Cast Iron Pipes

Most of the old Cast Iron pipes are cast vertically but this type has been largely superceded by spun iron type manufactured upto a diameter of 900 mm. Though the cast iron pipe has the disadvatages of heavy weight, and consequent high transport costs, short length, leading to higher laying and jointing cost, low tensile strength, liability to defect of inner surface, it is widely used because of its good lasting qualities. There are many examples of cast iron mains in this country which continue to give satisfactory services even after a century of use.

Cast of Iron pipes and fittings are being made in this country for more than a century. The production capacity exceeds more than 3,00,000 tons per annum. Due to its strength and corrosion resistance , C.I pipes can be used in soils and for water of slightly aggressive character. They are well suited for pressure mains and laterals where tapping are made for house connections. It is preferable to have coating inside and outside of the pipe.

Vertically cast iron pipes shall conform to IS 1537 -1976. The pipes are manufactured by vertical casting in sand moulds. The metal used for the manufacture of this pipe is not less than grade 15. The pipes shall be stripped with all precautions necessary to aviod wrapping or shrinking defects. The pipes shall be such that they could be cut, drilled or machined.

Cat Iron flanged pipe and fittings are usually cast in the larger diameters. Smaller sizes have loose flanges screwed on the ends of double spigot spun pipe.

The method of Cast Iron pipe production used vniversally today is to form pipes by spinning or centrifugal action. Compared with vertical casting in sand muulds, the spun process results in faster production, longer pipes with vastly improved metal qualities, a smoother inner surface and reduced thickness and consequent light weight. Centrifugally cast iron pipes are available in diameters from 800mm to 900 mm inclusive and are covered with protective coatings. Pipes are supplied in 3.7 m to 5.5 meters lengths and a variety of joints is available including socket and spigot and flanged joints.

The pipes have been classified as LA,A and B according to their thicknesses. Class LA pipes have been taken as the basis for evolving the series of pipes.

- Class A allows a 10% increase in thickness over Class LA.
- Class B allows a 20% increase in thickness over Class LA.

The pipes are either spigot and socket type and available with a nominal diameters ranging from 80mm to 900mm. When the pipes are to be used for conveying potable water the inside coating shall not contain any constituent soluble in water or any ingradient which could impart any taste or odour whatsoever to the potable water after sterilisation and suitable washing of the main.
Experinments in centrifugal casting of iron pipes were started in 1914 by a French Engineer which ultimately resulted in commerical production of spun pipes. Spun pipes are about 3/4 of the weight of vertically cast pipes of the same class. The greater tensile strength of the spun iron is due to close grain allowing use of thinner wall than for that of a Cast Iron pipe of

equal length. It is possible by this porcess to increase the length of the pipe whilst a further advantage lies in the smoothness of the inner surface.

Laying and Jointing

Before laying the pipes, the detailed map of the area showing the alignment sluice valves scour valvesm, air valves and fire hydrants along with the existing intercepting sewers, telephone and electric cables and gas pipes will have to be studied. Care should be taken to avoid damage to the existing sewer, telephone and electric cables and gas pipes.

The Pipe line may be laid on the side of the street where the population is dense.Pipes are laid underground with a cover of 1 meter on the top of the pipe. Laying of cast iron pipes for water supply purposes has been generally governed by the regulations laid down by the various municipalities and corporations. These regulations are intended to ensure proper laying of pipes giving due consideration to economy and safety workers engaged in laying.

Excavation and Preparation of Trench

Excavation may be done by hand or by machine. The trench shall be so dug that pipe may be laid to the required gradient and at the required depth. Whe the pipe line is under a road way a minimum cover of 1.0m is recommended for adoption. The width of the trench at bottom shall provide not less than 200 mm clearance on both sides of the pipe. Additional width shall be provided at positions of sockets and flanges for jointing.Depths of pits at such places shall also be sufficient to permit fininshing of joints.

Laying

While unloading pipes shall not be thrown down but may be unloaded on timber skids. Pipes shall not be dragged along concrete and similar pavements to avoid damage to pipes.

Detection of Cracks in Pipes

The pipe and fittings shall be inspected for defects and be rung with a light hammer, preferably while susupended, to detect cracks. Smearing the outside with chalk dust helps the location of cracks. If doubt persists further confirmation may be obtained by pouring a little kerosene on the inside of the pipe at the suspected spot. If a crack is present the kerosene seeps through and shows on the outer surface. Any pipe found unsuitable after inspection before laying shall be rejected.

Lowering of Pipes and Fittings

All pipes, fittings, valves and hydrants shall be carefully lowered into the trench by means of derrick, ropes or other suitable tools or equipment to prevent damage to pipe materials and protective coatings and linings. Pipes over 300 mm dia shall be handled and lowered into trenches with the help of chain pulley blocks.

Cleaning of Pipes and Fittings

All lumps, blisters and excess coating material shall be removed from socket and spigot end of each pipe and outside of the spigot and inside of the spigot shall be wire-burshed and wiped clean and dry and free from Oil and grease before the pipe is laid.

After placing a length of pipe in the trench the spigot end shall be centered in the socket and the pipe forced home and aligned to gradient. The pipe shall be secured in place with approved back fill material tamped on both sides except at socket.The socket end should face the upstream while laying the pipe line on level ground; when the pipe line runs uphill the socket ends should face the up gradient. When the pipes run beneath the heavy loads suitable size of casing pipes or culverts may be provided to protect the casing of pipe. High prssure mains need anchorage at dead ends and bends as appreciable thrust occur which tend to cause draw and even "blow out" joints. Where thrust is appreciable concrete blocks should be occur. Anchorages are necessary to resist the tendency of the pipes to pull a part at bends or other points of unbalanced pressure, or when they are laid on steep gradients and the resistance of their joints to longitudinal or shear stresses is either exceeded or inadquate. They are also used to restrain or direct the expansion and contraction of rigidly joined pipes under the influence of temperature changes. Anchor or thrust blocks shall be designed in accordance with IS 5330 -1984.

Joints

Joints are classified into the following three categories depending upon their capacity for movement.

(a)Rigid Joints-
Rigid joints are those which admit no movement at all and comprise flanged, welded and turned and bored joints. Flanged joints require perfect alignment and close fittings are frequently used where a longitudinal thrust must be taken such as at the valves and meters. The gasket used between flanges of pipes shall be compressed fiber board or natural or synthetics rubber. Welded joints produce a continuous line of pipes with the advantage that interior and exterior coatings can be made properly and are not subsequently disrupted by the movement of joints.

(b) Semi Rigid Joints
Semi rigid joints is represented by the spigot and socket with caulked lead joint. A semi rigid joint allows partial movement due to vibration etc. The socketed end of the pipe should be kept against the flow of water and the spigot end of the other pipe is inserted into this socket. A twisted spun yarn is filled into this gap and it is adjusted by the yarning tool and is then caulked well. A rope is then placed at the outer end of the socket and is made tight fit by applying wet clay, leaving two holes for the escape of the entrapped air inside. The rope is taken out and molten lead is poured into the

annular space by means of a funnel. The clay is then removed and the lead is caulked with a caulking tool. Lead wool may be used in wet conditions Lead covered yarn is of great use in repair work, since the leaded yarn caulked into palce will keep back water under very low pressure while the joint is being made.

(c) Flexible Joints

Flexible joints are used where rigidity is undesirable such as with filling of granular medium and when two sections cannot be welded. They comprise mainly mechanical and rubber ring joints or tyton joints which permit some degree of deflection at each joint and are therefore able to stand vibration and movement. In rubber jointing special type of rubber gasket are used to connect cat iron pipe which are cast with a special type of spigot and being socket in the groove, the spigot end being lubricated with grease and slipped into the socket by means of a jack used on the other end. The working conditions of absence of light, presence of water and relatively cool uniform temperature are all conducive to the prservation of rubber and consequetly this type of joint is expected to last as long as the pipes. Hence, rubber jointing is to be preferred to lead jointing.

Testing of the pipe Line

After laying and jointing the pipe line be pressure tested to ensure that pipe joints are sound enough to withstand the maximum pressure likely to be developed working conditions.

Testing of Pressure Pipes

The field test pressure to be imposed should be not less than the greatest of the following.

(a) 1 1/2 times the maximum sustain operting pressure

(b) 1 1/2 times the maximum pipe linstatic pressure

(c) Sum of the maximum sustained operating pressure and the maximum surge pressure.

(d) Sum of the maximum pipe line static pressure and the maximum surge pessure, subject to a maximum equal to the works test pressure for any fittings incorporated.

The field test pressure should whereever possible be not less than 2/3rd work test pressure appropriate to the class of pipe except in the case of spun iron pipes and should be applied and maintained for atleast four hours. If the visual inspection satisfies that there is no leakage the test can be passed.Where the fields test pressure is less than 2/3 the works test pressure, the period of test should be increased to atleast 24 hours. The test 1kg/cm2/min. If the pressure measurement are not made at the lowest point of the section an allowance should be made for the difference in static head between the lowest point and the point of measurement to ensure that the maximum pressure is not exceeded at the lowest point. If a drop in pressure is not exceeded at the lowest point. If a drop in pressure occurs the quantity of water added in order to re-establish the test pressure should be carefully measured. This should not exceed 0.1 liter per mm of pipe diameter per KM of pipe line per day for each 30 meter head of pressure applied.

In case of gravity pipes maximum working pressure shall be 2/3 works test pressure.

The hydrostatic test pressure at works and at field after installation and the working

pressure for the difference classes of C.I Pipes are given in Appendix 6.4.

The allowable leakage during the maintenance stage of pipes carefully laid and well tested during construction, however should not exceed.

$$q_L = N D \sqrt{P} \quad \text{---} \quad 115 \qquad (6.11)$$

where,
q_L = Allowable leakage in cm^3/ hour
N = No of joints in the length of pipe line
D = Diameter in mm
P = the average test pressure during the leakage test in kg/cm^2.

Where any test of pipe laid indicates leakage greater than the specified as per the above formula, the defective pipe (s) or joint(s) shall be repaired/ replaced until the leakage is with in the specified allowance.

The above is applicable to spigot and socket Cast Iron pipes and A.C pressure pipes whereas twice this figure may be taken for steel and prestressed concrete pipes.

TESTING OF NON-PRESSURE CONDUITS

In case of testing of non pressure conduits the pipe line shall be subject to a test for of 2.5 meters head of water at the height point of the section under test for 10 minutes. The leakage or quantity of water to be supplied to maintain the test pressure during the period of 10 minutes shall not exceed 0.2 liters/ mm dia of pipes per kilometer length per day.