shall be clear and legible.

All fabrication drawings shall be submitted to the **ENGINEER INCHARGE** for approval.

No fabrication drawings will be accepted for Engineer Incharge's approval unless checked and approved by the **VENDOR/Contractor's** qualified structural engineer and accompanied by an erection plan showing the location of all pieces detailed. The **VENDOR/CONTRACTOR** shall ensure that connections are detailed to obtain ease in erection of structures and in making field connections.

Fabrication shall be started by the VENDOR/CONTRACTOR only after Engineer Incharge's approval of fabrication drawings. Approval by the ENGINEER INCHARGE of any of the drawings shall not relieve the VENDOR/CONTRACTOR from the responsibility for correctness of engineering and design of connections, workmanship, fit of parts, details, material, errors or omissions or any and all work shown thereon. The Engineer Incharge's approval shall constitute approval of the size of members, dimensions and general arrangement but shall not constitute approval of the connections between members and other details.

The drawings prepared by the VENDOR/CONTRACTOR and all subsequent revisions etc. shall be at the cost of the VENDOR/CONTRACTOR for which no separate payment will be made.

### **Fabrication**

#### **General**

All workmanship and finish shall be of the best quality and shall conform to the best-approved method of fabrication. All materials shall be finished straight and shall be machined/ground smooth true and square where so specified. All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Unless otherwise approved by the ENGINEER INCHARGE, reference may be made to relevant IS codes for providing standard fabrication tolerance. Material at the shops shall be kept clean and protected from weather.

#### **Connections**

Shop/field connections shall be as per approved fabrication drawings. In case of bolted connections, taper washers or flat washers or spring washers shall be used with bolts as necessary. In case of high strength friction grip bolts, hardened washers be used under the nuts or the bolt heads whichever are turned to tighten the bolts. The length of the bolt shall be such that at least one thread of the bolt projects beyond the nut, except in case of high strength friction grip bolts where this projection shall be at least three times the pitch of the thread.

In all cases where bearing is critical, the unthreaded portion of bolt shall bear on the members assembled. A washer of adequate thickness may be provided to exclude the threads from the bearing thickness, if a longer grip bolt has to be used for this purpose.

All connections and splices shall be designed for full strength of members or loads. Column splices shall be designed for the full tensile strength of the minimum cross section at the splice.

All bolts, nuts, washers, electrodes, screws etc., shall be supplied/brought to site 10% in excess of the requirement in each category and size. Rates shall cover the cost of this extra quantity.

All members likely to collect rainwater shall have drain holes provided.

### **Straightening**

All materials, shall be straight and, if necessary, before being worked shall be straightened and/or flattened by pressure and shall be free from twists. Heating or forging shall not be resorted to without the prior approval of the ENGINEER INCHARGE in writing.

### **Rolling and Forming**

Plates, channels, R.S.J. etc., for circular bins, bunkers, hoppers, gantry girders, etc., shall be accurately laid off and rolled or formed to required profile/shape as called for on the drawings. Adjacent sections shall be match-marked to facilitate accurate assembly, welding and erection in the field.

### **High Strength Friction Grip Bolting**

Inspection after tightening of bolts shall be carried out as stipulated in the appropriate standards depending upon the method of tightening and the type of bolt used.

### **Welding**

Welding procedure shall be submitted to the ENGINEER INCHARGE for approval. Welding shall be entrusted to qualified and experienced welders who shall be tested periodically and graded as per IS 817, IS: 7310 (Part 1) and IS: 7318 (Part 1).

While fabricating plated beams and built up members, all shop splices in each component part shall be made before such component part is welded to other parts of the members. Wherever weld reinforcement interferes with proper fit-up between components to be assembled off welding, these welds shall be ground flush prior to assembly.

Approval of the welding procedure by the ENGINEER INCHARGE shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure.

No welding shall be done when the surface of the members is wet nor during periods of high wind.

Each layer of a multiple layer weld except root and surfaces runs may be moderately panned with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from overweening.

No welding shall be done on base metal at a temperature below –5 Deg.C. Base metal shall be preheated to the temperature as per relevant IS codes.

Electrodes other than low-hydrogen electrodes shall not be permitted for thickness of 32 mm and above.

All welds shall be inspected for flaws by any of the methods described under **Sub-clause 4.6.3**. The choice of the method adopted shall be agreed with the ENGINEER INCHARGE.

The correction of defective welds shall be carried out in a manner approved by the ENGINEER INCHARGE without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means approved by the ENGINEER INCHARGE shall be used to ensure that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. The cost of all such tests and operations incidental to correction shall be borne by the Contractor.

### **Tolerances**

The dimensional and weight tolerances for rolled shapes shall be in accordance with ARE: 1852 for indigenous steel and equivalent applicable codes for imported steel. The tolerances for fabrication of structural steel shall be as per ARE: 7215.

Cutting, punching, drilling, welding and fabrication tolerances shall be generally as per relevant IS codes.

### **End Milling**

Where compression joints are specified to be designed for bearing, the bearing surfaces shall be milled true and square to ensure proper bearing and alignment.

### **Inspection**

#### **General**

The Contractor shall give due notice to the ENGINEER INCHARGE in advance of the works being made ready for inspection. All rejected material shall be promptly removed from the shop and replaced with

new material for the Engineer Incharge's inspection. The fact that certain material has been accepted at the Contractor's shop shall not invalidate final rejection at site by the ENGINEER INCHARGE if it fails to conform to the requirements of these specifications, to be in proper condition or has fabrication inaccuracies which prevent proper assembly nor shall it invalidate any claim which the Employer may make because of defective or unsatisfactory materials and/or workmanship.

No materials shall be painted or dispatched to site without inspection and approval by the ENGINEER INCHARGE unless such inspection is waived in writing by the ENGINEER INCHARGE.

The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified.

For fabrication work carried out in the field the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the ENGINEER INCHARGE.

Inspection and tests on structural steel members shall be as set forth below.

#### Material Testing

If mill test reports are not available for any steel materials the same shall be tested by the Contractor to the Employer's Representative's satisfaction to demonstrate conformity with the relevant specification.

#### Tests on Welds

##### *(a) Magnetic Particle Test*

Where welds are examined by magnetic particle testing, such testing shall be carried out in accordance with relevant IS codes. If heat treatment is performed, the completed weld shall be examined after the heat treatment. All defects shall be repaired and retested. Magnetic particle tests shall be carried out using alternating current. Direct current may be used with the permission of the ENGINEER INCHARGE.

##### *(b) Liquid Penetrant Inspection*

In the case of welds examined by Liquid Penetrant Inspection, such tests shall be carried out in accordance with relevant IS Code. All defects shown shall be repaired and rechecked.

(c) *Radiographic Inspection*

All full strength butt welds shall be radiographed in accordance with the recommended practice for radiographic testing as per relevant IS code.

**Dimensions, Workmanship & Cleanliness**

Members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment, surface finish and painting are in accordance with the requirements shown in the Contractor's approved fabrication drawings.

**Test Failure**

In the event of failure of any member to satisfy inspection or test requirement, the Contractor shall notify the ENGINEER INCHARGE. The Contractor must obtain permission from the ENGINEER INCHARGE before any repair is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by the ENGINEER INCHARGE.

The ENGINEER INCHARGE has the right to specify additional testing as he deems necessary, and the additional cost of such testing shall be borne by the Employer, only in case of successful testing.

The Contractor shall maintain records of all inspection and testing which shall be made available to the ENGINEER INCHARGE.

**Shop Matching**

For structures like bunkers, tanks, etc. Shop assembly is essential. For other steel work, such as columns along with the tie beams/bracings may have to be shop assembled to ensure satisfactory fabrication, obtaining of adequate bearing areas etc., if so desired by the ENGINEER INCHARGE. All these shop assemblies shall be carried out by the Contractor.

**Drilling Holes for other works**

As a part of this Contract, holes in members required for installing equipment or steel furnished by other manufacturers or other contractors shall be drilled by the VENDOR/CONTRACTOR at no extra cost of the EMPLOYER. The information for such extra holes will be supplied by the EMPLOYER/ENGINEER INCHARGE.

### Marking of Members

After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it. The erection mark shall be stamped with a metal dye with figures at least 20 mm high and to such optimum depth as to be clearly visible.

All erection marks shall be on the outer surface of all sections and near one end, but clear of bolt holes. The marking shall be so stamped that they are easily discernible when sorting out members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location.

Erection marks on like pieces shall be in identical locations. Members having lengths of 7.0 m or more shall have the erection mark at both ends.

### Errors

Any error in shop fabrication which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the ENGINEER INCHARGE as defective workmanship. Where the ENGINEER INCHARGE rejects such material or defective workmanship, the same shall be replaced by materials and workmanship conforming to the Specifications by the Contractor, at no cost to the Employer.

### Painting of Steel Work

All fabricated steel material, except those galvanised shall receive protective paint coating as specified in specification, which is described below.

### Materials

Red-oxide – zinc chrome primer shall conform to IS:2074.

Synthetic enamel paint shall conform to IS : 2932.

Aluminum paint shall conform to IS:2339.

All the materials shall be of the best quality from an approved manufacturer. Contractor shall obtain prior approval of the ENGINEER INCHARGE for the brand of manufacture and the colour/shade. All the materials shall be brought to the site in sealed containers.

### Workmanship

Painting work shall be carried out only on thoroughly dry surfaces. Painting shall be applied

either by brushing or by spraying. Contractor shall procure the appropriate quality of paint for this purpose as recommended by the manufacturer. The workmanship shall generally conform to the requirement of IS:1477 (Part 2).

The type of paint, number of coats etc. shall be as specified in the respective items of work.

Primer and finish paint shall be compatible with each other to avoid cracking and wrinkling. Primer and finish paint shall be from the same manufacturer.

All the surfaces shall be thoroughly cleaned of oil, grease, dirt, rust and scale. The methods to be adopted using solvents, wire brushing, power tool cleaning etc., shall be as per IS:1477 (Part – I) and as indicated in the item of work.

It is essential to ensure that immediately after preparation of the surfaces, the first coat of red oxide-zinc chrome primer shall be applied by brushing and working it well to ensure a continuous film without holidays. After the first coat becomes hard dry, a second coat of primer shall be applied by brushing to obtain a film free from 'holidays'.

After the second coat of primer is hard dry, the entire surface shall be wet rubbed cutting down to a smooth uniform surface. When the surface becomes dry, the undercoat of synthetic enamel paint of optimum thickness shall be applied by brushing with minimum of brush marks. The coat shall be allowed to hard dry. The under coat shall then be wet rubbed cutting down to a smooth finish, taking adequate care to ensure that at no place the undercoat is completely removed. The surface shall then be allowed to dry.

The first finishing coat of paint shall be applied by brushing and allowed to hard dry. The gloss from the entire surface shall then be gently removed and the surface dusted off. The second finishing coat shall then be applied by brushing.

At least 24 hours shall elapse between the applications of successive coats. Each coat shall vary slightly in shade and this shall be got approved by the ENGINEER INCHARGE.

### **Acceptance of Steel, its Handling & Storage**

The Contractor shall carefully check the steel to be erected at the time of acceptance. Any fabrication defects observed should be brought to the notice of the ENGINEER INCHARGE.

No dragging of steel shall be permitted. All steel shall be stored 300mm above ground on suitable packing to avoid damage. It shall be stored in the order required for erection, with erection marks visible. All storage areas shall be prepared and maintained by the Contractor. Steel shall not be stored in the vicinity of areas where excavation or grading will be done and, if so stored temporarily, this shall be removed by the Contractor well before such excavation and/or grading commences to a safe distance to avoid burial under debris.



Scratched or abraded steel shall be given a coat of primer in accordance with the Specifications for protection after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from damage.

### **Anchor Bolts & Foundations**

The Contractor shall carefully check the location and layout of anchor bolts embedded in foundations constructed, to ensure that the structures can be properly erected as shown on the drawings. Any discrepancy in the anchor bolts/foundation shall be reported to the ENGINEER INCHARGE.

Leveling of column bases to the required elevation may be done either by providing shims or three nuts on the upper threaded portion of the anchor bolt. All shim stock required for keeping the specified thickness of grout and in connection with erection of structures on foundations, crane brackets or at any other locations shall be of good M.S. plates and shall be supplied by the Contractor at his cost.

A certain amount of cleaning of foundations and preparing the area is considered normal and shall be carried out by the Contractor at no extra cost. Here beams bear in pockets or on walls, bearing plates shall be set and leveled as part of the work. All grouting under column base plates or beam bearing plates will be carried out by the Contractor.

### **Assembly & connections**

Field connections may be effected by riveting, bolting, welding or by use of high strength friction grip bolts as shown on the design and erection drawings.

All field connection work shall be carried as per the drawings. All bolts, nuts, washers, rivets, electrodes required for field connections shall be supplied by the Contractor free of cost.

All assembling shall be carried on a level platform.

Drifts shall be used only for drawing the work to proper position and must not be used to such an extent as to damage the holes. Size of drifts larger than the normal diameter of hole shall not be used. Any damaged holes or burrs must be rectified to the satisfaction of the ENGINEER INCHARGE.

Corrections of minor misfits and reasonable amount of reaming and cutting of excess stock from rivets

shall be considered as a part of erection. Any error in the shop, which prevents proper fit on a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to the ENGINEER INCHARGE.

## Erection

All structural steel shall be erected as shown on the drawings prepared by the Contractor. Proper size steel cable slings, etc., shall be used for hoisting. Guys shall not be anchored to existing structures, foundations, etc., unless so permitted by the ENGINEER INCHARGE in writing. Care shall be taken to see that ropes in use are always in good condition.

Steel columns in the basement, if any, are to be lowered and erected carefully with the help of a crane and/or derrick without damaging the basement walls or floor.

Structural steel frames shall be erected plumb and true. Frames shall be lifted at points such that they are not liable to buckle and deform. Trusses shall be lifted only at node points. In the case of trusses, roof girders, all of the purlins and wind bracing shall be placed simultaneously and the columns shall be erected truly plumb on screed bars over the pedestals. All steel columns and beams shall be checked for plumb and level individually before and after connections are made. Temporary bracings shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment and the operation thereof. Such bracings shall be left in place as long as may be required for safety and stability.

Chequered plates shall be fixed to supporting members by tack welding or by countersunk bolts as shown/specified in relevant drawings and/or as approved by the ENGINEER INCHARGE. The edges shall be made smooth and no burrs or jagged ends shall be left. While splicing, care should be taken so that there is continuity in pattern between the two portions. Care should also be taken to avoid distortion of the plate while welding. The erection of chequered plates shall include:

- a) Welding of stiffening angles/vertical stiffening ribs
- b) Cutting to size and making holes to required shape wherever necessary to allow service piping and/or cables to pass through
- c) Splicing as shown in relevant drawings
- d) Smoothing of edges
- e) Fixing of chequered plates by tack welding or by countersunk bolts
- f) Providing lifting hooks for ease of lifting.

As erection progresses, the work shall be securely bolted to take care of all dead load, wind, seismic and erection stresses.

No riveting or welding or final bolting shall be done until the structure has been properly aligned and approved by the ENGINEER INCHARGE. No cutting, heating or enlarging of the holes shall be carried out without the prior written approval of the ENGINEER INCHARGE. The Contractor shall furnish test certificates.

### Inspection

The ENGINEER INCHARGE shall have free access to all parts of the job during erection and all erection shall be subjected to his approval. In case of faulty erection, all dismantling and re-erection required will be at the Contractor's cost. No paint shall be applied to rivet heads or field welds or bolts until these have been approved by the ENGINEER INCHARGE.

### Tolerances

#### General

Tolerances mentioned below shall be achieved after the entire structure or part thereof is in line, level and plumb.

#### Columns

Deviation of column axes at foundation top level with respect to true axes:

- |     |                           |            |
|-----|---------------------------|------------|
| (a) | In longitudinal direction | $\pm 5$ mm |
| (b) | In lateral direction      | $\pm 5$ mm |

Deviation in the level of bearing surface of columns at foundation top with respect to true level  $\pm 5$  mm.

Out of plumbness (verticality) of column axis from true vertical axis, as measured at column top:

- (a) For columns up to and including  $\pm 1/1000$  of column height in mm 15 meters  
in height or  $\pm 15$  mm whichever is less

- (b) For columns exceeding 15  $\pm 1/1000$  of column height in mm meters  
in height or  $\pm 20$  mm whichever is less

Deviation in straightness in longitudinal  $\pm 1/1000$  of column height in mm

And transverse planes of column at any or  $\pm 10$  mm whichever is less

Point along the height

Difference in erected position of adjacent  $\pm 10 \text{ mm}$

Pairs of columns along length or across

Width of building prior to connecting

trusses/beams with respect to true distance

Deviation in any bearing or seating level  $\pm 5 \text{ mm}$

with respect to true level

Deviation in differences in bearing level  $\pm 10 \text{ mm}$

of a member on adjacent pair of columns  
both across and along the building

## Trusses And Beams

Shift at the centre of span of top chord  $\pm 1/250$  of height of truss in mm

member with respect to the vertical plane or  $\pm 15 \text{ mm}$  whichever is less

passing through the centre of bottom chord

Lateral shift of top chord of truss at the  $\pm 1/1500$  of span of truss in mm

centre of span from the vertical plane or  $\pm 15 \text{ mm}$  whichever is less

passing through the center of supports of the truss

Lateral shift in location of truss from its  $\pm 10 \text{ mm}$

true vertical position

Lateral shift in location of purlin true position  $\pm 5$  mm

Deviation in difference of bearing levels of trusses or beams from  
i)  $\pm 20$  mm for trusses  
ii) For beams : the true difference

Depth  $< 1800$  mm :  $\pm 6$  mm  
Depth  $> 1800$  mm :  $\pm 10$  mm

Deviation in sag in chords and diagonals  $1/1500$  of length in mm or  
of truss between node points  $10$  mm whichever is smaller

Deviation in sweep of trusses, beams etc.  $1/1000$  of span in mm subject in the horizontal plan to a maximum of  $10$  mm

Crane Girders & Rails  
Shift in the centre line of crane rail with respect to centre line of web of crane girder  $\pm 5$  mm

Shift in plan of alignment of crane rail with  $\pm 5$  mm

#### **Crane Girder & Rails**

Shift in the centre line of crane rail with  
Respect to centre line of web of crane girder  $\pm 5$  mm

Shift in plan of alignment of crane rail with  
respect to true axis of crane rail at any point  $\pm 1$  mm

Difference in alignment of crane rail in plan  
measured between any two points  $2$  meters  $\pm 1$  mm

Apart along rail

Deviation in crane track with respect to

Time gauge

For track gauges upto and

Including 15 meters

$\pm 5$  mm

For track gauges more than

$\pm [5 + 0.25 (S-15)]$

15 meters

where S in meters is true gauge

Deviation in the crane rail level at any  
point from true level

$\pm 1/1200$  of the gauge distance or  
 $\pm 10$ mm whichever is less

Difference in the crane rail actual levels  
between any two points 2 meters apart  
along the rail length

$\pm 2$  mm

Difference in levels between crane track Rails at

(a) Supports of crane girders

$\pm 15$  mm

(b) Mid span of crane girders

$\pm 20$  mm

Relative shift of crane rail surfaces at a  
joint in plane and elevation surfaces for smooth transition

2 mm subject to grinding of

Relative shift in the location of crane tracks mm subject to maximum with track gauge S in mm

1/1000 of track gauge S in stops (end buffers) along the crane  
of 20 mm

## Painting

After steel has been erected, all bare and abraded spots, rivet heads, field welds, bolt heads and nuts shall be spot painted with primer. Before paint is applied, the surface shall be dry and free from dust, dirt, scale and grease. All surfaces inaccessible after erection shall receive two coats of the approved paint before erection.

## Clean up of Work site

During erection, the Contractor shall at all times keep the working and storage areas used by him free from accumulation of waste materials or rubbish. Before completion of erection, he shall remove or dispose of in a satisfactory manner all temporary structures, waste and debris and leave the premises in a condition satisfactory to the ENGINEER INCHARGE.

## EARTHWORKS

### Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

- |    |                  |   |   |
|----|------------------|---|---|
| a) | IS 783 - 1985    | - | Code of practice for laying of concrete pipes.  |
| b) | IS 3764 - 1992   | - | Excavation work - Code of Safety.   |
| c) | IS 2720          | - | Methods of test for soils:  |
|    | (Part-1) - 1983  | - | Part 1 Preparation of dry soil samples for various tests.                                 |
|    | (Part-2) - 1986  | - | Part 2 Determination of Water Content.  |
|    | (Part-4) - 1985  | - | Part 4 Grain size analysis.   |
|    | (Part-5) - 1985  | - | Part 5 Determination of liquid and plastic limit.   |
|    | (Part-7) - 1980  | - | Part 7 Determination of water content - dry density relation using light compaction.      |
|    | (Part-9) - 1971  | - | Part 9 Determination of dry density - moisture content by constant weight of soil method. |
|    | (Part-14) - 1983 | - | Part 14 Determination of density index (relative density) of cohesionless soils.          |
|    | (Part-22) - 1978 | - | Part 22 Determination of organic matter.  |
|    | (Part-26) - 1987 | - | Part 26 Determination of pH Value.  |
|    | (Part-27) - 1987 | - | Part 27 Determination of total soluble sulphates.   |
|    | (Part-28) - 1974 | - | Part 28 Determination of dry density of soils in place, by the sand replacement method.   |
|    | (Part-33) - 1971 | - | Part 33 Determination of the density in place by the ring and water replacement method.   |
|    | (Part-34) - 1972 | - | Part 34 Determination of density of soil in place by rubber balloon method.               |
|    | (Part-38) - 197  | 6 | - Part 38 Compaction control test ( Hilf Method ).  |

## General

The Contractor shall furnish all tools, plant, instruments, qualified supervisory personnel, labour, materials, any temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the work in accordance with the Employer's Requirements.

The Contractor shall survey the site before excavation and set out all lines and establish levels for various works such as grading, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference/grid lines at 8m intervals or nearer, if necessary, based on ground profile and thereafter properly recorded.

The excavation shall be carried out to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night.

Excavated material shall be dumped in regular heaps, bunds, riprap with regular slopes within the lead specified and leveling the same so as to provide natural drainage. Rock/soil & murrum excavated shall be stacked properly as approved by the Employer's Representative. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

Topsoil shall be stock piled separately for later re-use.

## Clearing

The area to be excavated/filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are encountered during excavation, they shall also be removed. The material so removed shall be disposed off as approved by the Employer's Representative. Where earth fill is intended, the area shall be stripped of all loose/ soft patches, top soil containing objectionable matter/ materials before fill commences.

## Excavation

All excavation work shall be carried out by mechanical equipment unless, in the opinion of Employer's Representative, the work involved requires it to be carried out by manual methods.

Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings provided by the Contractor or such other lines and grades as may be agreed with the Employer's Representative. Rough excavation shall be carried out to a depth of 150mm above the final level. The balance shall be excavated with special care.

Soft pockets shall be removed below the final level and extra excavation filled up with lean concrete as approved by the Employer's Representative. The final excavation should be carried out just prior to laying the blinding course.

To facilitate the permanent works the Contractor may excavate, and also backfill later, outside the lines shown on the drawings provided by the Contractor as agreed with the Employer's



Representative. Should any excavation be taken below the specified elevations, the Contractor shall fill it up with concrete of the same class as in the foundation resting thereon, upto the required elevation at no cost to the Employer.

All excavations shall be to the minimum dimensions required for safety and ease of working. Prior approval of the Employer's Representative shall be obtained by the Contractor in each individual case, for the method proposed for the excavation, including dimensions, side slopes, dewatering, disposal, etc. This approval, shall not in any way relieve the Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope.

### **Rock**

#### **General:**

'Rock' means a natural aggregate of mineral crystals, which for its excavation would normally require the use of heavy pneumatic/hydraulic breaker and/or cutting equipment or explosives. the term shall exclude any material that can be removed by ordinary excavating machinery and which in any individual mass has a volume not exceeding  $1\text{m}^3$  or  $0.25\text{m}^3$  where the net width of excavation is less than 2 m. Ordinary excavating machinery means a hydraulic back hoe with rated output of 50 kW or less.

Before classification of material as rock the Contractor shall demonstrate to the satisfaction of the Employer's Representative his inability to excavate it without resort to heavy percussion tools complete with rock bits, hydraulic wedges or blasting. Excavation by the use of explosive will not normally be permitted except for pipeline.

Material shall not be classified as rock unless the Employer's Representative has agreed to such classification on the basis of such a demonstration before its excavation. Excavations where rock has been encountered and classified as such shall not be backfilled before examination of the excavated faces by the Employer's Representative to enable the extent of the rock excavation to be determined.

#### **Excavation by the Use of Explosives**

Unless otherwise stated herein, I.S. Specification " IS:4081: Safety Code for Blasting and related Drilling Operations" shall be followed. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions shall be taken to preserve the rock below and beyond the lines specified for the excavation, in the soundest possible condition. The quantity and strength of explosives used, shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Employer's Representative, shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Employer's Representative at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

The contractor shall obtain a valid Blasting License from the authorities concerned. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done; and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as away as possible from the area to be blasted. Employer's Representative's prior approval shall be taken for the location proposed for the magazine.

In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old.

For blasting operations, the following points shall be observed.

- i) Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge of each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.
- ii) Before any blasting is carried out, Contractor shall intimate Employer's Representative and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.
- iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200 m radius from the firing point, at least 15 minutes before firing time by sounding warning whistle. The area shall also be given a warning by sounding a distinguishing whistle.
- iv) The blasting of rock near any existing buildings, equipments or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Employer's Representative, a trench shall have to be cut by chiseling prior to the blasting operation, separating the area under blasting from the existing structures.
- v) The firing shall be supervised by a Supervisor and not more than 6 (six) holes at a time shall be

set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

- vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth, the balance of the hole shall be filled with stemming, which may consist of sand or stone dust or similar inert material.
- vii) Contractor shall preferably detonate the explosives electrically.
- viii) The explosives shall be exploded by means of a primer, which shall be fired by detonating a fuse instantaneous detonator (F.I.D) or other approved cables. The detonators with F.I.D. shall be connected by special nippers.
- ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatin with detonator and fuse wire may be used. Underwater or for excavation in rock with substantial accumulated seepage electric detonation shall be used.
- x) Holes for charging explosives shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.
- xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level.

Any rock excavation beyond an over break limit of 75 mm shall be filled up as instructed by Employer's Representative, with concrete of strength not less than M10. Stopping in rock excavation shall be done by hand trimming.

- xii) Contractor shall be responsible for any accident to workmen, public or Employer's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the State and / or Union Government as applicable at the place of excavation.

### **Stripping Loose Rock**

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Employer's Representative, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Employer's Representative, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed.

### **Classification of Strata :**

The decision regarding, classification of strata shall rest with the Engineer in charge and his decision shall be final and binding to the contractor.

All the materials encountered in the excavation shall be classified as under :-

### **ORDINARY SOIL AND SOFT MURRUM :**

These will include all materials of an earthy or sandy nature, which can be easily ploughed or small shingle, and gravel, which can be easily removed.

### **HARD MURRUM :**

This shall include all kinds of disintegrated rock or shale or inundated clay which can be removed with a shovel without difficulty and which do not require blasting.

### **SOFT ROCK :**

This shall includes all materials which is rock or hard conglomerate, all decomposed and whether rock, highly fissured rock old masonry and also soft rock boulders bigger than 1/2 cubic meter and other varieties of rock. Which do not require blasting and which can be removed with the pie crowbars wedges and hammer.

### **HARD ROCK :**

This shall includes rocks, occurring in masses, which could best be removed by chiseling or by blasting.

### **Fill, Backfilling and Site Grading**

#### **General:**

All fill material shall be subject to the Employer's Representative's approval. If any material is rejected by Employer's Representative, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed off as directed by Employer's Representative after the fill work is completed.

No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Employer's Representative.

### **Material**

To the extent available, selected surplus spoil from excavations shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Employer's Representative. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Topsoil containing foreign material shall be removed. The materials so removed shall be disposed of as directed by Employer's Representative. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist.

### **Filling in pits and trenches around foundations of structures, walls, etc.**

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Employer's Representative. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Employer's Representative is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Employer's Representative.

### **Plinth Filling**

Plinth filling shall be carried out with approved material as described hereinbefore in layers not exceeding 15cm, watered and compacted with mechanical compaction machines. The Employer's Representative may, however, permit manual compaction by hand tampers where he is satisfied that mechanical compaction is not possible. The finished level of the filling shall be trimmed to the level/slope specified.

The thickness of each unconsolidated fill layer can in this case be upto a maximum of 300mm. The Contractor will determine the thickness of the layers in which fill has to be consolidated depending on the fill material and equipment used and the approval of the Employer's Representative obtained prior to commencing filling.

The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated, then filled and consolidated.

### **Sand Filling in Plinth and Other Places**

Where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours to

ensure maximum consolidation. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Employer's Representative has inspected and approved the fill.

### **Filling in Trenches**

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling material shall be properly consolidated taking due care so that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling upto a level 30 cm above the top of the pipe shall be done with fine materials such as earth, murrum, etc. The filling up to the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

### **General Site Grading**

Site grading shall be carried out as indicated in the drawings and as approved by the Employer's Representative. Excavation shall be carried out as specified in the Employer's Requirements. Filling and compaction shall be carried out as specified under Clause 2.7 and elsewhere unless otherwise indicated below.

If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 225 mm and leveled uniformly and compacted as indicated in Clause 2.7 before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, the Contractor shall remove the affected material and make good the slip.

If so specified, the rock as obtained from excavation may be used for filling and leveling to indicated grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cms approximately. After rock filling to the approximate level, indicated above has been carried out, the void in the rocks shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and earth shall be laid and consolidation carried out by a 12-ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

### **Fill Density**

The compaction, under the plant road area and building plinths shall comply with minimum 95% compaction by Standard Proctor at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained. In other areas the soil should be backfilled and compacted suitably as specified by the Engineer.

### **Timber Shoring**

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by the Employer's Representative. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walling of strong wood at maximum 1.2 meter spacing, struted with ballies or as approved by the Employer's Representative. The length of the ballie struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walling, which in turn shall be suitably struted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the Employer's Representative. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from the Employer's Representative.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of the Employer's Representative. In all other respects, the Employer's Requirements for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut.

### **Dewatering**

The Contractor shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction programme. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by Employer's Representative, but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete. The Contractor shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Contractor shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the Employer's Representative to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the Employer's Representative. The Contractor shall suitably divert the water obtained from dewatering from such areas of site where a build up of water in the opinion of the Employer's Representative obstructs the progress of the work, leads to unsanitary conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of Employer's Representative, to be large, a well point system- single stage or multistage, shall be adopted. The Contractor shall submit to the Employer's Representative, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval.

### **Rain Water Drainage**

Grading in the vicinity of excavation shall be such as to exclude rain/ surface water draining into excavated areas. Excavation shall be kept clean of rain and such water as the Contractor may be



using for his work by suitably pumping out the same. The scheme for pumping and discharge of such water shall be approved by the Employer's Representative.

**Item No: 11**

**Providing and supplying isl mark G. I. pipes with Couplings of following class and diometerincluding all taxesS. | insurance, transportation, freight charges, octroi, inspection charges, loading, unloading. conveyance to departmental stores, stacking etc. complete. (S -1239) (Not for well/tube well column pipe) 50 mm dia Medium Duty**

Galvanized iron pipes and its fitting on various diameters are to be provided by the contractor at his own cost. The pipes and fitting shall be of the best quality as approved by the engineer-in-charge. The pipe will be laid as per direction of the engineer-in-charge. Necessary excavation through all sorts of soil shall be carried out by the contractor to the required depth and width. The pipes will be jointed with each other by coupling and with necessary jointing materials such as white lead hamp or spun yarn etc. All the necessary fitting such as below, bands, tee, reducers, couplings, tapers, unions etc. Shall be fitted as required. The rate for different pipes shall be paid per meter of length of pipes provided and jointed. This rate for different pipes shall be paid per meter of length of pipes provided and jointed. This item includes cost of pipes specials jointing materials cutting the pipes to the required size, treading, welding, excavation etc. Complete in all respects.

The rate shall & paid running meter

**Item No. – 12**

**Excavation for foundation including throwing the excavatewd stuff up to a lead of 50 mt.depth 0.00 to 1.50 mt. depth**

**(a) Ordinary soil, sand & soft murrum (40%)**

**(b) In Hard Murrum (60%)**

**1.0. General:**

1.1 Loose of Soft Soil: Any soil which generally yields to the application of pickaxes and shovels, phawaras, rakes or any such ordinary excavating

implement or organic soil, gravel, silt, sand turf loam, clay, peat etc., fall under this category.

- 1.2 In Hard Murrum: Any soil which generally require close application of picks or jumpers or scarifies to loosen it stiff clay, gravel and stone etc. fall under this category.

## **2.0 Clearing the site:**

- 2.1 The site on which the structure is to be built shall be cleared and all obstructions, loose stone, materials and rubbish of all kind, bush, wood and trees shall be removed as directed.
- 2.2 The rate of site clearance is deemed to be included in the rate of earth work for which no extra will be paid.

## **3.0 Setting out:**

After clearing the site, the center lines will be given by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labourers, materials, etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

## **4.0 Excavation:**

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary

slopes to a safe angle, at his own cost. The bottom of the excavated area shall be levelled both longitudinally and transversely as directed by removing and watering as required. No earth filling will be allowed for bringing it to level, if by mistake or any; other reason excavation is made deeper or wider than shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.50 Mtr depth shall be measured under this item.

#### **5.0. Disposal of the excavated stuff:**

5.1. The excavated stuff of the selected type shall be used in filling the trenches and plinth or levelling the ground in layers including ramming and watering etc.

5.2. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

#### **6.0. Mode of measurement and payment:**

6.1. The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to slopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

6.2. The rate shall be for a unit of one cubic metre.

**Item No. – 13**

**Providing and casting In situ mass cement concrete in grade M10 (approx. corresp.to prop. 1:3:6) using granite quartzite trap metal of size 12mm to 25mm incl.consolidation curing etc.complet (without forms work)**

**1.0. Materials:****1.1. Water:**

Water shall not be salty brackish and shall be clean, reasonably clear and free objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar of concrete or cause efflorescence or attack the steel in R.C.C. Potable water will generally found suitable for curing, mortar or concrete.

**1.2 Sand:**

Sand shall be natural sand, clean, well graded hard strong, durable and gritty particles free from injurious amounts of dust, clay kankar nodules, soft or flaky particles shale, alkali salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-Charge.

**1.3 Stone Aggregate:**

Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape unless special stones of particular quarries are mentioned. Aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall be generally as per IS 456.

#### **1.4 Cement:**

Cement shall be ordinary Portland slag cement as per I.S.269-1976 or Portland slag cement as per I.S. 455-1976

#### **2.0 Workmanship:**

##### **2.1 General:**

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

**2.2 Proportion of Mix:** The Proportion of cement, sand and coarse aggregate shall be one part of cement, 3 parts of sand, 6 parts of stone aggregates and shall so measured by volume.

**2.3 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 machineries 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 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.

**2.4 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 s 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.

**2.5 Compacting:** The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and allow all the interstices to be filled with mortar.

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

### **3.0 Mode of measurement and Payment:**

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

#### **Item No. – 14**

**Precast concrete block masonry (including quoin blocks jamb blocks closer etc.) with solid concrete blocks of approved size made of cement concrete 1:3:6 mix (1- Cement : 3 coarse sand: 6- graded stone aggregates of 20 mm and down grade) in foundation and plinth cement mortar 1:6 (upto 10 ton)**

**(3.1) For Foundation and plinth**

**(3.2) For Superstructure**

**Material :-**

Masonry units of hollow and solid concrete blocks shall conform to the requirements of IS : 2185 (Part I).

Masonry units of hollow and solid light-weight concrete blocks shall conform to the requirements of IS : 2185 (Part 3).

Masonry units of autoclaved cellular concrete blocks shall conform to the requirements of IS:2185 (Part 3).

The height of the concrete masonry units shall not exceed either its length or six times its width.

The nominal dimensions of concrete block shall be as under.

Length 400, 500 or 600 mm

Height 100 or 200 mm

Width 100 to 300 mm in 50 mm increments

Half blocks shall be in lengths of 200, 250 or 300mm to correspond to the full length blocks.

Actual dimensions shall be 10mm short of the nominal dimensions.

The maximum variation in the length of the units shall not be more than  $\pm 5$  mm and maximum variation in height or width of the units shall not be more than  $\pm 3$ mm.

Concrete blocks shall be either hollow blocks with open or closed cavities or solid blocks.

Concrete blocks shall be sound, free of cracks, chipping or other defects which impair the strength or performance of the construction. Surface texture shall as specified. The faces of the units shall be flat and rectangular, opposite faces shall be parallel and all arises shall be square.

The bedding surfaces shall be at right angles to the faces of the block.

The concrete mix for the hollow and solid concrete blocks/light weight concrete blocks shall not be richer than one part of cement to six parts of combined aggregates by volume.

Concrete blocks shall be of approved manufacture, which satisfy the limitations in the values of water absorption, drying shrinkage and moisture movement, as specified for the type of block as per relevant IS code. Contractor shall furnish the test certificates and also supply the samples for the approval of GWSSB.

#### Workmanship :-

The type of the concrete block, thickness and grade based on the compressive strength for use in load bearing and/or non-load bearing walls shall be as specified. The minimum nominal thickness of non-load bearing internal walls shall be 100mm. The minimum nominal thickness of external panel walls in framed construction shall be 200 mm.

The workmanship shall generally conform to the requirements of IS:2572 for concrete block masonry, IS:6042 for light weight concrete block masonry and IS:6041 for autoclaved cellular concrete block masonry works.

From considerations of durability, generally concrete block masonry shall be used in superstructure works above the damp-proof course level.

Concrete blocks shall be embedded with a mortar which is relatively weaker than the mix of the blocks in order to avoid the formation of cracks. Cement mortar of proportion 1:6 shall be used for the works. The thickness of both horizontal and vertical joints shall be 10mm. The first course shall be laid with greater care, ensuring that it is properly aligned, levelled and plumb since this will facilitate in laying succeeding courses to obtain a straight and truly vertical wall. For the horizontal (bedding) joint, mortar shall be spread over the entire top surface of the block including front and rear shells as well as the webs to a uniform layer of 10mm. For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. The mortar may be applied either to the unit already placed on the wall or on the edges of the succeeding unit when it is standing vertically and then placing it horizontally, well pressed against the previously laid unit to produce a compacted vertical joint. In case of two cell blocks with slight depression on the vertical sides these shall also be filled up with mortar to secure greater lateral rigidity. To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block as the mortar will stiffen and lose its plasticity Mortar while hardening shrinks slightly and thus pulls away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after it has stiffened to effect intimate contact between the mortar and the unit to obtain a weather tight joint. The mortar shall be raked to a depth of 10mm as each course is laid to ensure good bond for the plaster.



Dimensional stability of hollow concrete blocks is greatly affected by variations of moisture content in the units. Only well dried blocks should be used for the construction. Blocks with moisture content more than 25% of maximum water absorption permissible shall not be used. The blocks should not be wetted before or during laying in the walls. Blocks should be laid dry except slightly moistening their surfaces on which mortar is to be applied to obviate absorption of water from the mortar.

As per the design requirements and to effectively control cracks in the masonry, RCC bound beams/studs, joint reinforcement shall be provided at suitable locations. Joint reinforcement shall be fabricated either from mild steel wires conforming to IS:280 or welded wire fabric/high strength deformed basis.

For jambs of doors, windows and openings, should concrete blocks shall be provided. If hollow units are used, the hollows shall be filled with concrete of mix 1:3:6. Hold fasts of doors/windows should be arranged so that they occur at block course level.

At intersection of walls, the courses shall laid up at the same time with a true masonry bond between at least 50% of the concrete blocks. The sequence for construction of partition walls and treatment at the top of load bearing walls for the RCC slab shall be as detailed under for the brick work.

Curing of the mortar joints shall be carried out for at least 7 days. The walls should only be lightly moistened and shall not be allowed to become excessively wet.

Double scaffolding shall be adopted for execution of block masonry work. Cutting of the units shall be restricted to a minimum. All horizontal and vertical dimensions shall be in respectively, adopting modular co-ordination for walls, opening locations for doors, windows etc.

Concrete blocks shall be stored at site suitably to avoid any contact with moisture from the ground and covered to protect against wetting.

The rate shall be paid per 1 cum of work done.

**Item No. – 15**

**Providing and fixing iron door ,window and cupboard etcincl.using the frame of channels conglesungles and hats 7 M.S. sheet as per design incl. rivetings or weldingsatc complete inc.3 coast of approved points(exclud.rate of angle).**

Specification for steel windows shall be as under :

**SIZE :**

The size of a window shall be for clear opening size 0.8 x 1.20 m.

**MATERIAL :**

Window frame manufacturing from EZ-7 hot rolled steel section shall confirm to I.S. 226-1969

Dimension tolerance, weight, finishing and working shall confirm to I.S. 7452-1974

The frame of shutters shall be prepared from rolled section of 30 x 30 x 3mm with upright of 25x25x3mm.

Panels shall be of black iron steel 20 gauge welded with frame continuously.

Guide bars shall be of 16 mm square a 15 cm c/c with two vertical flats 30mm x 5mm also

The standard fittings shall be as per I.S.S. shall be given

**FABRICATION :**

Fabrication shall be carried out as per I.S. 1038-1975

Painting, marking and packing etc. shall be as per I.S. 1038-1975

**MODE OF PAYMENT**

The payment shall be made on receipt of materials in good condition specified as per Schedule-B.

### **Item No. – 16**

**Providing and laying cement concrete 1:4:8 (1- Cement : 4- coarse sand : 8- hand broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth (Up to 10 ton)**

#### **1.0. Materials:**

##### **1.1. Water:**

Water shall not be salty brackish and shall be clean, reasonably clear and free objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar of concrete or cause efflorescence or attack the steel in R.C.C. Potable water will generally found suitable for curing, mortar or concrete.

##### **1.2 Sand:**

Sand shall be natural sand, clean, well graded hard strong, durable and gritty particles free from injurious amounts of dust, clay kankar nodules, soft or flaky particles shale, alkali salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-Charge.

##### **1.3 Stone Aggregate:**

Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape unless special stones of particular quarries are mentioned. Aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall be generally as per IS 456.

##### **1.4 Cement:**

Cement shall be ordinary Portland slag cement as per I.S.269-1976 or Portland slag cement as per I.S. 455-1976

## **2.0 Workmanship:**

### **2.1 General:**

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

**2.2 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.

**2.3 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 machineries 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 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.

**2.4 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 methods 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.

**2.5 Compacting:**The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and allow all the interstices to be filled with mortar.

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

### **3.0 Mode of measurement and Payment:**

The concrete shall be measured for its length breadth and depth, limiting dimensions to those specified on plan or as directed. The rate shall be paid per Cum basis.

#### **Item No:17**

**Providing and laying C.C flooring 1:2:4 (1cement 2coarse sand 4 graded stone aggregate 20mm nominal size ) laid in one layer finished with a floating coat of neat cement (A) 50mm thick (upto 10 ton)**

#### **1.0. Materials:**

##### **1.1. Water:**

Water shall not be salty brackish and shall be clean, reasonably clear and free objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar of concrete or cause efflorescence or attack the steel in R.C.C. Potable water will generally found suitable for curing, mortar or concrete.

##### **1.2 Sand:**

Sand shall be natural sand, clean, well graded hard strong, durable and gritty particles free from injurious amounts of dust, clay kankar nodules, soft or flaky particles shale, alkali salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-Charge.

##### **1.3 Stone Aggregate:**

Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape unless special stones of particular quarries are mentioned. Aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall be generally as per IS 456.

#### **1.4 Cement:**

Cement shall be ordinary Portland slag cement as per I.S.269-1976 or Portland slag cement as per I.S. 455-1976

#### **2.0 Workmanship:**

##### **2.1 General:**

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

**2.2 Proportion of Mix:** The Proportion of cement, sand and coarse aggregate shall be one part of cement, 2 parts of sand, 4 parts of stone aggregates and shall so measured by volume. total thickness of the flooring shall be kept 50mm.

**2.3 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 machineries 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 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.

**2.4 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 methods 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.

**2.5 Compacting:** The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and allow all the interstices to be filled with mortar.

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

**3.0 Mode of measurement and Payment:**

The concrete shall be measured for its length breadth and depth, limiting dimensions to those specified on plan or as directed. The rate shall be for a unit of one square metre.

The concrete shall be consists of one part of approved quality cement with two parts of clean and angular sand with out parts of coarse aggregates of 12mm to 20mm size.

Portable water shall be added as per required quantity and shall be mixed in best work manlike manner.

Necessary form work shall be done by the contractor. Lining work shall be carried out as per instruction of Engineer-in-Charge.

The entire work shall be cured at least for 14 days the total thickness of the flooring shall be kept 50mm.

The rate include all materials labour for mixing finishing, lining curing form work etc. complete

The rate shall be paid per one square meter.

**Item No.18:-**

**Providing corrugated G.I. sheet of class-3 roofing fixed with glavanished iron J or L Hooks, Bolts and nuts 8mm diameter with bitumen and G.I. limpet washer or G.I. limpet washer. filled with white lead complete excluding the cost of purlins, Rafters and Trusses.(1) 0.80 mm thick sheet. (upto 10 ton)**

**Galvanized Iron Sheets**

The galvanized iron sheets shall be plain or corrugated sheets of gauges as specified in item. The G.I. Sheets shall conform to I.S.277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise. They shall have clean and bright surface and shall be free from dents, bends, holes, rust or white powdery deposit.



The length and width of G.I. sheets shall be as directed as per site condition.

### **G.I. valleys gutter, ridges**

The G. I. ridges and hips shall be of plain galvanized sheets Class - 3, of the thickness as specified in item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

Valleys gutters and flashings shall also be of galvanized sheet of thickness as specified in item Valleys shall be 900 mm. wide overall and flashing shall be 380 mm wide overall. They shall be bent to the required shape without damage to the sheet in the process of bending.

The Rate shall be paid per Sqmt. of complete work.

### **Item No.19:-**

**Purchasing and supplying at site of work with Railway freight , loading , unloading and carting etc comp. such as joist, Channel, angles, Iron rail etc.**

**Size:- 25 mm x 25 mm x 3 mm thick**

The item pertains to the provision & supplying of wrought iron or mild steel as mentioned in the item as per the size & requirement or as directed by engineer-in-charged.

Materials :

The wrought iron or mild steel section shall confirm as per I.S.S. The sections shall be of required dimension and shape as per instruction of engineer-in-charge.

Mode of Measurement & Payment :

The contract rate shall be for MT. & payment is done as per actual wt. of item.

### **Item No.20:-**

**Labour charges for Lowering, laying and fixing various size of M.S. section such as joints, channls , angles plates etc. complete with fabrication**

**General**

All workmanship and finish shall be of the best quality and shall conform to the best-approved method of fabrication. All materials shall be finished straight and shall be machined/ground smooth true and square where so specified. All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Unless otherwise approved by the ENGINEER INCHARGE, reference may be made to relevant IS codes for providing standard fabrication tolerance. Material at the shops shall be kept clean and protected from weather.

**Connections**

Shop/field connections shall be as per approved fabrication drawings. In case of bolted connections, taper washers or flat washers or spring washers shall be used with bolts as necessary. In case of high strength friction grip bolts, hardened washers be used under the nuts or the bolt heads whichever are turned to tighten the bolts. The length of the bolt shall be such that at least one thread of the bolt projects beyond the nut, except in case of high strength friction grip bolts where this projection shall be at least three times the pitch of the thread.

In all cases where bearing is critical, the unthreaded portion of bolt shall bear on the members assembled. A washer of adequate thickness may be provided to exclude the threads from the bearing thickness, if a longer grip bolt has to be used for this purpose.

All connections and splices shall be designed for full strength of members or loads. Column splices shall be designed for the full tensile strength of the minimum cross section at the splice.

All bolts, nuts, washers, electrodes, screws etc., shall be supplied/brought to site 10% in excess of the requirement in each category and size. Rates shall cover the cost of this extra quantity.

All members likely to collect rainwater shall have drain holes provided.

**Straightening**

All materials, shall be straight and, if necessary, before being worked shall be straightened and/or flattened by pressure and shall be free from twists. Heating or forging shall not be resorted to without the prior approval of the ENGINEER INCHARGE in writing.

**Rolling and Forming**

Plates, channels, R.S.J. etc., for circular bins, bunkers, hoppers, gantry girders, etc., shall be accurately laid off and rolled or formed to required profile/shape as called for on the drawings. Adjacent sections shall be match-marked to facilitate accurate assembly, welding and erection in the field.

**High Strength Friction Grip Bolting**

Inspection after tightening of bolts shall be carried out as stipulated in the appropriate standards depending upon the method of tightening and the type of bolt used.

**Welding**

Welding procedure shall be submitted to the ENGINEER INCHARGE for approval. Welding shall be entrusted to qualified and experienced welders who shall be tested periodically and graded as per IS 817, IS: 7310 (Part 1) and IS: 7318 (Part 1).

While fabricating plated beams and built up members, all shop splices in each component part shall be made before such component part is welded to other parts of the members. Wherever weld reinforcement interferes with proper fit-up between components to be assembled off welding, these welds shall be ground flush prior to assembly.

Approval of the welding procedure by the ENGINEER INCHARGE shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure.

No welding shall be done when the surface of the members is wet nor during periods of high wind.

Each layer of a multiple layer weld except root and surfaces runs may be moderately panned with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from overweening.

No welding shall be done on base metal at a temperature below –5 Deg.C. Base metal shall be preheated to the temperature as per relevant IS codes.

Electrodes other than low-hydrogen electrodes shall not be permitted for thickness of 32 mm and above.

All welds shall be inspected for flaws by any of the methods described under Sub-clause The choice of the method adopted shall be agreed with the ENGINEER INCHARGE.

The correction of defective welds shall be carried out in a manner approved by the ENGINEER INCHARGE without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means approved by the ENGINEER INCHARGE shall be used to ensure that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. The cost of all such tests and operations incidental to correction shall be borne by the Contractor.

### **Tolerances**

The dimensional and weight tolerances for rolled shapes shall be in accordance with ARE: 1852 for indigenous steel and equivalent applicable codes for imported steel. The tolerances for fabrication of structural steel shall be as per ARE: 7215.

Cutting, punching, drilling, welding and fabrication tolerances shall be generally as per relevant IS codes.

As per Lumsum Rate

### **Item No.21:-**

**Providing 15mm thick cement plaster in single coat on Rough (Similar)side of single or half brick walls for interior plastering upto floor two level and finished even and smooth in (i) Cement mortar 1:3 (1-cement:3-sand)**

(i) Wetting and Racking :- All joints in masonry shall be thoroughly wetted and racked to a depth 20 mm. at least and the walls washed with fresh water and through wetted for 3 hours before plastering is done.

(ii) Coats the plaster with water proofing compound shall be laid in two coats. The thickness of the first coats shall be just surface to fill up the unevenness in surface under treatment. The total thickness of the plaster shall be 20 M.M.

(iii) Application : The first coat shall be applied on the prepared surface with a trowel to even up irregularities but the surface shall not be smoothened. The second coats shall be applied while the first coats is still soft.

(iv) Materials and Mixing : In the proportioning each bag of cement shall be taken as Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. the proportion of cement will be by volume on the basis of 50 Kg/Bag of cement being equal to 0.0342 Cu.m. The mortar may be hand mixed or machine mixed as directed. For the corresponding quantity of sand required for one bag of cement. Cement and sand shall be mixed dry in proportion and one part of cement and two parts of sand properly washed. Cement used shall be fresh Portland cement of approved brand and shall be free from any lumps etc. Water proofing compound of approved quality shall be used as directed by the Engineer-in-Charge.

The sand shall be clean sharp, angular and free from dust or any other foreign materials and shall be screened and washed before use.

The test for water tightness of the tank structure etc. shall have to be carried out by the contractor entirely at his own cost and any defects in the plaster shall have to be rectified by the contractor at his cost. Maximum  $\frac{1}{2}$ " drop of water per sq. m will be allowed. Water for the test will have to be brought by the contractor at his own cost.

Plaster shall be wetted and kept damp for 7 days. The rate shall be per Sq.Mtr.

**Sign of Contractor**

**Deputy Executive Engineer,  
P.H.S.Sub-Division-1,Bhuj**