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Indian Standard

CODE OF PRACTICE FOR
LAYING OF ASBESTOS CEMENT
PRESSURE PIPES

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

CODE OF PRACTICE FOR LAYING OF ASBESTOS CEMENT PRESSURE PIPES

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Indian Standard

CODE OF PRACTICE FOR LAYING OF ASBESTOS CEMENT PRESSURE PIPES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 February 1972, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Asbestos cement pressure pipes have been in use in this country over the past several years. The quality requirements for asbestos cement pressure pipes have been covered by IS:1592-1970*. Asbestos cement pressure pipes have to be properly handled, laid and backfilled if they have to fulfil the desired design and service requirements. Even the best quality pipe manufactured in accordance with the standard specification may be damaged by improper handling. With the increasing use of asbestos cement pressure pipes, it has, therefore, become necessary to lay down certain guidelines and unified practice for handling, laying and jointing of asbestos cement pressure pipes and testing the pipeline. This code is intended to provide general guidelines and specify a uniform practice for laying of asbestos cement pressure pipes so as to obtain the optimum results.

0.3 Guidance regarding selection of asbestos cement pressure pipes for different types of applications underground under different bedding conditions may be obtained from 'Indian Standard guide for selection of asbestos cement pipes subject to external loads with or without internal pressure' (*under preparation*) (*see Note*) which forms a necessary adjunct to this code.

NOTE—Until the standard under preparation is published, the matter shall be subject to agreement between the concerned parties.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Specification for asbestos cement pressure pipes (*first revision*).

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the method of handling, laying, jointing and field testing of asbestos cement pressure pipes.

2. MATERIALS

2.1 Asbestos Cement Pressure Pipes — Asbestos cement pressure pipes shall conform to IS: 1592-1970*.

2.2 Asbestos Cement Couplings — Asbestos cement couplings shall conform to the material requirements of **8.2** of IS: 1592-1970*.

2.3 Cast Iron Detachable Joints — Cast iron detachable joints shall conform to the material and strength requirements of IS: 5531-1969†.

2.4 Rubber Rings — Rubber rings used in jointing shall comply with the requirements of IS: 5382-1969‡ and **8.3** of IS: 1592-1970*.

3. STORAGE OF PIPES AND ACCESSORIES AT SITE OF WORKS

3.1 To avoid any costly manipulation of handling, the pipes shall be unloaded where they are required, if the trenches are ready to receive them.

3.1.1 Unloading (Except Where Mechanical Handling Facilities are Available) — Pipes weighing up to 60 kg shall be handled by two persons by hand-passing. Heavier pipes shall be unloaded from the lorry or wagon by holding them in loops, formed with ropes and sliding over planks set not steeper than 45°. The planks shall be sufficiently rigid and two ropes shall always be used to roll the pipes down the planks. The ropes should be tied on the side opposite the unloading. Only one pipe shall be unloaded at a time.

3.1.2 Under no circumstances shall the pipes be thrown down from the carriers or be dragged or rolled along hard surfaces.

3.1.3 The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for reclamation. Any pipe which shows sufficient damage to preclude it from being used shall be discarded.

*Specification for asbestos cement pressure pipes (*first revision*).

†Specification for cast iron specials for use with asbestos cement pressure pipes.

‡Specification for rubber sealing rings for gas mains, water mains and sewers.

3.2 Storing

3.2.1 Each stack shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible.

3.2.2 Storage shall be done on firm level and clean ground and wedges shall be provided at the bottom layer to keep the stack stable.

3.2.3 The stack shall be in pyramid shape or the pipes laid lengthwise and crosswise in alternate layers. The pyramid stack is advisable in smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5 m.

3.2.4 Cast iron detachable joints and fittings shall be stacked under cover and separated from the asbestos cement pipes and fittings.

3.2.5 Rubber rings shall be kept clean, away from grease, oil, heat and light.

3.3 Cutting of Pipes

3.3.1 Cutting of pipes may be necessary when pipes are to be laid in lengths shorter than the lengths supplied such as while salvaging the pipes with damaged ends or while replacing cast iron accessories like tees, bends, etc, at fixed positions in the pipeline. In such cases it may also be necessary to reduce the cut ends by rasps to suit the inner diameter of central collar. The cutting of pipes shall be done as in 3.3.2.

3.3.2 A line shall be marked around the pipe with a chalk piece at the point where the cut is to be made. The line shall be so marked that the cut is truly at right angle to the longitudinal axis of the pipe. The pipe shall be rigidly held on two parallel rafters nailed to cross beams, taking care that the portion to be cut does not overhang and the cut mark is between the two rafters. The pipe shall be neatly cut at the chalk mark with carpenter's saw or hack-saw having a long blade, by slowly rotating the pipe around its longitudinal axis so as to have the uncut portion on top for cutting. Cutting of the pipe at the overhang should as far as possible be avoided, it is dangerous as an overhanging end is liable to tear off due to its weight before the cut is completed (see Fig. 1).

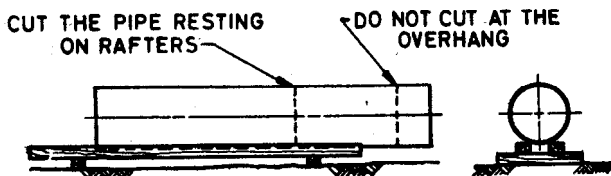


FIG. 1 CUTTING OF ASBESTOS CEMENT PRESSURE PIPE

4. TRENCHES

4.1 The trenches shall be so dug that the pipes may be laid to the required alignment and at required depth.

4.1.1 Width—The width of the trench above pipe level shall be as small as possible but shall provide sufficient space necessary for jointing the pipes. The trench width shall be such as to provide a space of 300 mm on either side of the pipe.

4.1.2 Depth—The pipes shall have a minimum soil cover of 750 mm when laid under foot paths and side walks, 900 mm when laid under roads with light traffic or under cultivated soils and 1.25 m when laid under roads with heavy traffic. When the soil has a poor bearing capacity and is subject to heavy traffic, the pipes shall be laid on a concrete cradle. An extra trench depth of 100 mm shall be provided for each jointing pit.

NOTE 1 — Cover shall be measured from top of pipe to the surface of the ground.

NOTE 2 — For calculation of external loads and different bedding conditions etc, the requirements of 'Indian Standard guide for selection of asbestos cement pipes subject to external loads with or without internal pressure' (*under preparation*) (*see Note 3*), shall be satisfied.

NOTE 3 — Until the standard under preparation is published, the matter shall be subject to agreement between the concerned parties.

4.2 Excavation

4.2.1 The excavation of the trenches shall be so carried out that the digging of the trenches does not get far ahead of the laying operations. By doing this, the risk of falling of sides and flooding of trenches shall be avoided.

4.2.2 The walls of the trench shall be cut generally to a slope of $\frac{1}{4}:1$ or $\frac{1}{3}:1$ depending on the nature of the soil.

4.2.3 If the trench bottom is extremely hard or rocky or loose stony soil, the trench should be excavated at least 150 mm below the trench grade. Rocks, stone or other hard substances from the bottom of the trench shall be removed and the trench brought back to the required grade by filling with selected fine earth or sand (or fine murum if fine soil or sand is not available locally) and compacted so as to provide a smooth bedding for the pipe. Where excavation requires blasting operation it shall be ensured that no pipes have been stacked in the vicinity or completed pipeline in the vicinity have already been covered before starting of blasting operations; this is necessary to prevent damage to the exposed pipes in the vicinity by falling stones as a result of blasting.

4.2.4 Roots of trees within a distance of about 0.5 m from the side of the pipeline shall be removed or killed.

4.2.5 The excavated soil shall preferably be deposited on one side of the trench, so that it leaves a bench of about 0.5 m facilitating the workmen to move along the trench without any difficulty.

4.2.6 In places of heavy or light traffic the excavated soil shall be on the traffic side for the protection of the traffic from accidents. The other side of the trench may be used for placing pipes and other accessories.

4.2.6.1 To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways.

The relevant Indian Standards and the rules and regulations of local authorities in regard to safety provisions shall be observed.

4.2.7 During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. This is necessary to prevent any damage to the completed pipeline due to the fall of stones during re-filling of the trench.

4.2.8 Where loose earth is encountered during excavation and where the trench is very deep, the side walls shall be properly shored for the safety of workmen.

4.2.9 The bed of the trench shall be excavated to the pipe grades so that uniform support is assured for the full length of the pipe. (see Fig. 2).

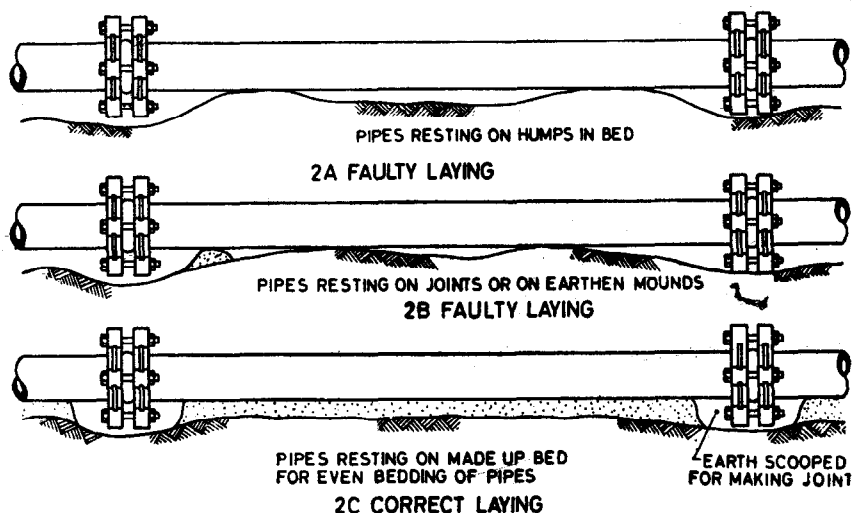


FIG. 2 LAYING OF ASBESTOS CEMENT PRESSURE PIPES IN TRENCHES

5. LAYING

5.1 The pipes shall be lowered into the trenches either by hand passing or by means of two ropes. One end of each rope shall be tied to a wooden or steel peg driven into the ground and the other end shall be held by men which when slowly released will lower the pipe into the trench.

5.2 The pipes shall rest continuously on the bottom of the trench. The pipes shall not rest on lumps of earth or on the joints. Four-metre long wooden templates may be used to check the level of the bed. Clearance of approximately 100 mm in depth and width equal to length of the collar plus 30 mm on both sides shall be provided at the joint which shall be refilled from sides after the joint is made.

5.3 In unstable soils, such as soft soils and dry lumpy soils it shall be checked whether the soils can support the pipelines and if required suitable special foundation shall be provided.

5.4 Some clayey soils (for example black cotton soil) are drastically affected by extremes of saturation and dryness. In changing from totally saturated to a completely dry condition, these soils are subjected to extraordinary shrinkage. This shrinkage is usually seen in the form of wide and deep cracks in the earth surface and may result in damages to underground structures, including pipe materials. The clay forms a tight gripping bond with the pipe, subjecting it to excessive stresses as the clay shrinks. In such areas, the engineer should establish whether the condition exists to a degree justifying special precautions. It is recommended that in such cases an envelope of a minimum 100 mm of tamped sand shall be made around the pipeline to avoid any bonding.

5.5 In places where rock is encountered, cushion of fine earth or sand shall be provided for a depth of 150 mm by excavating extra depth of the trench, if necessary, and the pipes laid over the cushion. Where the gradient of the bed slopes is more than 30° it may be necessary to anchor a few pipes against their sliding downwards (see Fig. 3).

6. JOINTING

6.1 Before commencing jointing, the pipes shall be cleaned; the joints and the ends of the pipe shall be cleaned, preferably with a hard wire brush to remove loose particles.

6.2 Cast Iron Detachable Joints

6.2.1 The joint shall consist of a central collar, two rubber rings, two flanges of cast iron and the required number of bolts and nuts.

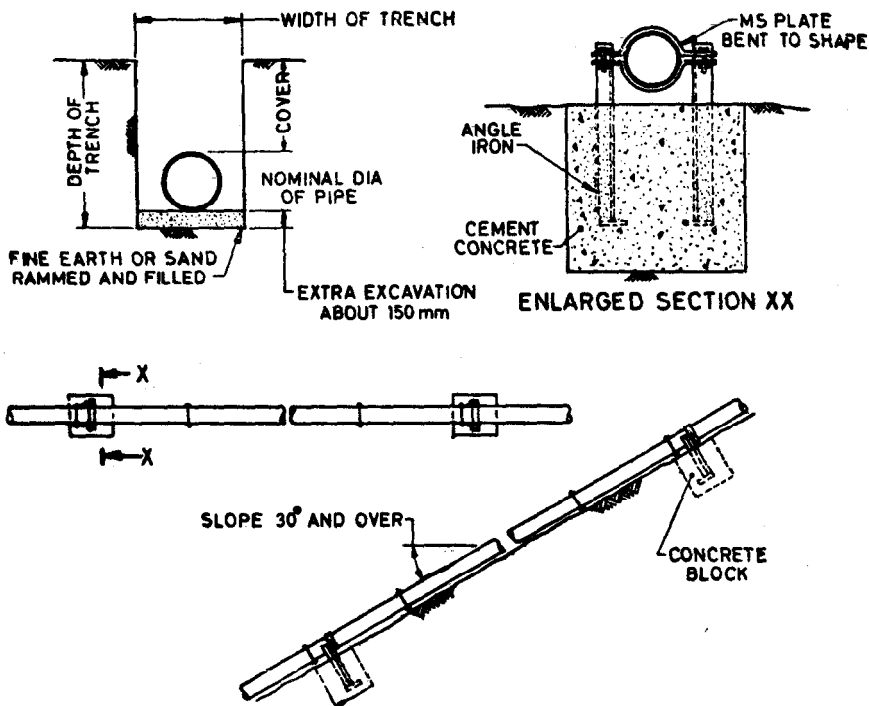


FIG. 3 LAYING OF ASBESTOS CEMENT PRESSURE PIPES IN ROCKS

6.2.2 One flange and rubber ring shall be placed on end of the pipe already laid, and the other flange, rings and central collar shall be slipped on to the pipe to be assembled (*see* Fig. 4).

6.2.3 The rubber ring shall be kept positioned at half the collar width less 2.5 mm from the end of the pipe already laid. A site gauge as shown in Fig. 4 may be used for convenience.

6.2.4 The other pipe shall be brought nearer leaving a gap of 5 mm between the two pipe ends. This gap will facilitate manouvering of deflection at joints after assembly and will take care of an expansion in the pipeline.

6.2.5 The collar shall be slid to sit square around the rubber ring on pipe 1, and then the rubber ring shall be rolled on pipe 2 to sit around the collar.

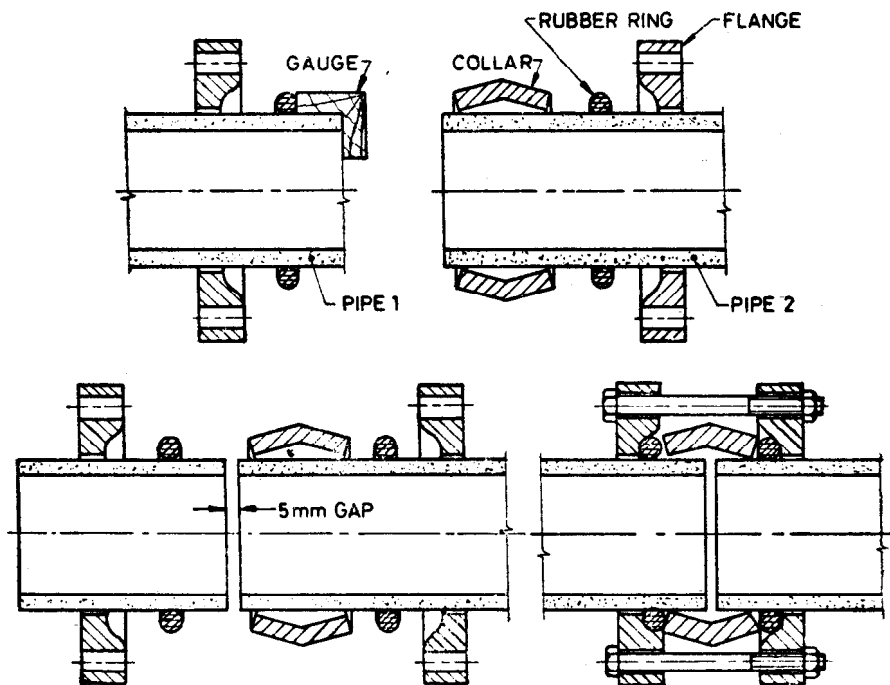


FIG. 4 CAST IRON DETACHABLE JOINT

6.2.6 The flanges shall be moved on both ends to enclose rubber rings. The fastening bolts shall be inserted through the holes of the flanges and the bolts shall be tightened alternately and evenly for proper sitting of the joint.

6.3 Asbestos Cement Coupling

6.3.1 This joint shall consist of three rubber rings and an asbestos cement coupling machined on the inside.

6.3.2 The rubber rings shall be sealed in their respective grooves, after cleaning the coupling and rubber rings. The machined ends of the pipe and end rings in the coupling shall be suitably lubricated with a soft soap solution or other lubricant which is not detrimental to rubber rings or drinking water. Then, the assembly shall be made by pushing with a crow-bar (see Fig. 5) or using a pipe puller.

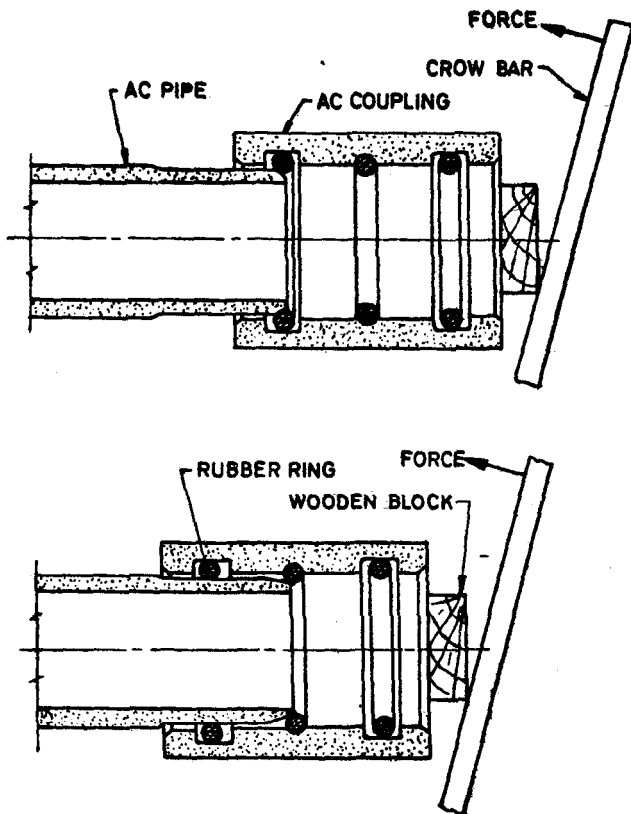


FIG. 5 ASBESTOS CEMENT COUPLING JOINT

6.4 The joints shall be made by keeping the pipes in one line. Any permissible deflection at the joint shall be made after completion of the joint only. The amount of deflection and the radius of curvature by successive deflection shall be as given in Table 1 (see Fig. 6).

6.5 Wherever necessary, change over from cast iron pipe to asbestos cement pipes and *vice versa* shall be done with the help of suitable adaptors (see Fig. 7).

7. THRUST BLOCKS

7.1 Thrust blocks are required to transfer the resulting hydraulic thrust from the fitting or pipe on to a larger load bearing soil section.

TABLE 1 DEFLECTION AND RADIUS OF CURVATURE

(Clause 6.4, and Fig. 6)

ANGLE OF DEFLECTION	DISPLACEMENT D IN mm FOR PIPE LENGTH				RADIUS R OF CURVATURE FOR PIPE LENGTH			
	1 m	2 m	3 m	4 m	1 m	2 m	3 m	4 m
1°	20	35	50	70	60	120	180	240
2°	35	70	100	135	30	60	90	120
3°	50	100	150	200	20	40	60	80
4°	70	135	200	270	15	30	45	60
5°	85	170	250	335	12	24	36	48

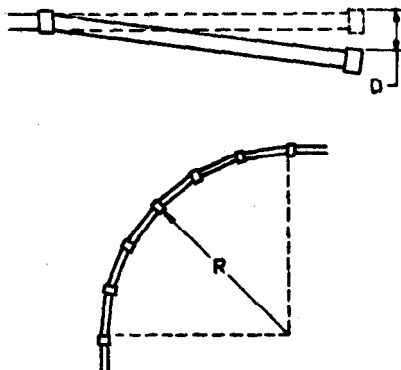


FIG. 6 DEFLECTION AND RADIUS OF CURVATURE BY SUCCESSIVE DEFLECTION OF PIPES

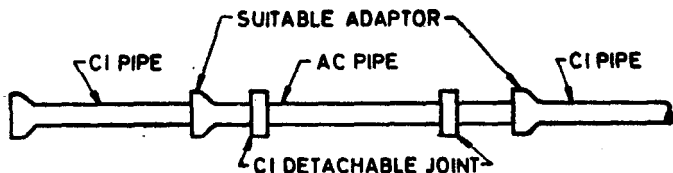


FIG. 7 LINE DIAGRAM SHOWING CHANGE OVER FROM CAST IRON TO ASBESTOS CEMENT PRESSURE PIPE

7.2 Thrust blocks shall be installed wherever there is a change in the direction of the pipeline, size of the pipeline or the pressure-line diagram, or when the pipeline ends at a dead end. If necessary, thrust blocks may be constructed at valves also.

7.3 Thrust blocks shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component shell when laid on slopes and the type of soil. The location of thrust blocks for various types of fittings is given in Fig. 8.

7.4 When a fitting is used to make a vertical bend, it shall be anchored to a concrete thrust block designed to have enough weight to resist the upward and outward thrust. Similarly at joints, deflected in vertical plane, it shall be ensured that the weight of the pipe, the water in the pipe and the weight of the soil over the pipe provide resistance to upward movement. If it is not enough, ballast or concrete shall be placed around the pipe in sufficient weight to counteract the thrust.

7.5 When the line is under pressure there is an outward thrust at each coupling. Good soil, properly tamped is usually sufficient to hold pipe from side movement. However, if soft soil conditions are encountered, it may be necessary to provide side thrust blocks or other means of anchoring. In such cases only the pipe on each side of the deflected coupling shall be anchored without restricting the coupling.

7.6 Pipes on slopes need be anchored only when there is a possibility of the backfill around the pipe sloping down the hill and carrying the pipe with it. Generally for slopes up to 30° good well drained soil, carefully tamped in layers of 100 mm under and over the pipe, right up to the top of the trench will not require anchoring.

7.6.1 For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

8. SPECIAL CAST IRON FITTINGS AND ACCESSORIES

8.1 Normally when pipeline is laid, a certain number of cast iron fittings such as tees, bends, reducers, etc, and special fittings such as air or sluice valves are required.

8.2 Laying of Fittings — All cast iron fittings shall be plain ended to suit the outside diameter of asbestos cement pressure pipes and to the class and diameter of pipe manufactured. When using such cast iron fittings, they are jointed by cast iron detachable joints only. For any cast iron specials having flanges, they are jointed in the pipeline with cast iron flange adaptors having one end flanged and the other plain ended.

8.3 Anchorages — It should particularly be noted that the cast iron joints do not hold pipe ends within it firmly. During working or test pressure, there will be the tendency for the pipe ends or special ends to slip out of the joint, more so with the case of blank end cap used for closure of

pipeline and all degree bends and tees. In order to keep them firmly in the pipeline, anchoring of these specials are necessary against the direction of thrust.

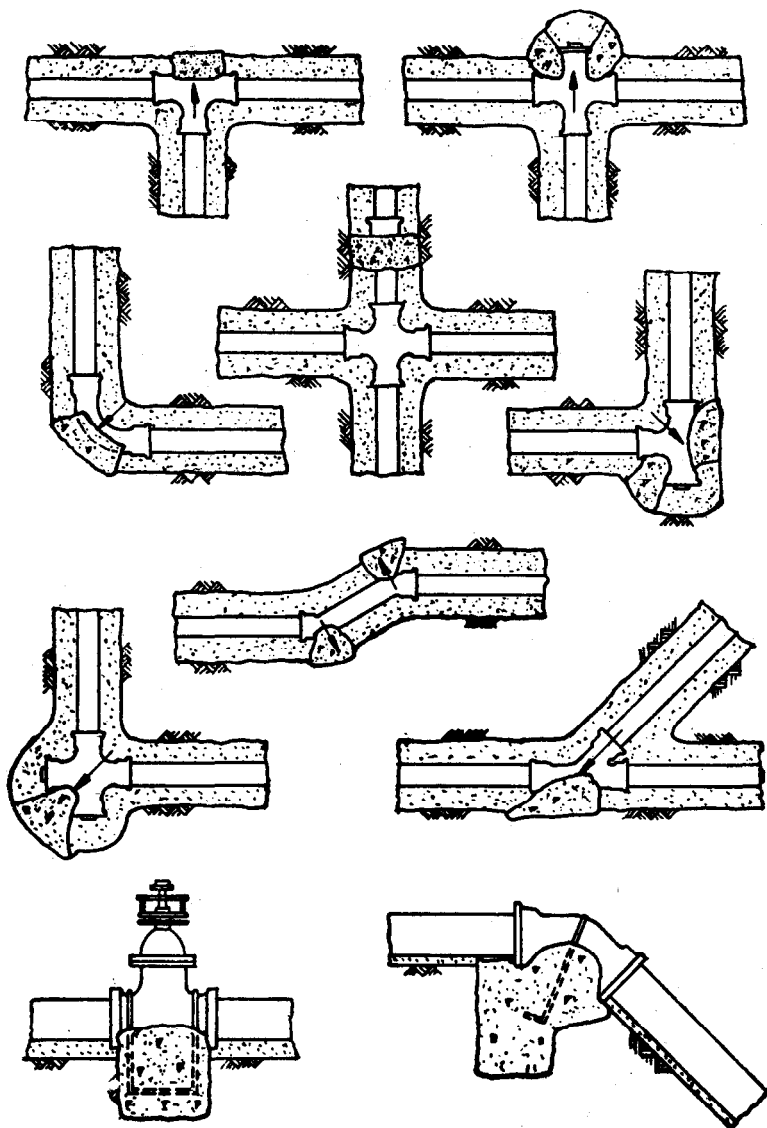


FIG. 8 LOCATION OF THRUST BLOCKS

8.3.1 The anchorage shall consist of either concrete cast-in-situ or masonry built in cement mortar. The anchors shall be extended to the firm soil of the trench side. The shape of the anchors will depend on the kind of specials used. They shall be spread full width of trench and carried vertically by the side and over the special to about 15 cm. The bearing area on sides of the trench will be proportional to the thrust and to the bearing capacity of the sides of the trench.

9. SERVICE CONNECTIONS

9.1 When the pipe is used in distribution house service, connections shall be provided through a saddle piece.

9.1.1 The saddle piece consists of two straps which envelopes the portion of pipe from where connection is to be given. The hole of required size shall be drilled through the pipe and the boss provided in the top strap. Ferrule piece shall be connected after making threads in the boss and pipe. Suitable rubber packing shall be used between the straps and the pipe to provide cushioning as well as sealing against leakages (see Fig. 9).

9.2 The size of the hole drilled in the pipe shall be limited to those given in Table 2.

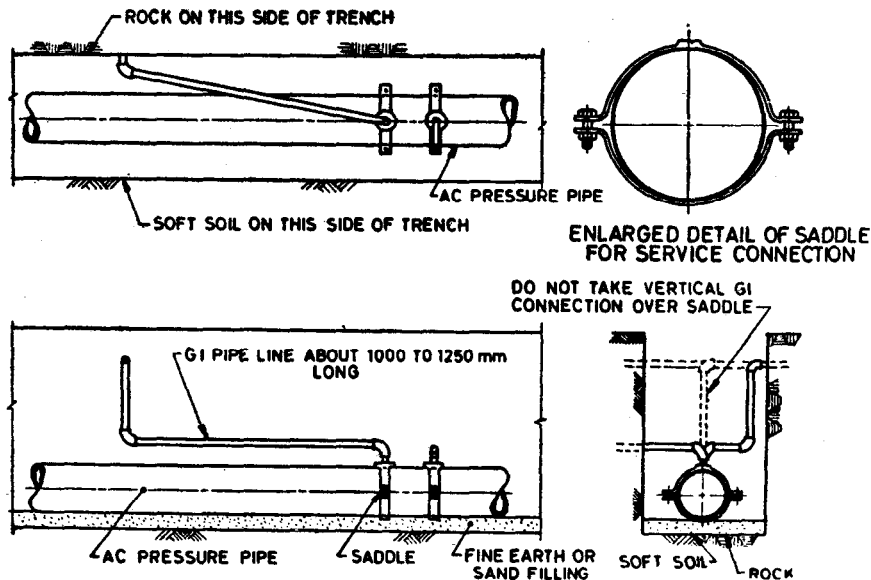


FIG. 9. DETAIL SHOWING METHOD OF TAKING SERVICE CONNECTIONS FROM THE ASBESTOS CEMENT PRESSURE PIPE

TABLE 2 SIZE OF HOLE DRILLED IN PIPE

(Clause 9.2)

PIPE SIZE	MAXIMUM SIZE OF DRILLED HOLE	
	mm	mm
80 and 100		20
125 and 150		25
200		35
250 and above		50

10. BACK FILLING AND TAMPING

10.1 Back filling shall follow pipe installation as closely as possible to protect pipe from falling boulders, eliminating possibility of lifting of the pipe due to flooding of open trenches and shifting pipe out of line by caved in soil.

10.2 The soil under the pipe and coupling shall be solidly tamped to provide a firm and continuous support for the pipeline. Tamping shall be done either by tamping bars or by using water to consolidate the back fill material.

10.3 The initial back fill material used shall be free of large stones and dry lumps. In stony areas the material for initial back fill can be shave from the sides of the trenches. In bogs and marshes, the excavated material is usually little more than vegetable matter and this should not be used for bedding purposes. In such cases, gravel or crushed stone shall be hauled in.

10.4 The initial back fill shall be placed evenly in a layer of about 100 mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300 mm of cover over the pipe.

10.5 If it is desired to observe the joint or coupling during the testing of mains (see 11) they shall be left exposed. Sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing.

10.6 Balance of the back fill need not be so carefully selected as the initial material. However, care shall be taken to avoid back filling with large stones which might damage the pipe when spaded into the trench.

10.7 Pipes in trenches on a slope shall have extra attention to make certain that the newly placed back fill will not become a blind drain in effect because until back fill becomes completely consolidated there is a tendency for ground or surface water to move along this looser soil resulting in

a loss of support to the pipe. In such cases, the back fill should be tamped with extra care and the tamping continued in 100 mm layers right up to the ground level.

11. TESTING

11.1 It is recommended to test the portions of the line by subjecting to pressure test as in **11.2**, as the laying progresses before the entire line is completed. In this way any error of workmanship will be found immediately and can be corrected at a minimum cost.

11.1.1 Usually the length of the section to be tested shall not exceed 500 m.

11.2 The pipes shall be tested as specified in IS:5913-1970* in the factory and hence the purpose of field testing is to check the quality of workmanship and also to check whether the pipes have been damaged in transit. As such, the test pressure shall be kept as 1.5 times the actual operating pressure, unless a higher test pressure is specified. However, it may be noted that the test pressure during the field test shall not exceed the values given in Table 3.

TABLE 3 TEST PRESSURE FOR PIPES

CLASS OF PIPE	MAXIMUM FIELD TEST PRESSURE kgf/cm ²
5	3.75
10	7.50
15	11.25
20	15.00
25	18.75

11.3 Prior to testing enough back fill as described in **10** shall be placed over the pipeline to resist upward thrust. All thrust blocks forming part of the finished line shall have been sufficiently cured and no temporary bracing shall be used.

11.4 The open end of the section can be sealed temporarily with an end cap having an outlet which can serve as an air relief vent or for filling the line, as may be required.

11.5 The blind face of the end cap shall be properly braced during testing by screw jacks and wooden planks or steel plate (see Fig. 10).

*Methods of test for asbestos cement products.

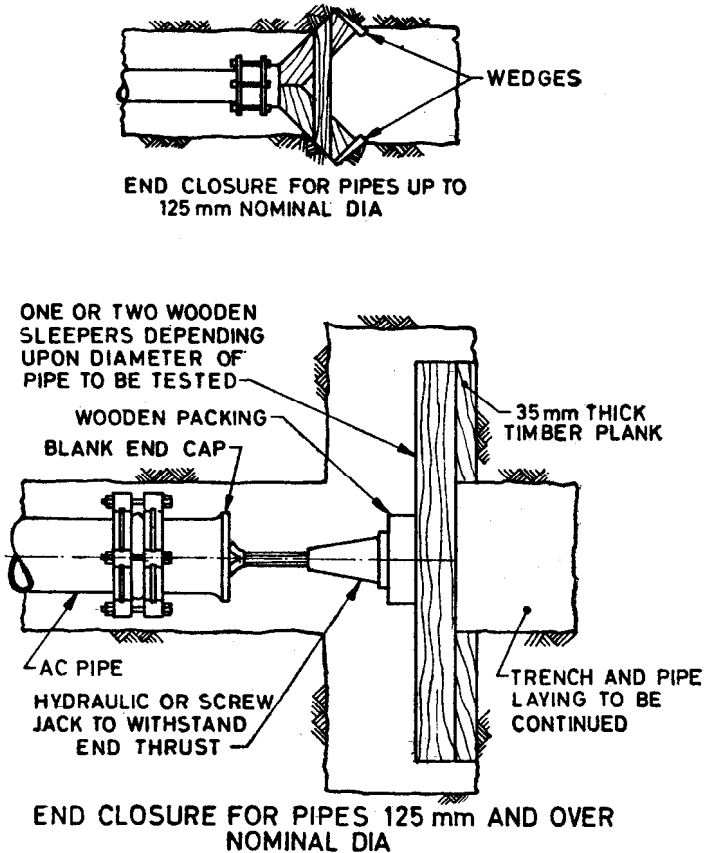


FIG. 10 TYPICAL DETAIL OF SHORING AT THE PIPE END FOR TESTING

11.6 The section of the line to be tested shall be filled with water manually or by a low pressure pump. Air shall be vented from all high spots in the pipeline before making the pressure strength test because entrapped air gets compressed and causes difficulty in raising the required pressure for the pressure strength test.

11.7 Asbestos cement pipes always absorb a certain amount of water. Therefore, after the line is filled, it should be allowed to stand for 24 h, before pressure testing and the line shall be again filled.

11.8 The test pressure shall be gradually raised at the rate of approximately one kg/cm²/min.

11.9 The duration of the test period if not specified shall be sufficient to make a careful check on the pipeline section.

11.9.1 After the test has been completed, the trench shall be filled back as in **10.6**.

12. DISINFECTION OF PIPELINE BEFORE COMMISSIONING

12.1 Pipelines carrying potable water shall be suitably disinfected before commissioning. For this purpose guidance may be obtained from IS: 3114-1965* or IS: 5822-1970†.

*Code of practice for laying of cast iron pipes.

†Code of practice for laying of welded steel pipes for water supply.

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AMENDMENT NO. 1 MARCH 1991
TO
IS 6530 : 1972 CODE OF PRACTICE FOR LAYING
OF ASBESTOS CEMENT PRESSURE PIPES

(Page 6, clause 4.1.1) — Substitute the following for the existing clause:

‘4.1.1 Width — The net trench width inside any shuttering which may be used should be sufficient to permit the pipe and joints to be properly bedded and to facilitate adequate compaction of the initial fill, particularly around the underside of the pipe. The recommended net width at bedding level is $D + 0.4$ m for pipes of nominal diameter up to 500 mm, and $D + 0.6$ m for pipes of nominal diameter exceeding 500 mm, D being the external diameter of the pipe in metres. The minimum width of the trench at bedding level should be 0.6 m for trench depths up to 1.5 m and 0.8 m for greater depths. If special equipment is required to mount the joints, it may be necessary to widen the trench at these points.’

(Page 7, clause 4.2.9) — Substitute the following for the existing clause:

‘4.2.9 The bed of the trench shall be excavated to the pipe grades so that uniform support is assured for the full length of the pipes by providing even bedding as shown in Fig. 2C.’