PRESTRESSED CONCRETE PIPES

While RCC pipes can cater to the needs where pressures are upto 3.0Kg/cm2 and C.I and steel pipes cater to the needs of higher pressures around 24 Kg/cm2, the P.S.C pipes cater to intermediate pressure range for which the metallic pipes are expensive while RCC pipes would not be suitable . The strength of a P.S.C pipe is achieved by helically binding high tensile steel wire under tension around a concrete core there by putting the core into compression. When the pipe is pressurised the stresses induced relieve the compressive stress but they arae not sufficent to subject the core to tenslie stresses. The prestressing wire is protected against corrosion by a surround of cementatious cover coat giving at least 25mm of cover

P.S.C competes economically with steel for pipe diameters of 600 mm and above. It is a unique combination of durability of concrete and high strength of steel combined with economy in raw materials. The P.S.C pipes are ideally suited for water supply mains where pressures in the range of 6 Kg/cm2 to 20 Kg/cm2 are encountered.

Two types of P.S.C pipes are in use today.

- Cylinder type: Consists of a concrete lined steel cylinder with steel joint rings welded to its ends warpped with a helix of highly stressed wire and coated with dense cement mortar concrete.
- Non cylinder type: Consists of a concrete core which is pre-compress both in longitudinal and circumferential directions by a highly stressed with the wire wrapping is protected by coat of cement mortar or concrete.

Physical behaviour of P.S.C pipes under internal and external load is superior to R.C.C pipes. The P.S.C pipe wall is always in a strength of compresion which is the most favourable factor for impermeability. These pipes can resist high external loads. The protective cover cement sand mortar which covers the tensions wire wrapping by its ability to create and maintain alkaline environment around the steel inhibits corrosion. P.S.C pipes are jointed with flexible rubber rings. The deflection possible during laying main is relatively small and the pipes cannot cut to size to close gaps in the pipeline. Special closure units (consisting of a short double space piece and a plain ended concrete lined steel tube with a follower-ring assembled at each end)are manufactured for this purpose, the closure unit(minimum length 1.27m) must be ordered specially to the exact length.

Specials such as bends, bevel pipes, flanged tees tapers and adapters to flange the couplings are generally fabricated as mild steel fittings lined and coated with concrete. It is worth while when designing the pipe line to make provision for as many branches as likely to be required in the future and then to install sluice valves or blank flanges on these branches. It is possible to make connections to the installed pipe line by empting, breaking out and using a special closure unit but this is a costly item.

Laying and Jointing:

PSC pressure pipes are provided with flexible joints, the joints being made by the use of rubber gasket. They have socket spigot ends to suit the rubber ring joint. The rubber gasket is intended to keep the joint water tight under all normal conditions of service including expansion, contraction, normal earth settlement. The quality of rubber used for the gasket should be water proof, flexible and should have a low permanent set Refer to IS 784- 1978, for laying of PSC pipes.

Pressure Test:

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.

$$qL = ND \sqrt{P} \quad / \quad 115 \qquad (6.11)$$

where,
qL = Allowable leakage in cm3/ 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/cm2.

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