CIRCULAR PRECAST INSPECTION CHAMBER

FOREWORD

The inspection chamber is an integral component of underground drainage systems. It serves as an access point for inspection, maintenance, and cleaning of the drainage network. Proper design, construction, and installation of inspection chambers are vital to ensure efficient functioning and longevity of the drainage system.

Inspection chambers are a necessity in drainage systems for several reasons.

1. Firstly, they provide access points for inspection, maintenance, and cleaning activities. Without inspection chambers, it would be challenging to identify and resolve issues within the drainage network, such as blockages, leaks, or structural damage.
2. Secondly, inspection chambers allow for the integration and connection of different pipes and sections of the drainage system. They ensure proper flow and connectivity, enabling the efficient movement of wastewater.
3. Thirdly, inspection chambers play a crucial role in ensuring the safety of personnel and facilitating emergency access. In case of repairs, maintenance, or rescue operations, these chambers provide secure entry points to the underground drainage network.
4. Furthermore, inspection chambers allow for testing and monitoring of the drainage system's performance, including assessing pipe conditions, flow rates, and water levels. This helps in identifying potential problems early on and maintaining the system's efficiency.

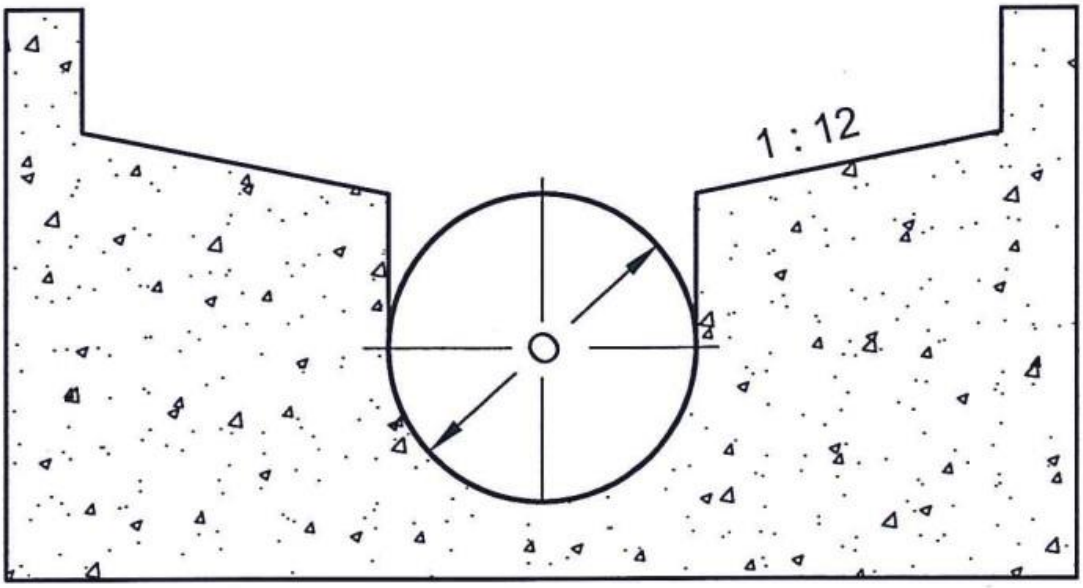
SCOPE

This report emphasizes the importance of selecting appropriate materials for the construction of inspection chambers, considering factors such as strength, durability, resistance to corrosion, and compatibility with the surrounding soil conditions.

This Report Does not cover about Manholes as they are classified already in IS 17725.
This Report Does not cover about Covers for Inspection Chamber as they are classified already in IS 12592.

TERMINOLOGY:

1. **Inspection Chamber**: structure as a manhole, but without access for personnel.
2. **Cover Slab:** Unit forming the horizontal roof of a chamber or shaft and having an access opening, immediately above which an adjusting unit or frame and cover is designed to fit.
3. **Unit:** precast concrete component of a manhole or inspection chamber structure.
4. **Benching:** Sloping surfaces having slope in transverse direction constructed on either side of channels at the base of manholes or inspection chamber for the purpose of confining the flow of sewage, avoiding the accumulation of deposits and providing a safe working platform.



2A MONOLITHICALLY CAST BASE SLAB AND BASE RISER UNIT

CLASSIFICATION:

There are several types of inspection chambers or manholes used in drainage systems, each designed to meet specific requirements. The main types of inspection chambers include:

1. Circular Inspection Chamber: This is the most common type of inspection chamber, typically constructed with circular walls and a circular cover. It is suitable for connecting pipes of similar diameter and is easy to install and maintain.
2. Rectangular Inspection Chamber: Rectangular inspection chambers are used when space constraints or specific design requirements necessitate a different shape. They provide flexibility in connecting pipes of varied sizes and allow for easy access and maintenance.
3. Square Inspection Chamber: Similar to rectangular inspection chambers, square chambers are utilized when space considerations or design preferences require a square shape. They offer the ability to connect pipes of many sizes and provide convenient access for inspection and maintenance.
4. Multiple Entry Chamber: Multiple entry chambers are designed with multiple access points to allow for convenient access from different directions. They are used in complex drainage systems or areas where multiple pipes converge.
5. Catch Basin: A catch basin, also known as a stormwater chamber, is an inspection chamber specifically designed to collect and manage surface water runoff, particularly during heavy rainfall or in urban areas. They typically have a grated cover and are used to capture debris and sediments before they enter the drainage system.

The main components of an inspection chamber include:

1. Chamber Walls: These are the vertical walls that form the inspection chamber's structure. The walls are usually made of concrete or other durable materials to withstand external loads and provide structural integrity.

2. Chamber Base: The chamber base is the floor or bottom part of the inspection chamber. It is designed to support the weight of the chamber and any equipment or personnel accessing it.
3. Chamber Cover: The chamber cover is the top part of the inspection chamber and serves as the lid or access point. It is typically made of concrete, cast iron, or other sturdy materials to prevent unauthorized entry and protect the chamber from external elements.
4. Cover Frame: The cover frame surrounds the chamber cover and provides a secure fit to prevent displacement. It also helps distribute the load applied to the cover evenly.
5. Sealing Arrangement: Sealing materials such as rubber gaskets or O-rings used in joints and connections should be selected with chemical compatibility with the anticipated environment and fluids in the drainage system. They should be resistant to degradation or chemical attack from substances commonly found in sewage systems.
6. Inlet and Outlet Pipes: The inspection chamber contains inlet and outlet pipes that connect to the main drainage network. Inlet pipes direct wastewater and stormwater into the chamber, while outlet pipes carry the flow to the next section of the drainage system.
7. Benching: Benching is a sloped or leveled surface constructed inside the chamber at the base to allow smooth flow of wastewater. It helps prevent the accumulation of debris and ensures the flow remains uninterrupted.
8. Ventilation Arrangement: Some inspection chambers may include ventilation pipes or openings to allow proper airflow, preventing the buildup of gases and foul odors.
9. Reinforcement: Reinforcement bars or mesh may be used within the chamber walls to enhance its structural strength.

These components work together to provide access for inspection, maintenance, and cleaning activities within the drainage system.

Proper design, construction, and maintenance of these components are crucial to ensure the functionality and longevity of the inspection chamber and the overall drainage system.

MATERIALS

Cement Cement complying with any of the following Indian Standards may be used:

(a) Ordinary Portland cement conforming to IS 269.
(b) Portland slag cement conforming to IS 455.
(c) Portland pozzolana cement conforming to IS 1489 (Part 1).
(d) Portland pozzolana cement, calcined clay based conforming to IS 1489 (Part 2).
(e) Super sulphated cement conforming to IS 6909
(f) Rapid hardening Portland cement conforming to IS 8041
(g) Sulphate resisting Portland cement conforming to IS 12330
(h) Hydrophobic cement conforming to IS 8043.

NOTES

i. The manufacturer shall give a certificate indicating the type and quantity of cement used in the concrete mix.
ii. Site blending with fly ash up to a maximum of 30 percent may be carried out provided its uniform blending with ordinary Portland cement is ensured.
iii. Site blending with GGBS up to a maximum of 50 percent may be carried out provided its uniform blending with ordinary Portland cement is ensured.
iv. Blending of any one out of fly ash and GGBS is permitted.

Aggregates

Fine and coarse aggregates used in the manufacture shall conform to IS 383. The coarse aggregate shall be graded aggregate of maximum 20 mm nominal size.

The maximum nominal size of coarse aggregates may be as large as possible within the limits specified but in no case greater than one-fourth of the minimum thickness of the unit.

Pulverized Fuel Ash Pulverized fuel ash, if used shall conform to IS 3812 (Part 1).

Ground Granulated Blast Furnace Slag Ground granulated blast furnace slag, if used shall conform to IS 16714.

Additives or Chemical Admixtures Additives or chemical admixtures may be added in the preparation of the concrete mix. The chemical admixture used shall conform to IS 9103.

Reinforcement Steel for reinforcement of concrete complying with any of the following standards may be used:

a. Mild steel and medium tensile steel bars conforming to IS 432 (Part 1); Hard-drawn steel wire conforming to IS 432 (Part 2);
b. High strength deformed steel bars and wires conforming to IS 1786;
c. Hot rolled medium and high tensile structural steel conforming to IS 2062.

GENERAL DETAILS of INSPECTION CHAMBER

Base Section: The base section of an inspection chamber typically has a height ranging from 150 mm (6 inches) to 300 mm (12 inches). This height provides enough space for wastewater flow and installation of other chamber components.

Riser Sections: Riser sections are added on top of the base section to increase the overall height of the inspection chamber. The height of each riser section can vary, typically ranging from 150 mm (6 inches) to 300 mm (12 inches). Multiple riser sections can be added to achieve the desired height based on the specific project requirements and the depth of the drainage system.

Cover Slab: The cover slab is the topmost component of the inspection chamber and provides access to the chamber for maintenance and inspection purposes. The height of the cover slab is between 50 mm (2 inches) and 100 mm (4 inches). This height ensures that the cover slab is flush with the surrounding ground or pavement when installed. Bearing of cover shall be 50mm all around and rest over the wall.

Frame: The frame surrounds the opening of the inspection chamber and provides support for the cover slab. It is usually made of cast iron or another sturdy material. The frame is securely fixed to the surrounding structure to prevent movement or displacement of the cover slab.

It is important to note that these are general height ranges, and the actual dimensions may vary based on project specifications, local building codes, and specific design considerations.

For the purpose of this standard, Circular Precast Inspection Chambers shall be classified as under:-

Diameter	Inner Height	Base Thickness	External Height	Wall thickness
300	450	100	550	100
450	600	100	700	100
450	900	100	1000	100

Reinforcement Details of Inspection Chambers:

					Reinforcement Detail

Sl No	Chamber Component	Internal Diameter	Thickness	Height	Longitudinal		Circumferential		Remarks
		mm	mm	mm	Dia mm	Pitch mm	Dia mm	Pitch mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Option-1 (Wall thickness 100mm)								
1	Base Slab								The reinforcement shall be placed in mesh/grid pattern.
		300	100	-	8	200	8	200	
		450	100	-	8	200	8	200	
		450	100	-	8	200	8	200	
2	Side wall								Single layer reinforcement at center, Detailing around pipe opening shall be followed as per SP34, Cl.no-9.6.
		300	100	300	8	200	8	200	
		450	100	600	8	200	8	200	
		450	100	900	8	200	8	200	
	Option-2 (Wall thickness 75mm)								
1	Base Slab								The reinforcement shall be placed in mesh/grid pattern.
		300	100	-	8	200	8	200	
		450	100	-	8	200	8	200	
		450	100	-	8	200	8	200	
2	Side wall								Single layer reinforcement at center, Detailing around pipe opening shall be followed as per SP34, Cl.no-9.6.
		300	75	300	8	200	8	200	
		450	75	600	8	200	8	200	
		450	75	900	8	200	8	200	

Notes for refence:

1. Base slab and side wall shall be casted monolithically.
2. Co-efficient of Active Earth pressure at rest (Ka) = 1
3. Density of Soil considered is 1.8 T/m^3
4. Density of Sewage considered is 1.05 T/ m^3
5. Net SBC of soil considered is 8.0 T/ m^3
6. Water table is considered at ground level for design purpose
7. Vehicular load considered is Class AA loading
8. Design is done by limit state method with a design crack width of 0.2mm.
9. Development length and lap length shall be as per IS456

TOLERANCES

Dimensions. The actual dimensions shall not vary from the manufacturer's stated dimensions by more than the permissible deviations given in Table 3.

Height	$\pm$10 mm
Internal Diameter	$\pm$5 mm
Thickness	+7, -3.5 mm

Twist. For circular units or components, the squareness of the ends of the unit or component in relation to the axis of the cylinder shall be within a limit of 6 mm.

Out of squareness. No two diagonals of a unit or component, measured in the same plane, shall differ from each other by more than the following amounts:

- diagonals up to 1000 mm: 8 mm;
- diagonals above 1000 mm: 10 mm

TYPES OF JOINTS

Joints shall be either ogee (rebated) or tongued and grooved. The minimum depths shall be 6 mm for tongued and grooved joints and 10 mm for ogee joints.

The joints between components shall be so designed that they may be sealed by cement mortar or a suitable proprietary jointing compound.

PHYSICAL REQUIREMENTS

Dimensions

The inspection chamber components' dimensions shall be in accordance with Table 2 subject to the tolerances mentioned in Table 3.

Compressive Strength

The concrete used in manufacture of Precast Concrete Manhole units shall not be less than M 35 Grade when tested in accordance with IS 516 (Part 1/Sec 1), and the minimum cementitious content shall be 360 kg/m^3.

Water Absorption - Inspection chamber components, when tested for water absorption in accordance with IS 3597, shall not be more than 5 percent, when immersed in water for 24 hours. The size of the sample used for testing shall have square area of 100 cm2 ± 10 percent with full thickness.

Strength Requirement

1. For inspection chambers with a diameter up to 600 mm (24 inches), a minimum compressive strength of 25 MPa (megapascals) is typically recommended.
2. For inspection chambers with a diameter ranging from 600 mm to 1200 mm (24 to 48 inches), a minimum compressive strength of 30 MPa is often specified.

It is important to note that these are general guidelines and the actual compressive strength requirements may vary based on project specifications, local building codes, and specific design considerations. Additionally, larger inspection

chambers or chambers subject to heavy loads may require higher compressive strengths.

Workmanship and Finish

The inspection Chamber shall be free from local dents or bulges greater than 3.0 mm in depth and extending over a length in any direction greater than twice the barrel wall thickness.

Hydrostatic Pressure Test

Every Component of the inspection unit shall be tested for Hydrostatic pressure of 0.07 N/mm2 as per Annex F and no leakage shall be observed in the stipulated time.

CHEMICAL REQUIREMENTS

Water to Cement Ratio - The ratio of water to cement plus any pozzolanic or latent hydraulic addition in the fully compacted state shall not be greater than 0.45.

Chloride Content - Requirement for chloride content the calculated chloride ion content of the concrete shall not exceed the relevant value given in Table 4.

Table 4

Type Of Concrete	Cl^- by Mass of Cement
Unreinforced	1.0%
Steel Fiber	0.4%
Reinforced	0.4%

SAMPLING AND CRITERIA FOR CONFORMITY

Scale of Sampling

Lot The Inspection Chamber component of same size and belonging to the same mix of concrete produced in one day shall be grouped together to constitute a lot.

These Inspection Chamber Components shall be selected at random. To ensure the randomness of selection, procedures given in IS 4905/ISO 24153 may be followed. The number of Inspection chamber component to be selected from the lot shall depends upon the lot size and shall be in accordance with Table 5.

Number of Tests and Criteria for Conformity

Each Inspection Chamber component selected in accordance with col 2 and col 3 of Table 5 shall be subjected to tests for dimensional requirements. Any Inspection Chamber component failing to meet one or more of the requirements shall be considered defective. If the number of Inspection Chamber components found defective is less than or equal to the corresponding acceptance number given in col 4, the lot shall be considered as conforming to the dimensional requirements.

The lot conforming to the dimensional requirement shall then be subjected to a strength requirement test. For this purpose, the number of Inspection Chamber components to be selected shall be in accordance with col 2 and col 5 of Table 5. The lot shall be considered as conforming to these requirements if no defect is found.

ANNEX A

REFRENCES

IS 17725 - Precast Concrete Circular Manhole — Specification.

EN 1917 - Concrete manholes and inspection chambers, unreinforced, steel fibre and reinforced.

BS 5911-2 - Precast concrete pipes and ancillary concrete products — Part 2: Specification for inspection chambers.

Annex B
Test method for water absorption

B.1 Principle

The purpose of this test is to evaluate the water absorption of hardened concrete by immersion, which is defined as
the difference between the mass of a given sample immersed in water and the mass of the same sample when
dried, expressed in terms of the mass of the dry sample.

B.2 Sample

The sample shall have a mass of not less than 2 kg and not more than 4 kg when cut from a hardened unit.

B.3 Apparatus

The apparatus shall consist of a ventilated oven controlled at 105 ^{0}C ± 5 ^{0}C and scales sensitive to 0,05 % of the
sample's mass.

B.4 Procedure

B.4.1 Determination of mass of immersed sample m_1

The sample shall be brought to a temperature of 20 °C ± 3 °C, then immersed in tap water at the same temperature
until a constant mass has been reached. This shall be achieved in stages by successively immersing the sample at
intervals of one hour to approximately 1/3 of the height, approximately 2/3 of the height and the total height, with a
final water level of 20 mm above the top surface of the sample.
The constant mass m_1 shall be assumed to have been achieved when two weighings, 24 hours ± 1 hour apart,
result in a difference in mass smaller than 0,1 % of the mean value of the mass of the immersed sample.
The surface of the sample shall be dried before each weighing, for example by a sponge (wet and squeezed) so as to remove all surface water.

B.4.2 Determination of mass of dried sample m_2

The sample shall be dried to constant mass in a ventilated oven at a temperature of 105 °C ± 5 °C.

NOTE It is recommended to check that the capacity and ventilation of the oven are sufficient to dry the number of samples

placed in it. Wet samples should not be placed in the oven before earlier samples have been completely dried.

After cooling the sample to 20 °C ± 3 °C the mass m_2 shall be determined. The state of constant mass m_2 shall be
assumed to have been reached when two weighings at least 24 hours apart result in a difference smaller than
0,1 % of the mean value of the mass of the dry sample.

B.5 Expression of results

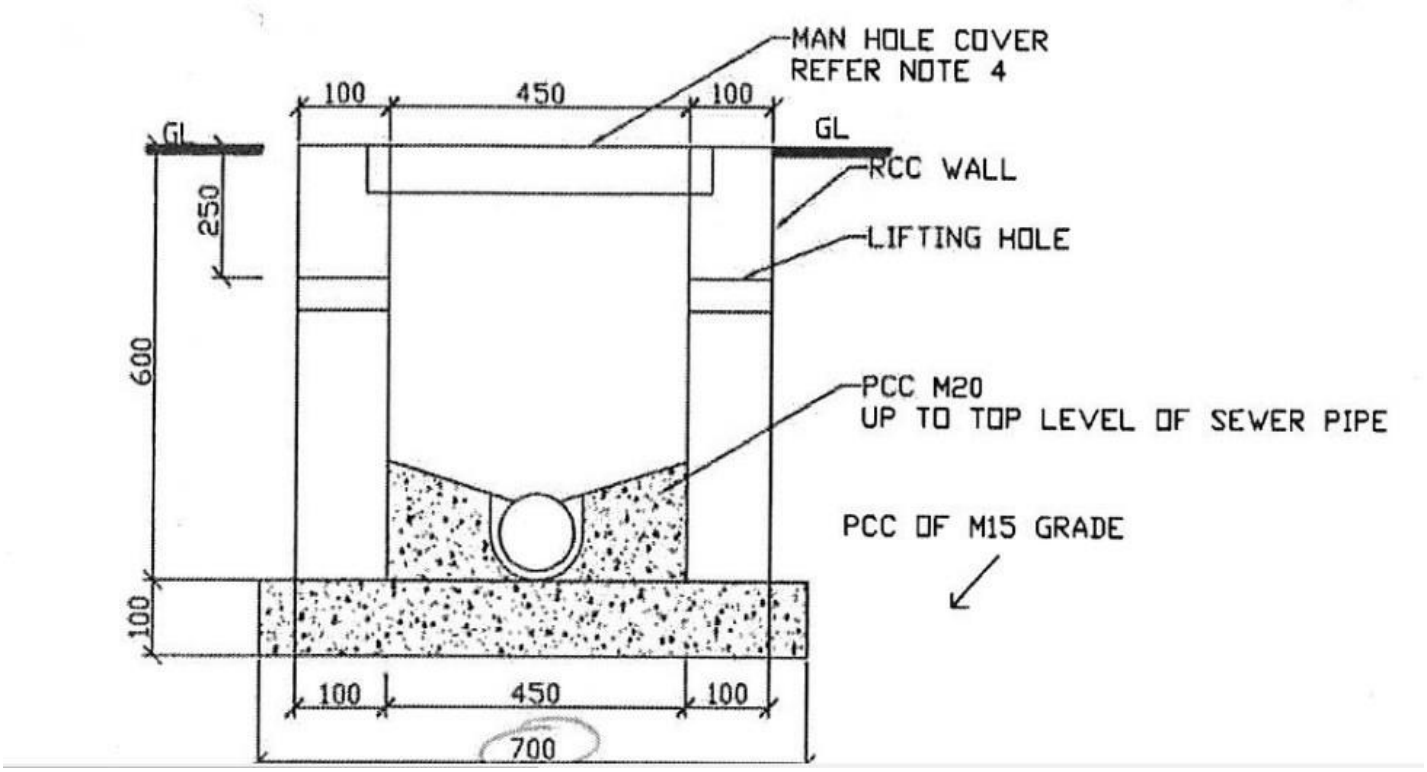
The absorption of water by immersion A_w expressed in per cent to two decimal places, is obtained from the
following expression and recorded.

$$A_w = 100 \times (m_1 - m_2)/m_2$$

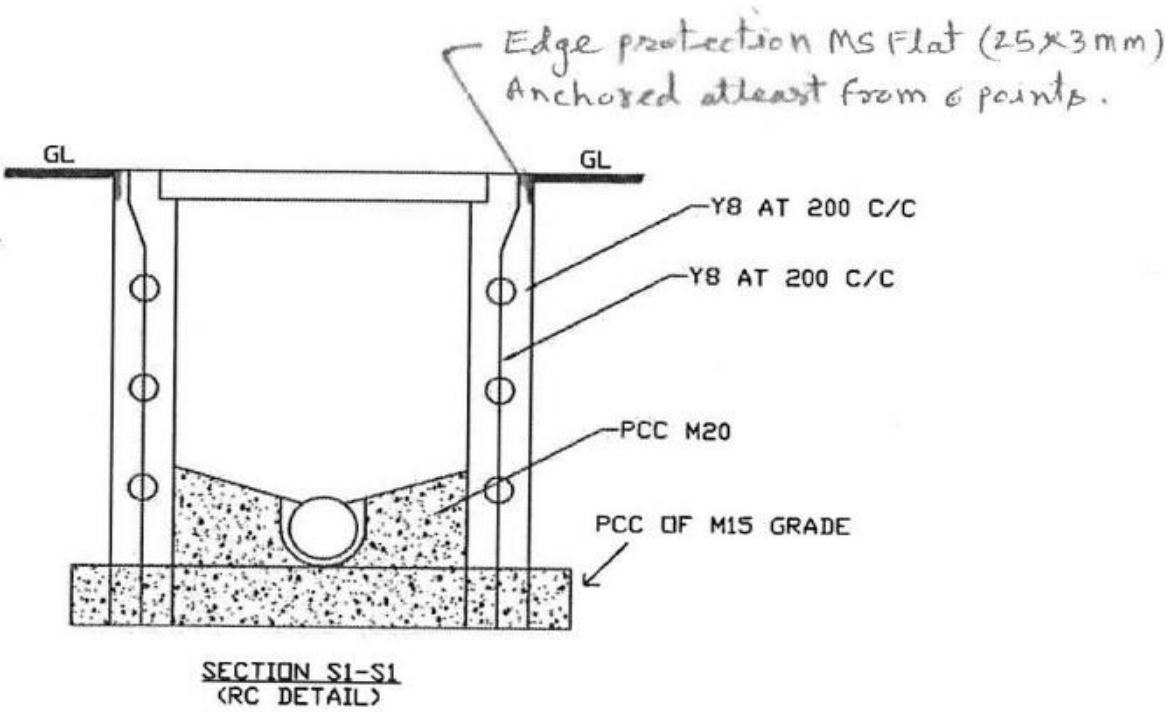
Where
m_1 is the constant mass of immersed sample;
m_2 is the constant mass of dry sample.

ANNEX B

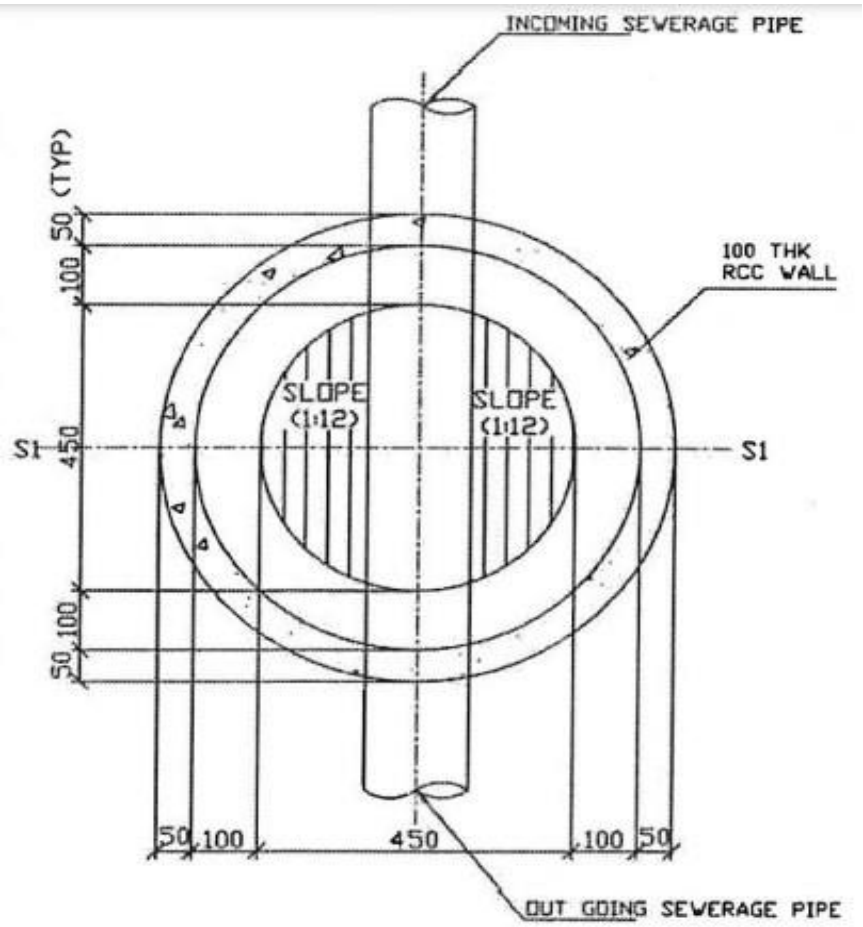
TYPICAL DIMENSIONS AND ARRANGEMENT OF REINFORCEMENT OF PRECAST CONCRETE CIRCULAR MANHOLE



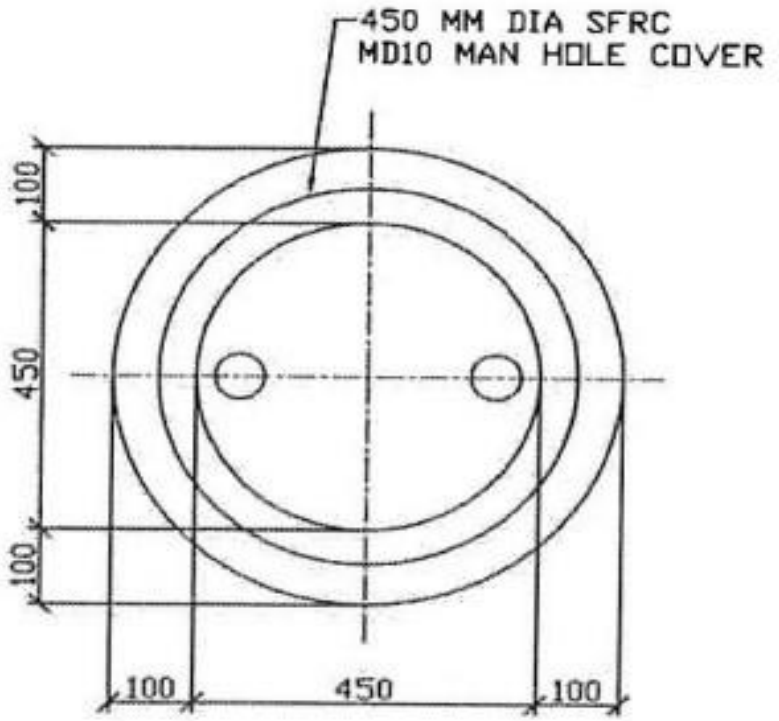
General Dimensions of IC



Reinforcement Details of IC



PLAN AT BOTTOM LEVEL



PLAN AT TOP LEVEL

ANNEX C

COMPRESSIVE STRENGTH TEST

RISER UNIT AND ADJUSTING UNIT -

Test Setup: Riser unit shall be positioned in the testing machine as shown in Fig and be supported and loaded through elastomeric bearers placed parallel to the unit's longitudinal axis. The bearers may be continuous. The centroid of the load shall be at a distance of h/2 from the outside face of the socket and the load shall be distributed uniformly as shown in Fig. For circular units the load shall be applied through one top bearer. The bottom bearer shall be formed as a V-shaped support with an included angle, p of 150° ± 3° as shown in Fig. The elastomeric material for bearers shall have a mean hardness of (50 ± 5) IRHD with a thickness of (20 ± 5) mm.

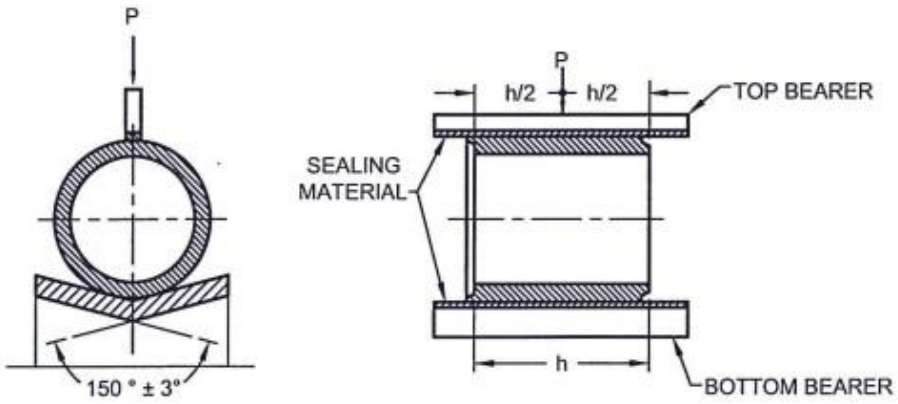


FIG. 16 ARRANGEMENT FOR TEST FOR STRENGTH REQUIREMENT OF RISER UNIT AND ADJUSTING UNIT

Procedure: During application of the test load, it shall be increased at a rate between 20 kN/m per min and 25 kN/m per min. The reinforced concrete unit shall be able to withstand the specified load for 3 min without showing any crack.

ANNEX D

HYDROSTATIC PRESSURE TEST

D-1 **TEST SPECIMEN** Every component of the Inspection Chamber unit for determination of leakage under internal hydrostatic pressure shall be sound. If the specimen is tested after storing in adverse weather condition, presoaking shall be permitted. For presoaking, of the Chamber unit shall be submerged in water or sprayed with water for a period not less than 6 h prior to testing and excess water removed.

D-2 **PROCEDURE**

D-2.1 The test specimen be supported in such a way that the longitudinal axis is horizontal and the exterior surface excepting the supports can be examined readily.

D-2.2 The equipment for making the test shall be such that the specimen under test can be filled with water to the exclusion of air and subjected to the required hydrostatic pressure. Apply hydrostatic pressure to the component of the chamber unit.

D-2.3 The specimen shall be filled with water and the air expelled. Pressure shall be applied at a gradual rate until the specified test pressure is reached, or beads of water on the component of chamber unit are seen, whichever occurs first.

D-2.4 Pressure shall be maintained for 1 min plus 30 s for each 10 mm of wall thickness, or for twice that entire period if the application of pressure resulted in the formation of beads of water on the component of the chamber unit.

D-2.5 At the end of the holding period, the pressure shall be released immediately if the test pressure has been maintained. If the beads of the water have not grown or run, the pressure shall be increased slowly until the test pressure is reached or the beads of water grow or run (whichever occurs first).

D-2.6 If the test pressure has been reached without the beads of water growing or running, the test pressure shall be maintained constant for 1 min plus 10 s for each 10 mm of wall thickness. At the end of the holding period the pressure shall be released immediately. After releasing the pressure, the component of the chamber unit used for testing shall be drained completely.