

# **Mahindra** WORLD CITY

Mahindra World City (Jaipur) Limited, 411, Neelkanth Towers, 1,

Bhawani Singh Marg, C-Scheme, Jaipur- – 302001

Tel: +91 141 6683454, Fax: +91 141 2243060

Email : Jaipurtenders@mahindraworldcity.com

## **VOLUME-II**

## **TECHNICAL SPECIFICATIONS**

**Technical specification for sanitary sewers and manholes**

**Technical specification for sanitary sewers and manholes Contents**

<b>Clause no.</b>	<b>Description</b>	<b>Page nos.</b>
1. Scope .....		4
2. General requirements .....		5
3. Codes and standards .....		5
4. Sewers .....		5
5. Laying of sewers .....		6
6. Testing and acceptance.....		18

## **Technical specification for sanitary sewers & manholes**

### **1. Scope**

- 1.1** The work shall include providing of materials, all necessary plant and equipment, providing adequate engineering supervision and technical personnel, skilled and unskilled labour, etc. as required to carry out the entire work as indicated on the drawings and/or described herein subsequently and/or as directed by the Engineer.
- 1.2** The Contractor shall carry out all works meant within the intent of this specification even if not explicitly mentioned herein. All works shall be executed to the satisfaction of the Engineer.
- 1.3** This specification is divided into 6 sections, section C-17 deals with sanitary sewers and manholes and the other sections deal with specifications for 5 different items / activities. Stipulations contained in sections, C-1, C-2, C-3, C-4, C-5 and C- 17 shall form part of specifications for sanitary sewers and manholes.

All these six sections are as follows:-

- |               |  |
|---------------|--|
| Section C – 1 | Technical specification for excavation and filling   |
| Section C – 2 | Technical specification for properties, storage and handling of common building materials.   |
| Section C – 3 | Technical specification for cast in site concrete and allied works.<br><b>Sub section:</b><br>1 - Common requirement<br>2 - Cast in site concrete and Allied works 3 - Reinforcement<br>4 - Formwork and staging |
| Section C – 4 | Technical specification for masonry and allied works   |
| Section C – 5 | Technical specification for plastering and allied works  |
| Section C –17 | Technical specification for sanitary sewers and manholes layout and details of bore logs.  |

## 2. General requirements

- 2.1** Any approval, instructions, permission, checking, review, etc. whatsoever by the Engineer, shall not relieve the Contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.
- 2.2** The Contractor shall make his own surveying arrangements for locating the coordinates and positions of all work and establishing the reduced levels (RLs) at these locations, based on two reference grid lines and one bench mark which will be furnished by the Employer. The Contractor has to provide at Site, all the required survey instruments, along with qualified surveyors, to the satisfaction of the Engineer so that the work can be carried out accurately and according to the specifications and drawings.

## 3. Codes and standards

- 3.1** All applicable standards, specifications, etc. and codes of practice shall generally be the latest editions, including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the Contractor.
- 3.2** All work shall be carried out as per the stipulations contained in various sections of these specifications and the latest Indian Standards, Act, Codes and best practices.
- 3.3** In case of conflict between the stipulations contained in various sections of these specifications and stipulations of Indian Standards, Codes, etc. the requirements of stipulations contained in various sections of these specifications shall prevail over that of Indian Standards, Codes, etc.
- 3.4** Some of the applicable Indian Standards, Codes etc. are referred to herein below. These are only indicative. Apart from these the relevant standard codes are applicable wherever necessary. The latest amendment/version shall be used.

IS: 651	Glazed stoneware pipes and fittings
IS: 458	Precast concrete pipes
IS: 1726	Manhole covers & frames
IS: 5455	C.I. Rungs
IS: 458	Vent shafts
IS: 4127	Code of practice for laying of glazed stoneware pipes
IS: 783	Code of practice for laying of concrete pipes
IS: 4111 (Part1)	Code of practice for ancillary structures in sewerage system (manholes)
IS:12330	Sulphate resisting portland cement.

## 4. Sewers

4.1 UPVC pipes shall conform to IS: 15328

4.2 Glazed Stoneware pipes shall conform to IS: 651

4.3 Concrete pipes shall conform to IS: 458

4.4 Manhole covers and frames shall conform to IS: 1726

4.5 Cast iron rungs shall conform to IS: 5455

## **5. Laying of sewers**

### **5.1 Excavation for sewers**

**5.1.1.** The whole of the excavation will be classified under two heads only, viz :

- (a) General excavation to include excavation in road surfaces of every description together with their foundations, clay, loose sand stone, murum, boulders, sand, lime cement masonry and all other materials of whatever description not requiring to be blasted.
- (b) Rock excavation to comprise excavation in rock big boulders more than 0.25 cubic metre in volume, very hard sand stone or littoral concrete, requiring to be blasted by an explosive or burst out in small pieces by Iron wedges or Chisels.

### **5.1.2. Class of excavation to be determined**

In case of any question arising as to the class of excavation, the Engineer shall determine under which category, and to what extent any particular excavation shall be classed and this decision will be binding to the contractor.

### **5.1.3. Trial holes**

Trial holes of such sizes and depths and in such positions as may be necessary or be directed by the Engineer shall be dug and subsequently made good as may be ordered by and to the satisfaction of the Engineer.

Sufficient trial holes must be dug to accurately locate and determine the positions of services like water mains, Electricity Cables, Culverts and obstructions in advance of the main excavation.

In all cases the trial holes are to be excavated in accordance with the specification for excavation, refilling and reinstatement etc.

#### 5.1.4. Widths of excavation for different diameter of pipes

The width at bottom of trenches for different diameters of pipes for excavation of trenches will be as follows: (Widths of excavation for sections without shoring shall be obtained by deducting 0.1 m from those given in the Table).

**Table showing the proposed widths for excavation of trenches in sewerage works**

Excavation in ordinary soil			Excavation in rock wherever it is met with		
Sizes of pipe	Shoring in one stage		Shoring in two stages more than 5m depth	Shoring in one Stage up to 5m depth	Shoring in two stages more than 5 M depth
	Up to 3M depth	Above 3 M & 5M			
(1)	(2a)	(2b)	(2c)	(3a)	(3b)
150mm	0.8 M	0.9 M	....	0.8 M	...
250mm	0.9 M	1.0 M	1.4 M up to 5m} 1.0 M below 5m}	0.9 M	1.0 M
300mm	0.9 M	1.0 M	1.4 M upto 5m} 1.0 M below 5 m}	0.9 M	1.0 M
350mm	1.3 M	1.5 M	1.8 M upto 5m} 1.5 M below 5m}	1.3 M	1.50 M
400mm	1.40 M	1.60 M	1.90 M upto 5m} 1.60 M below 5m}	1.40 M	1.60 M
450mm	1.50 M	1.70 M	2.0 M upto 5m} 1.70 M below 5m}	1.50 M	1.70 M
500mm	1.50 M	1.70 M	2.0 M upto 5m} 1.70 M below 5m}	1.50 M	1.70 M
600mm	1.60 M	1.80 M	2.10 M upto 5m} 1.80 M below 5m}	1.60 M	1.80 M
700mm	1.70 M	1.90 M	2.20 M upto 5m} 1.90 M below 5m}	1.70 M	1.90 M
800mm	2.00 M	2.30 M	2.60 M upto 5m} 2.30 M below 5m}	2.00 M	2.30 M
900mm	2.10 M	2.40 M	2.70 M upto 5m} 2.40 M below 5m}	2.10 M	2.40 M
1000mm	2.20 M	2.50 M	2.80 M upto 5m} 2.50 M below 5m}	2.20 M	2.50 M
1100mm	2.30 M	2.60 M	2.90 M upto 5m} 2.60 M below 5m}	2.30 M	2.60 M

1200mm	2.40 M	2.70 M	3.0 M upto 5m} 2.70 M below 5m}	2.40 M	2.70 M
1400mm	2.70 M	3.00 M	3.40 M upto 5m} 3.00 M below 5m}	2.70 M	3.00 M
<b>Excavation in ordinary soil</b>			<b>Excavation in rock wherever it is met with</b>		
<b>Sizes of pipe</b>	<b>Shoring in one stage</b>		<b>Shoring in two stages more than 5m depth</b>	<b>Shoring in one Stage up to 5m depth</b>	<b>Shoring in two stages more than 5 M depth</b>
	<b>Up to 3M depth</b>	<b>Above 3 M &amp; 5M</b>			
1600mm	2.90 M	3.20 M	3.50 M upto 5m} 3.20 M below 5m}	2.90 M	3.20 M
1800 mm	3.10 M	3.40 M	3.70 M upto 5m} 3.40 M below 5m}	3.10 M	3.40 M

**Note:** Widths for trenches less than those mentioned in the above table shall not be permitted.

**The size of excavation for manhole will be taken as follows:-**

<b>Size of manhole</b>	<b>Depth of Manhole up to invert level in meter</b>	<b>Size of excavation without drop arrangement</b>	<b>Size of excavation with drop arrangement</b>
1.2 m x 0.75 m	Up to 1.50 m	2.50 m x 2.05 m	
1.2 m x dia	greater than 1.5 m to 2.70 m	2.50 m x 2.50 m	3.00 m x 2.50 m
1.35 m dia	greater than 2.70 m to 3.30 m	2.55 m x 2.55 m	3.05 m x 2.55 m
1.35 m dia	greater than 3.30 m to 4.50 m	2.75 m x 2.75 m	3.25 m x 2.75 m
1.50 m dia	greater than 4.50 m to 6.00 m	3.10 m x 3.10 m	3.60 m x 3.10 m
1.50 m dia	greater than 6.00 m to 7.00 m	3.30 m x 3.30 m	3.80 m x 3.30 m

**Note:** Size of excavation shall not be less than those mentioned in the above table.

### 5.1.5. Depth of excavation of trenches

The depths for the trenches will be from the surface to the bed of the pipes and in case when a layer of concrete and/or precast blocks are required to be placed below



the pipe line, the depth will be upto the bottom of the concrete and/or of the Block below the underside of the pipe line.

The depth of excavation for manhole shall be from the surface of the existing ground level to the bottom of foundation.

#### **5.1.6. Grip for collar Joints**

Where a collar occurs a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipes so that the pipe may have a fair bearing on its shaft and not rest upon its collar. Such grip shall be of sufficient size in every respect to admit the hand, all around the collar in order to make the joint, and the grip shall be maintained clear until the joint has been passed by the Engineer.

#### **5.1.7. Trenches in rocky ground**

The trenches in stony or rocky ground are to be excavated all along to the full depth such that the bottom of the excavation shall not be higher at any point than the bottom of the concrete bedding layer below the sewer pipe.

**5.1.8.** When any portion of the excavation has been carried down to the necessary depth, the Contractor shall obtain permission from the Engineer before commencing the laying of Pipes or concrete or the construction of masonry.

### **5.2 Alignment**

#### **5.2.1. Sight rails**

- a) The sight rails (about 25 cm wide and 40 mm thick) are to be screwed with the top-edge against the level marks. The centre line of the pipe sewer or the drain will be marked on the rail and this mark will denote also the meeting point of the centre lines of any converging drains or pipe sewers. A line drawn from the top- edge of the next rail will be vertically parallel with the bed of the sewer or drain at any intermediate point may be easily determined by letting down the selected boning staff until the tee head comes in the line of sight from rail to rail.
- b) The posts and rails are to be perfectly square and planed smooth on all sides and edges. The rails are to be painted white on both sides, and the tee heads and cross piece of the boning staves are to be painted black.

If the pipes or drains covering to a manhole come in at various levels there must be a rail fixed for every different level. When a rail comes within 0.60 m of the surface of the ground

a higher sight-rail must be fixed for use with the rail over the next point.

The posts and rails must in no case be removed until the trench is excavated the drains are constructed and the pipes are laid and permission given to proceed with the filling in.

### **5.2.2. Boning staves**

Boning staves shall be prepared by the Contractors about 75 mm by 50 mm of various lengths, each length being of a certain number of meter and with a fixed tee head and fixed intermediate cross piece, each about 300 mm long. The top edge of the cross piece must be fixed at a distance below the top edge of this tee head, equal to as the case may be, the outside diameter of the pipe or the thickness of the concrete bed to be laid. The boning staff must be marked on both sides to indicate its full length. According to the circumstances of each case, a suitable length of boning staff will be determined upon, and the reduced level of the bed of the pipe or bottom of concrete of drain at each sight-rail added to the selected length of boning staff, will be marked by a horizontal line on both posts, or on walls or fences to which the sight-rail is to be fixed.

### **5.3 Bedding in soft grounds**

- 5.3.1** a) When the work of constructing the sewers has to be carried out in soft under ground strata, such as puddle etc. or in a reclaimed land, a good foundation shall be provided for the pipes and manholes. For the former excavation in the trench shall be taken 75 mm deeper than what is ordinarily required and for this depth the whole of the trench shall be covered over with M 15 concrete slab of the required width, reinforced with B.R.C. fabric No.9 or any other fabric approved by the Engineer. The foundation concrete of the manholes shall similarly be reinforced with same fabric, spread to cover the whole area of the foundation.
- b) The fabric shall be suitably cut to the requirement and securely joined together with adequate laps which should not be less than 200 mm. The fabric in the line and manholes must also be securely jointed together. The rates in both the cases shall be held to include all lapping, jointing and also any probable wastage.

### **5.3.2 Encasing / bedding / haunching etc.**

The pipes shall be provided with encasement / bedding / haunching etc. as specified in drawings.

### **5.4 Laying of pipes**

#### **5.4.1 Handling pipes**

At every point of loading or unloading, pipes or castings must be handled by approved lifting tackle. Unloading by rolling down planks or any other form of inclined ramp will not be allowed unless the written consent of the Engineer to the method proposed has been obtained. Pipes are to be

carefully stacked on site with timber packings under and between the pipes.

#### **5.4.2 Placing in trenches**

- c) The pipes are to be laid up the gradients beginning at the lower end. No pipe is to be laid until the trench has been excavated to its required depth for a distance of 2.0 M. in front of the pipe to be laid. (This distance may vary as directed by the Engineer)

All the pipes are to be laid perfectly true, both in line and on gradient. The pipes in a trench shall be all laid and fitted previous to the jointing being commenced.

- d) Properly fitted temporary wooden stopper shall be provided and constantly used to close the ends of all incompleting pipe lines. The stoppers are only to be removed when pipes are being laid and jointed.

### **5.5 Jointing of pipes**

#### **5.5.1 Jointing of R.C. pipes with collar joints**

The R.C. Pipes shall be carefully laid in position over the concrete bedding or over the firm ground at the required level and their abutting faces shall be coated with hot bitumen in liquid condition by means of a brush. The wedge-shaped groove in the end of the pipe shall then be filled with a sufficient quantity of a special bituminous plastic compound. The collar then shall be slipped over the end of the pipe and the next pipe butted well against the plastic ring by suitable appliance approved by the Engineer so as to thoroughly compress the plastic compound into the grooves, care being taken that the concentricity of the pipes and the levels are not disturbed during this operation.

The collar shall then be placed symmetrically over the end of the two pipes and the space between the inside of the collar and the outside of the pipe filled with a 1:1 mixture of cement and sand tampered with just sufficient water to have a consistency of the semi-dry condition well packed and thoroughly rammed with caulking tools. The joints shall be finished off with a fillet sloping at 45 Deg. to the size of the pipe and finished joints will be protected and cured for atleast four days or as directed.

Any plastic solution or cement mortar that may have been squeezed into the inside of the pipe shall be removed so as to leave the pipe perfectly clean

#### **5.5.2 Water tightness of joints / works**

- a) The drains, manholes and all joints of pipes must be made thoroughly sound and water tight, and any joint which may be proved to be leaky at any time during the progress of the works or during the contractors subsequent period of maintenance shall be

immediately made sound by the contractors at their own expenses.

The contractors, when required by the Engineer shall at their own cost prove all works to be water tight by filling it with water to such height as the Engineer may determine. Any additional precautionary measures of appliances that may be found necessary to ensure the water tightness of the manholes, flush tanks, disc plugs in junctions and the joints of pipes shall be adopted by the Contractor without extra charge, the responsibility of making them completely water tight resting upon the Contractors.

Immediately after the test with the double disc or Cylinder as mentioned in Clause No.5.5.5. has been completed and any defect thereby disclosed have been made good the Contractor shall prove the joints of the stretch of underground pipes whether of stoneware, cast iron or RC pipes, to be water tight by filling in pipes with water before back filling the trench to the level of 1.50 M above the top of the highest pipe in the stretch and holding the water up for the period of one hour or such further time as the Engineer may direct. The apparatus used for the purposes of testing shall be approved by the Engineer. The contractor if required by the Engineer shall pump the excavation dry and keep it so during the period of testing. No test applied to part of a stretch of pipes shall be considered conclusive nor shall it be deemed to obviate the necessity of an application of the test to the whole of stretch when completed. The loss of water over a period of 30 mins should be measured by adding water from a measuring vessel at regular 10 mins. Intervals and noting the quantity required to maintain the original water level. For the purposes of the test the average quantity added should not exceed 1 lt/hour/100 linear meters /10 mm of nominal internal dia (0.2 gallons / hr / 100 linear ft/inch of nominal internal diameter).

Any leakage including excessive sweating which causes a drop in the test water level will be visible and the defective part of the work should be removed and made good.

The manholes when they have been raised above the subsoil water, water level expected in the monsoon shall similarly be tested for water tightness as for the pipelines. The procedure for this shall be as follows:

The mouths of all pipes entering the manhole shall be suitably plugged with brick, masonry or wooden any other type of plug. The manhole under test shall then be filled with water upto the general subsoil water level and observed for a period of 1 hr. If the level does not drop by more than 50mm in 1 hr. it shall be assumed that the manhole is water tight. During the period of the test the outside trench shall be kept free from any accumulation of subsoil water in case of a drop of more than 50 mm in the water level the Contractor shall locate the places from where the leakage is taking place and take steps to stop the leakage. For the work of laying jointing and testing of GSW pipes

and RCC pipes the payment will be made on running metre basis but 10% amount will be withheld till the satisfactory Hydraulic Test will be given.

#### **5.5.3 Inspection of the joints**

After the joints of any pipes in underground work have thoroughly set, the Engineer (or any person whom he may appoint) may inspect the joints and if he has any doubt as to their soundness he may require the Contractors to put open and clean away the cement or lead at their expense provided that unless some defect be found, they shall not be required to open more than one joint in 20 M of pipe though if the defect be found the Engineer may direct them to open as many joints as may be deemed necessary.

#### **5.5.4 Cleansing of the pipes**

As soon as a stretch of pipes whether of stoneware or cast iron or RC Pipes has been laid complete from manhole to manhole the Contractor shall run through the pipes both backwards & forwards a double disc/solid/closed cylinder 75mm less in dia. than the internal dia. of the pipes. The open ends of the other pipes in the manhole shall be closed as directed by the Engineer to prevent entry of mud or silt etc. If as a result of the removal of any obstruction the Engineer considers that damages may have been caused to the pipes lines, he shall be entitled to order the length to be retested at the expenses of the Contractor. Should such retest prove unsatisfactory the Contractor shall at his own expense amend the work & carry out such further tests as are required by the Engineer. It shall also be ascertained by the Contractors that each stretch from manhole is absolutely clear & without any obstruction by means of visual examination of the interior of the pipe line suitably enlightened by projected sunlight or mirror and lamp or smooth ball or otherwise as directed by the Engineer.

#### **5.5.5 Fracture of pipes**

- a) In the event of pipes being fractured after being apparently properly laid whether due to imperfect loads having been formed or the material for refilling having been improperly selected or to any other causes the Contractor in every instances will be held responsible and will be called upon to replace such defective pipes at his own cost, if such defect appears before the expiration of the period of maintenance.
- b) Any pipe or length of pipes found to be defective shall be immediately removed and replaced at the Contractor's expense and leaking joints shall be remade, the inspections and tests shall then be repeated as often as necessary until the whole line under inspection or test is accepted by the Engineer.

#### **5.5.6 All works to be clear, clean and perfect**

The Contractors shall after completion or whenever required by the Engineer, prove all pipes and fittings to be clear and perfect, and for this purpose shall, at their own expense and in the presence of the Engineer or his appointees, provide suitable instruments and appliances and pass them through the pipes shall if required, throw in water and show that it passes freely through every portion of the work. Brick, mortar and rubbish shall not be allowed to fall into the manholes of sewer lines while fixing or if allowed, shall be removed by the Contractors at their own expenses.

#### **5.5.7 Laying and jointing of UPVC pipes**

The trench bottom should be flattened; stones and sharp projections are removed from the trench bottom. In cases where the trench bottom is very stiff, the soil is loosened up a little. If it is clay trench bottom, imported soil to be used to as a bedding layer of 20 cm thick. This layer need not be compacted to the trench bottom. After this trench bottom preparation, the pipe is positioned and the native soil (if it is pure clay, then imported soil to be used) is to be placed alongside the pipe up to the crown of the pipe, exercising foot tamping to create a good haunching zone. Then compaction of the side zone is to be done either by mechanically or manually to achieve the compaction of the side fill up to a relative density of 98-100%

standard proctor. Then, the next layer of 30cm is to be placed and compacted in the same way as the side fill. This procedure is to be repeated till the minimum cover over the crown of the pipe which should be 90cm. The rest of the trench can be filled with excavated soil till the top of the trench and compacted with machine or manual. Proper care shall be taken while doing so, that there should not be any damage caused to the pipes.

#### **5.5.8 Jointing:**

For the best performance of the pipeline jointing of the pipe plays a major part. PVC sewer pipes are manufactured conforming to IS 15328 with two types of joints.

1. Solvent weld joint
2. Rubber Ring Joint.

##### **5.5.8.1 Solvent cement joint:**

Special grade of cement is available for jointing the underground sewerage pipes to give a monolithic joints which are totally leak-proof and this should be used which is supplied by the manufacturer of pipes.

The inside of the socket should be cleaned thoroughly to remove any dust and foreign

particles adhering to the inside surface of the socket before applying a thin coat of cement on the inside surface of the socket. The socket inside should be smooth and should not be scratched with blades and rough sand paper to remove the dirt or foreign particles sticking to the surface. The thin layer applied should cover the entire surface of the socket and applying too much of solvent cement should be avoided as it will pool on the bottom side of the socket and create a hole in the pipe socket due to solvent nature of the cement.

The same way the spigot end of the other pipe which is to be jointed to the socket of the pipe already applied with solvent cement should be cleaned of any dirt and foreign particles sticking to it and in this case the spigot portion can be cleaned uniformly with a soft grained emery sheet if needed. After cleaning the spigot end of the pipe, mark the depth of the coupler on the spigot and apply two layers of cement on the spigot up to the marking.

Insert the spigot in to the socket after aligning the pipe and push the spigot fully in to the socket till the marking comes in line with the socket end and hold it for a few minutes. If the jointing pressure is removed immediately after the spigot is inserted, the spigot may come out and the jointing will be defective. Do not twist the spigot once it is home inside the socket. The excess cement that comes out of the socket at the end of the spigot should be wiped clean with a cloth and allow the joint to cure for 24 hours before testing the joint for pressure are commissioning the line.

Ensure that the cement is applied with a brush and close the lid of the solvent cement container immediately after taking out the cement for jointing. Store the cement in cool and dark place. While using the cement at the field does not keep it under direct sunlight as it will polymerize the solvent and the cement will lose its dissolving character.

Do not use fire near the solvent cement as it is highly inflammable. Do not smoke while doing the jointing which is very dangerous.

#### **5.5.8.2 Rubber ring joints:**

Sewerage pipes conforming to IS 15328 also manufactured with integral Rubber Ring Joint on one end of the pipe and the spigot end is with a chamfer to gain entry in to the rubber ring socket. Apply soft soap on the rubber ring and also on the spigot of the pipe up to a length that is marked for the socket depth insertion. Then align the spigot in to the socket till the chamfered end touches and compress the rubber ring in the socket. In case of smaller diameter pipe, a slight push of the pipe in to the socket will drive the spigot in to the socket compressing the rubber ring around the OD of the pipe. In case of larger diameter pipes, it is essential to tap the pipe with hammer from the other end of the pipe which will have the socket end. However, the tapping with hammer should not be done directly on the socket. Instead, place a 1/2 an inch thick wooden plank, the width of the plank being slightly more than the socket diameter and tap the wooden plank with hammer to drive the spigot



in to the socket of the other pipe. Care should be taken to maintain the alignment of the spigot pipe which is being tapped in to the socket to prevent dislocation of rubber ring from the socket groove. Do not use solvent cement with the rubber ring joints.

## **5.6 Manholes**

### **5.6.1 Depth of manholes**

The manholes on the sewers shall be constructed in the form and of the dimensions shown on the drg. The depth of the manholes shall be measured from the top of cover to the invert level of the manhole.

The manholes shall be constructed at places shown on the drawings or wherever directed by the Engineer. Type designs for these manholes are shown on the drawing. But the actual dimensions shall in each case be determined by the Engineer as the circumstances may require.

### **5.6.2 Construction of burnt clay brick masonry manholes**

The walls of the manholes shall be built in Burnt clay ash brick work in cement mortar and walls and the cap is plastered both from inside and outside with cement plaster 1:3. In case of conical manholes, the walls shall be brought up and 15 cm thick concrete cap of M 15 truncated conical shape as shown in the drawing and shall be cast in situ and shall be covered over with a cast iron frame and cover or a cast iron plate as may in each case be required by the Engineer. Whenever rectangular manholes are to be constructed the brick walls shall be brought up and shall cover over with a reinforced cement concrete slab with an opening in the position as directed by the Engineer.

### **5.6.3 Drop arrangement**

The drop arrangements in manholes will include as per drawing providing and fixing the required length of pipe embedded in the burnt clay brick masonry of the manhole, the bends, double tees including cutting the ends if required and filleting with extra brick work below the bend and plugging the open mouths of the double Tee junctions wherever directed to make them water tight. It will also include providing and fixing pipe including cutting, jointing, filleting, etc. all complete and burnt clay brick masonry encasement all round including curing, finishing smooth the exposed surface with cm 1:3 20 mm thick.

### **5.6.4 Floors and half channel pipes**

The floors shall consist of cement concrete. Concrete or R.C. half channel pipes of the required size and curves shall be laid and bedded in cement on the concrete base to the same line and fall as sewers unless otherwise directed. Both sides of the channel pipes



shall be benched up in a concrete and rendered in cement mortar 20 mm thick and formed to a slope of not less than 1 in 12 to the channel.

#### **5.6.5 Steps**

Where the depth of the invert exceeds 0.80 M below the surface of the ground, cast iron steps weighing not less than 5.44 kg and of approved pattern shall be built at every four courses or 40 cm. intervals in manhole with such additional hand irons as may be necessary for safety. The first step shall be provided at 0.6 M below the Road surface or top of Manhole cover.

#### **5.6.6 Pipe entering and leaving manholes**

Whenever a pipe enters or leaves manholes, bricks on edge shall be laid around the upper half of the pipe so as to form an arch. All around the pipe, there shall be joint of cement mortar 13 mm thick between it and the bricks or cement concrete. The ends of all pipes shall be properly built in and neatly finished of with cement mortar. The pipe projections are to be cut so that the ends are flush with plastered surface.

#### **5.6.7 Frames and covers**

Cast iron frames are to be provided by the Contractor and bedded in cement mortar on the brick work or cement concrete with splayed fillet all around and in such position that the top may be 13 mm above the original surface of the road. The covers are to be placed in position and the whole left neat and dry.

Covers to be provided by the Contractor shall be of cast iron (heavy duty), circular pattern. They shall be coated with bituminous paint.

#### **5.6.8 Smart cover systems**

The Smart Cover should create an automated system that should serve two basic purposes:

1. Provides continuous monitoring that establishes a detailed record of manhole conditions over a period of time
2. Rapidly alerts field response personnel using wireless field devices such as cell phones etc. to
  - a) Surcharging water levels in a manhole prior to a sewage spill, and;
  - b) Manhole cover has been opened.

#### **5.7 Vent shafts**

Vent shafts are to be provided and fixtures by the Contractor as shown in the drawing and as directed by the Engineer in concrete. They shall be connected to the manhole, the connection consisting of R.C. NP2 pipe 150 mm in diameter surrounded by 150 mm thick concrete of M 10 strength. The installation for the vent shaft shall include excavation , concrete foundation, bend head piece, connecting R.C. Pipe, the R.C. shaft all necessary fittings and fixtures etc. as also the erecting scaffolding cutting through cornices, roofs and making good the same etc.

R.C. vent shafts when required shall be provided of approved make as per drawing. It shall have a flue chamber, connecting pipe line, basic block of M 10 concrete and the shaft will be tapering with slits on all sides at the top.

## **6. Testing and acceptance**

### **6.1 Inspection before installation**

All pipes, fittings are fixtures shall be inspected before delivery at the site to see whether they confirm to accepted standards. The pipes shall again be inspected before laying by sounding to disclose cracks. All defective items shall be clearly marked and removed from the site.

1. **LIST OF APPROVED MAKES**

<b>SR. NO.</b>	<b>ITEM</b>	<b>APPROVED MAKE</b>
1.	UPVC PIPE & FITTINGS	Kissan / Ashirvad / Supreme / Prince/ Finolex
2.	Precast RCC Chambers	As per approval by Engineering in charge
3.	Vent pipe	As per approval by Engineering in charge

NOTE : (1) Equivalent makes shall be approved by PMC before procurement