

## Sub Section 4 SPECIAL SPECIFICATION FOR SEWERAGE WORKS

### 1. Sight rails and Boning rods

1.1 The works will be set out by the Contractor. The Contractor shall be required to fix over the centre of each manhole or where a change in direction or gradient occurs a strong timber sight rail, 150mm x 25mm with top edge placed straight and true. These shall be supported and fixed to stout wooden posts at each side of the excavation. The centre line of the sewer shall be marked on each sight rail both back and front by a single vertical line drawn thereon and on other side white. All lengths of sewer shall have three sight rails fixed one at each end and one in the centre and worked one with the other. The boning rods shall have a movable cross head at right angles to the rod. So arranged that it can slide up and down the rod and capable of being fixed at any required position on the rod by screws. The foot of the boning rod shall be provided with the shoe made truly at right angles to the rod so that when placed on the pipe being laid it shall rest properly on the pipe when the rod is truly vertical.

### 2 Laying and jointing of RCC pipes on concrete

2.1 Before laying the pipes, the Contractor shall carefully brush them to remove any soil, stones or other materials which may be therein, even and regular bed having been prepared, and joint pit excavated to form a recess under the socket of each pipe of no greater width and depth than to enable the pipe jointing to be properly done. each pipe shall then to carefully lowered and placed singly in the trench and shall rest on the solid ground for a distance of not less than two thirds of its entire length.

2.2 Each pipe shall be brought into a true line from manhole to manhole, for this purpose, a strong twin line (rat thread) sufficiently long to reach the full length between manholes shall be used. Each pipe shall be set correctly to level by means of the boning rod and sight rails.

2.3 The spigot of each pipe shall be carefully wrapped with a ring a spun yarn dipped in cement grout or tarred gasket sufficiently thick to properly fit the socket of the adjoining pipe and to allow true alignment. The Pipe shall then be driven fully home into the socket of the adjacent previously laid pipe and yarn or tarred gasket carefully driven home with caulking tool.

2.4 The remaining space in the socket shall than be tightly and completely filled with cement mortar composed of one part of Portland cement and one and a half parts sand and shall be neatly beveled off around the circumstances and finished at an angle of 45 degree outside the socket of the pipes. A wooden caulking tool shall be used for forcing

the mortar

into the sockets.

2.5 A tightly fitting bag of shavings or straw having a rope attached shall be drawn through the pipes as the work proceed to ensure that there is no cement or yam or other obstruction projecting into the interior.

2.6 All joints shall be kept moist either by means of wet bags, wet clay or wet earth which ever may be ordered by the engineer to protect them from the sun. Such covering shall be removed when the length is tested for water tightness.

### **3 Junctions on RCC pipes**

3.1 Where shown on the drawings or where directed by the Engineer Junctions pipes shall be provided at intervals during the construction of sewers, the jointing being effected in a similar manner to the pipe of the sewer in which they are placed.

3.2 These junction arms shall be closed with stoneware or cement disc and the sockets filled with cement mortar. The trench shall not be filled in until the position and orientation of each junction has been measured and recorded by the Engineer.

For water testing of stoneware sewers refer clause 4.9

## **4 Laying of RCC Pipes**

### **4.1 RCC Pipes**

#### **(a) General**

Jointing of RCC pipes shall be done as per the requirements of following corporation's Requirements and as per the relevant IS. After jointing, extraneous material, if any, shall be removed from the inside of the pipe and the newly made joints shall be thoroughly cured. In case, rubber sealing rings are used for jointing, these shall conform to IS: 5382 - 1985.

#### **(b) Spigot and Socket joint with Rubber Gasket (SBR) quality**

The spigot of each pipe shall be slipped home well into the rubber gasket inside the socket of the pipe previously laid and adjusted in the correct position.

#### **(c) Spigot and Socket Joint (Flexible)**

The rubber gasket joints shall be of confined joint. The RCC pipe

with the rubber

ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipe by means of uniformly applied pressure with the aid of a jack or similar appliance. The RCC pipes shall be of spigot and socket type and rubber rings shall be used, and the manufacturer's instructions shall be deemed to form a part of these corporation's Requirements. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

**(d) Cleaning of Pipes**

As soon as a stretch of RCC pipes has been laid complete from manhole to manhole or for a stretch as directed by the corporation's Representative, Contractor shall run through the pipes both backwards and forwards a double disc or solid or closed cylinder 75 mm less in diameter than the internal diameter of pipes. The open end of an incomplete stretch of pipe line shall be securely closed as may be directed by the corporation's Representative to prevent entry of mud or silt etc.

If as result of the removal of any obstructions the corporation's Representative considers that damages may have been caused to the pipe lines, he shall be entitled to order the stretch to be tested immediately. Should such test prove unsatisfactory, contractor shall amend the work and carry out such further tests as are required by the corporation's Representative.

It shall also be ascertained that each stretch from manhole to manhole or the stretch as directed by corporation's Representative is absolutely clear and without any obstruction by means of visual examination of the interior of the pipe line suitably enlightened by projected sunlight or otherwise.

**(e) Testing at work site**

After laying and jointing of RCC pipes is completed the pipe line shall be tested at work site as per the following corporation's Requirements and as directed by the corporation's Representative. All equipment for testing at work site shall be supplied and erected by contractor. Water for testing of pipes shall be arranged by him. Damage during testing shall be contractor's responsibility and shall be rectified by him to full satisfaction of the corporation's Representative. Water used for the test shall be removed from the pipes and not released to the excavated trenches.

After the joints have thoroughly set and have been checked by the corporation's Representative and before back filling the trenches, the entire section of the sewer \_\_\_\_\_ or storm water

drain shall be proved by the contractor to be watertight by filling in pipes with water to the level of 2.50m above the invert at the upper end in the stretch and heading the water up for a period of one hour. The apparatus used for the purpose of testing shall be approved by the corporation's Representative.

Contractor if required by the corporation's Representative shall dewater the excavated pit and keep it dry during the period of testing.

In case of pressure pipeline, the completed stretch of pipeline shall be tested for site test pressure. The site test pressure should not be less than the maximum operating pressure plus the calculated surge pressure, but in no case should it exceed the hydrostatic test pressure as specified in IS: 458.

**(f) Testing of RCC Sewers**

In the case of RCC pipe sewers testing at work site shall be as per clause 4.5.1.

(e)

**5 Laying Ductile Iron Pipes**

**In Trench - Granular Bed**

In trench pipes shall be laid on a well compacted bed of granular material or selected fill material as shown on the Drawings extending for the full width of the trench and with sufficient material at the sides to permit the pipes to be worked into the pipe bedding material and firmly supported to true line and level. Sufficient space should be left to enable the joints to be made tested and inspected but the Contractor shall ensure that at least three quarters of the pipe length is fully supported. After the pipeline has been tested and approved by the Engineer the trench shall be carefully filled and compacted in layers not exceeding 150mm to the required levels.

**5.1 Handling of pipes**

The pipes shall be transported to the laying site though trucks. During transport the pipes shall be so loaded that there is adequate clearance between outer surface of sockets, so that they will not be damaged. Timber blocks or sandbags shall be placed below & between two layer of the pipes to avoid shocks & displacement during transport on bad roads.

Unloading of the pipes shall be done either by tripod with chain block or with a crane. Pipes shall not be rolled or dropped from transport vehicles during unloading. Damaged pipes shall not be used in the pipeline until usability has been cleared by the Engineer.

**5.2 Handling of Rubber rings**

- The rubber rings shall be stored in a cool dark, dry and dust free environment. The room temperature should not be more than +20° C.

- The storage location may not be exposed to direct sunlight or radiator appliances.
- The rubber rings should not come into contact with fuels such as diesel, Kerosene oil or Lubricants.
- Rings stored free of tension, i.e. not subjected to severe deformation (hanging from a hook etc.)

### 5.3 Checking & preparing the pipe ends, mounting rubber ring

The pipe ends especially the sealing surfaces of the socket & spigot must be carefully cleaned and inspected for any damage. Minor chippings shall be corrected on site according to instructions. Seriously damaged pipes shall not be installed unless they have been explicitly cleared for use.

**Roll on rubber ring joint** - The ring must be mounted on the groove of the spigot.

**Confined rubber ring joint** - The ring is placed directly in the groove. Both ring and the inside of the socket are coated with a lubricant (vegetable soap).

The ring shall not become twisted during mounting, no matter what type of joint is used. Just as important is the uniform tension of the ring along the entire circumference of the pipe. Prior to fitting, the rings should be inspected for dirt and /or damage such as buckling, scratching, or cracking. Damaged rings shall never be used.

### 5.4 Finishing the Trench Bottom

The bottom of the trench must possess a prerequisite load-bearing capacity to ensure that no settling will occur, after pipe laying and during pipeline operating which could result in damage to the pipeline. Where the ground is a poor load-bearer, suitable measures must be taken to increase the load-bearing capacity, e.g. soil stabilization as approved by the Engineers.

In rocky or stony ground, the bottom of the trench be excavated at least 15 cm deeper and that this excavation be replaced by a stone less layer. In order to avoid uneven compression loads in the bedding, adequate stone less soil is particularly important in the area of the pipe joints.

Socket pits of 15 to 30 cm depth, depending on the pipe diameter, are to be provided for the socket of the pipe so that, during placement of the pipe, the socket does not come in contact with the bedding.

### 5.5 Laying Procedure, Pipe Jointing, Deviations

In the phase 1, the trench is prepared by leveling and cleaning the bottom and excavating the socket pit for the next pipe.

In the phase 2, Suspended from a crane, the pipe is oriented in the direction of the pipeline and so placed into the previously laid pipe that the rubber ring coincides uniformly with

the circumference of the beveled guide of the socket, in which direction pipe laying is carried out. However, it is more common because more simple - to insert the spigot of the pipe to be laid into the bell of the pipe already laid.

In the phase 3, pulling the pipe home can be accomplished by means of suitable pulling devices, when the pipe is suspended in the device to eliminate friction between the pipe and the bedding.

It may prove operationally advantageous, especially for pipes pulling/ device into the or inside of the pipeline having a diameter of 800 mm and greater, to guide the cable of the 60 % of the weight of the pipe can be assumed as a rough guide for the force required to pull the pipe home.

### 5.6 Confined Rubber Ring Type

When commencing the pulling-home procedure, the lubricant must be fully present over the rubber ring and the inside the socket. When placing the spigot into the conical inside of the socket, the pipe is first centered and the gasket then compressed by it in the seating groove. In this phase of the procedure, attention must be paid to ensure that the gasket is not squeezed out of the groove either partly or fully due to uneven pressure. Completion of location must then proceed without any appreciable increase in force.

The gap between the end surfaces of the pipes (c) must be approximately 10 mm in a straight-line joint for all types of rings in order to maintain the required freedom of movement in the joint. The gap can be set by inserting small wooden wedges or bonded rubber pads.

After completing the pipe joint, the angular arrangement of the pipes can be imposed as required. The maximum permissible values for pipe deflection are indicated by the value "d" in the table below

#### Tabulated data of angular deviation

DN	Min.c (mm)	D (cm)	R (m)
900	5	11	240
1000	5	9	265

d = Maximum permissible deviation of a pipe 5 m long pipe.

r = Minimum bend radius.

c = Minimum gap between pipes.

### 5.7 Bedding the pipe

The bedding of the pipe has a major effect on the load-bearing capacity of the pipeline and must be executed so that the support stresses are distributed as evenly as possible. Linear and point loadings are to be avoided.

The pipe bedding must, therefore, be effected in such a way that surface providing the intended support angle will be achieved with certainty using the above pipe laying procedure. This support angle is assumed to be min.  $90^\circ$ , so that the pipe rests on the bottom fourth of its circumference.

It is not permissible to initially rest the pipe on its ends only and to provide the bedding underneath over the full length at a later date, since this fails to assure an effective continuous support. The correct procedure is to bed the pipe from the outside over its full length - with the exception of the forward 25 cm - 30 cm of the socket which initially remain free - so that the necessary full-surface contact is achieved. The correct method is the previously described laying procedure. Concrete supports are necessary only under special conditions and the same shall be decided in concurrence with the Engineer.

Only compatible soil material is to be used for bedding the pipe. The maximum permissible grain size of the bedding material used as per clause 5.2.1.

After being pulled home, the pipe remains suspended from the crane and the bedding material is tamped from both sides into the gap between the bottom of the trench and the pipe, either manually or by means of tamping machines, over the full length of the pipe (with the exception of the front portion of the socket). For this purpose, the bottom of the trench is excavated approximately 5 cm deeper than the planned pipe bottom.

After releasing the pipe from the handling device, the tamped material is subjected in most cases to an initial slight settling of a few millimeters. The amount of settling depends on the nature of the soil. This must be taken into account prior to insertion of the bedding, which is further compacted and in this way improved by the weight of the pipe. The proper elevation of the pipe is checked with the aid of a boning rod or by means of leveling instrument.

## 5.8 Pressure Testing

The pressure test shall be carried out as per IS: 3114 code of practice of laying cast iron pipes IS: 1536 centrifugally cast (spun) iron pipes for water, gas and sewage and as directed by the Engineer. The length of the test section depends largely on local conditions, i.e. on the size of the pipeline, on nearby structures, on soil conditions and also on the time of the year. The individual test sections should not be less than 50 m and not be more than 1500 m in length.

In the course of preparing for pressure testing all horizontal and vertical bends

must be adequately anchored. Straight pipe sections should also be covered to such an extent that they are adequately braced against the pipe trench wall. The pipe joints remain uncovered. Terminal pressure resisting elements may not be removed until the pipeline has been completely relieved of pressure.

OR

Filling the pipeline must be carried out gradually and carefully so that any air present in the pipes is able to escape completely. It is recommended that the pipeline be filled; beginning from the low points. Between line filling and testing roughly 1 day should be interposed to permit any air still present in the pipeline to escape.

#### **Preliminary Test:**

It has the purpose of establishing and eliminating any changes in position and permeability in the test section prior to the main test. The preliminary test should be carried out for a minimum of 24 hours starting from the time where the rated pressure has been attained. The rated pressure shall be maintained by pumping if required during the last 6 hours.

#### **Main Test:**

The duration of the main test is 12 hours for pipes up to DN 700 and 18 hours for pipes having a nominal diameter greater than DN 700. During this time, the test pressure must be maintained. The test is documented as being successful when the water flow permissible during the test period has not been exceeded.

During testing, pressure, water flow and temperature are checked.

Pressure gauges are to be located wherever possible at the low point of the test section and evaluation of results is also required to be relative to the lowest point of the test section.

The pressure gauge should be capable of recording differences in pressure of up to 0.25 kg/cm<sup>2</sup>.

The water flow should be measured on an hourly basis and is to be recorded during the first 6 hours of the main test.

All results must be recorded in a test report,

#### **Final Test:**

The final test covers the complete pipeline length once the individual sections have successfully passed the main test; the final test requires that the pipeline, including all joints effected subsequent to the main test, be subject to the rated pressure for a duration of 2 hours.

### **5.9 Auxiliary Equipment for Pressure Test**



Prior to testing the pipes ends of the test sections are closed by test covers. A girder grill of section steel, on which rests a steel cover having either a spigot or a socket end as in a normal pipe. The test cover is secured to the pipe with the usual rubber gasket.

The test covers are supported by means of screw or hydraulic jacks or other suitable bracing elements. A temporary abutment in the form of a concrete wall or a section steel girder grill serves to distribute the load; this abutment must be designed to withstand the considerable horizontal forces produced during testing.

Design of this arrangement shall be submitted by contractor for approval of Engineer.

#### 5.10 Record Plan

After the Final Hydraulic Test is completed Contractor will take level on the top of every 6th pipe & prepare record plans. Locations of Air Valves, scour valves, Bends etc. shall be marked on the plan. Final payment will be released only after two copies of record plans are submitted.

#### 5.11 Performance Guarantee

The pipeline shall be maintained in all respects by the contractor free of cost for a period covering the performance guarantee.

### 6 R.C.C Manholes

6.1 RCC Manholes shall be constructed on the sewers in the positions shown in the drawings or in such position as the Engineer may direct. The work shall be done strictly in accordance with the detailed drawings except where alterations are required by the Engineer. The excavation shall not be larger than sufficient to admit of the trench being properly timbered and to facilitate plastering outside. The bottom of the excavation shall be properly leveled up, rammed and a bed of concrete laid thereon. When the concrete has sufficiently set the construction of the RCC walls shall then be proceeded with and all stoneware pipe connections through the walls shall be made and all iron work fixed in as construction proceeds. Manhole less than 2.5m from invert to sewer to ground level shall be built circular and shall have a flat top constructed as shown in the drawings, Manholes more than 2.5m from surface to invert shall be built circular and the walls corbelled as shown in the drawing. The manholes bottoms shall be properly formed with stone ware channels fixed in cement mortar. The channels shall be neatly formed to the radius of the pipe and all side connection curved and channeled to admit the sewage at an angle of 45 degree to the line of flow Manholes shall be topped with a circular cast iron frame with cover or cover of such pattern as may be ordered by the Engineer. The manhole frame and cover to be fixed at top of manhole shall be fiber reinforced cement as per IS.

Where pipes pass through walls of manholes relieving arches shall be turned

neatly over the upper half of the pipes.

## 6.2 Drop manholes:

Wherever the drop depth for sewer line exceeds 0.60m drop manholes are provided. Drop manhole shall be constructed on the sewers in the position shown in the drawings or in such position as the engineer may direct. The work shall be done strictly in accordance with the detailed specification / drawings except where alterations are required by the engineer. The Cast Iron drop pipe connection outside the manholes shall be secured by suitable M 25 concrete shall be built in as the work proceeds in accordance with the drawings.

Any variation in locating the drop manholes and subsequent revision in levels during execution if found necessary, shall be carried out by the tenderer at his cost.

## 7 Cleaning out Sewers and Manholes

During the whole of the work the contractor shall keep interior surface of sewers and manholes free from cement mortar, bricks, soil or other superfluous matter and shall handover the sewers perfectly clean and free from deposit on completion.

## 8 Water Test of Sewers

8.1 All sewers shall be tested before the filling in of the trench or other excavations. Testing shall also be done after refilling of the trench or other excavation, if considered necessary by the Engineer. The testing or retesting shall be carried out by and at the expenses of the Contractors who shall also provide the necessary appliances and water for the same. The tests will only be made from manhole to manhole after the manholes connected with the length under test have been completely finished.

8.2 The test shall be carried out in the following manner.

8.2.1 The pipes shall be carefully cleared of all earth or materials that may be lying thereon or therein and all joints shall be exposed right round so that through examinations may be made while the pipes are under test.

8.2.2 The ends of the pipe shall be closed by means of expanding stoppers and all junctions with

stoneware stoppers or cement disc fixed in cement mortar.

8.2.3 The last but one pipe at the higher end of the length shall be a junction pipe with the junction arm at the top which will permit of the filling of length with water and also allow the escape of all air in the pipes.

8.2.4 The expanding stoppers at each end of the length under test shall have a hold in the centre with a small piece of a pipe screwed therein and threaded on the projecting piece to permit of a flexible tube not less than 2m long fixed there to by a coupling. At the end of the tubing, the following shall be fixed.

- a) at lower end of length, a sock.
- b) at top end of length, a funnel of 15cm diameter.

8.2.5 The top of the runnel shall be fixed rigidly at a height of 30cm above the ground level, or such other height as may be decided by the Engineer.

8.2.6 After the above-mentioned expanding stoppers have been fixed together with flexible tubing and funnel, the length shall then be filled with water through the junction arm of the pipe provided therefore. As soon as the water has risen of the level of the filling junction arm an expanding stopper shall be fixed thereon. After a short time has been allowed for absorption, water shall be poured into the funnel until the same is filled to the top.

8.2.7 If any of joints are leaking or if during a period of ten minutes the water level in the funnel drops 25mm or more (no more water being added or sewer interfered with in any way during the period) the test shall be considered unsatisfactory. If the water does not drop more than 25mm and there is no sign of leakage at any of the joints, the test shall be continued for one hour and at the end of the hour the pipe lines including the joints shall be examined and, if no indication of sweating or leakage is found then the test will be considered satisfactory. Should the test be unsatisfactory, all such joints or pipes found to be defective shall be removed, replaced or re-laid to the satisfaction of the Engineer by the Contractor at his cost.

8.2.8 The test shall be done as many times as may be necessary until the length is found to be watertight to the satisfaction of the Engineer.

9.2.9 The water required for testing shall be clean.

