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CODE OF PRACTICE FOR SANITARY PIPE WORK ABOVE GROUND FOR BUILDINGS

(First Revision)

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Indian Standard

CODE OF PRACTICE FOR SANITARY PIPE WORK ABOVE GROUND FOR BUILDINGS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 November 1983, after the draft finalized by the Water Supply and Sanitation Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 All aspects of design, layout construction and maintenance of drains for carriage of wastes and sewage together with all ancilliary works like manholes, inspection chambers, etc, have been generally dealt with in IS : 1742-1983*. However, a code of practice specially dealing with the design and layout of soil and waste pipes of buildings was felt necessary to give detailed guidance for this part of work.

0.2.1 The code covers the traditional two-pipe system of plumbing and the modern methods of plumbing, namely, the one-pipe and the single stack system. In this revision guidance for the choice of plumbing system and safeguards for single stack system have been covered in detail. The requirements for soil pipe, waste pipe and ventilating pipe have also been included.

0.3 This code represents a standard of good practices and, therefore, takes the form of recommendations.

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.

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*Code of practice for building drainage (*first revision*).

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

1. SCOPE

1.1 This code deals with the design, installation of soil, waste and ventilating pipes where they occur above ground both inside and outside the building.

1.2 Rainwater pipes are not covered by this code.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Back Pressure — Air or waste water from pipes being forced up through traps.

2.2 Branch Ventilating Pipe (B.V.P.) — A pipe, one end of which is connected to the system adjacent to the trap of an appliance and the other to a main ventilating pipe or a drain-ventilating pipe. It is fitted to prevent loss of water seal from a trap owing to partial vacuum back pressure, or surging caused by air movement within the pipe system. It also provides ventilation for the branch waste pipe.

2.3 Branch Soil Pipe (B.S.P.) — A pipe connecting one or more soil appliances to the main soil pipe.

2.4 Branch Waste Pipe (B.W.P) A pipe connecting one or more waste appliances to the main waste pipe.

2.5 Branch Soil Waste Pipe (B.S.W.P.) — A pipe connecting one or more soil and/or waste appliances to the main soil waste pipe (one-pipe system).

2.6 Building Drain (*see* **Fig. 1**) — The building (house) drain is the part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building (house) sewer beginning one metre outside the building wall.

2.7 Building Sewer (*see* **Fig. 1**) — The building (house) sewer is the part of the horizontal piping of a drainage system which extend from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sewer, private sewer, individual sewage-disposal system, or other point of disposal.

2.8 Cleaning Eye — An access opening in a pipe or pipe fitting arranged to facilitate the clearing of obstructions and fitted with removeable cover.

2.9 Crown of Trap — The topmost point of the inside of a trap outlet.

2.10 Diameter — The nominal diameter of pipes fittings.

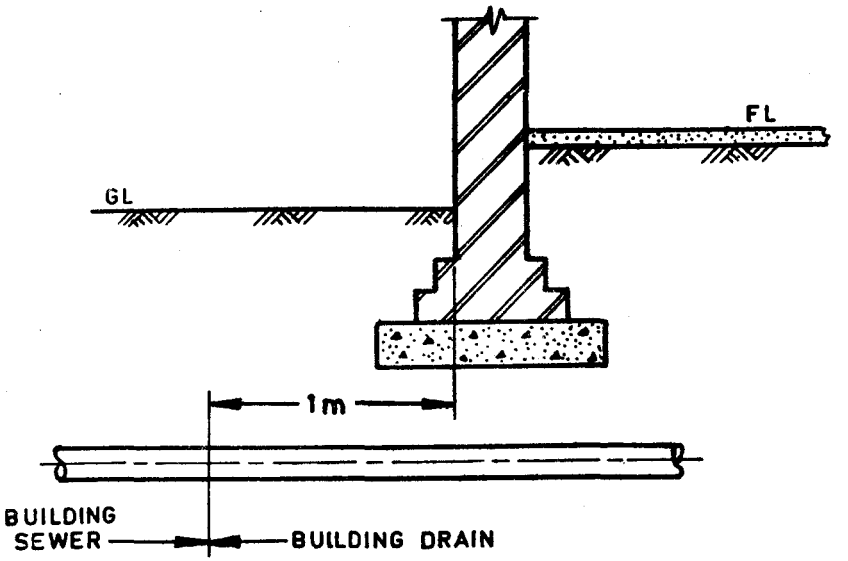

FIG. 1 DEFINITION OF BUILDING DRAIN AND BUILDING SEWER

2.11 Drain — Any pipe which conveys discharges from sanitary appliances in a drainage system.

2.12 Drain Ventilating Pipe (D.V.P.) — A pipe installed to provide flow of air to or from a drain to prevent undue concentration of foul air in drain. Main soil pipe or main waste pipe may serve as drain ventilating pipe wherever their upper portions, which do not receive discharges, are extended to the roof level and let open to air.

2.13 Holderbat — A bracket made in halves, with bolts and nuts for joining the halves and with provision for building-in or screwing to the structure.

2.14 Induced Siphonage — The extraction of water from a trap by siphonage set up by reduction of pressure at the outlet of the trap.

2.15 Main Soil Pipe (M.S.P.) — A pipe connecting one or more branch waste pipes to the drain.

2.16 Main Ventilating Pipe (M.V.P.) — A pipe which receives a number of branch ventilating pipes.

2.17 Main Waste Pipe (M.W.P.) — A pipe connecting one ormore branch waste pipes to the drain.

2.18 Main Soil Waste Pipe (**M.S.W.P.**) — A pipe connecting one more branch soil waste pipes to the drain.

2.19 Pipe Ears — Two wings cast integrally with the pipe socket provided with holes to take fixing nails or screws.

2.20 Pipe Systems — The system to be adopted will depend on the type and planning of the building in which it is to be installed and will be one of the following:

a) *Two Pipe System* (*see Fig. 2*) — A discharge pipe system comprising two independent discharge pipes one of which conveys soil directly to the drain, the other conveying waste water to the drain through a trapped gully. The system may also require ventilating pipes.

b) *One Pipe System* (*see Fig. 3*) — The plumbing system in which the waste connection from sinks, baths and wash basins and the soil pipe branches are all collected into one main pipe which is connected directly to the drainage system. Gully traps and waste pipes are completely dispensed with but all the traps of water closets, basin, etc, are completely ventilated to preserve water seal.

c) *Single Stack System* (*see Fig. 4A and 4B*) — One pipe system without trap ventilation pipe work.

2.21 Self Siphonage — The extraction of water from a trap by siphonage setup by the momentum of the discharge from the sanitary appliance to which the trap is attached.

2.22 Stack — A main vertical discharge or ventilating pipe.

2.23 Trap — A fitting or device so designed and constructed as to provide, when properly vented, a liquid seal which will prevent the back passage of air without materially affecting the flow of sewage or water through.

2.24 Water Seal — The water in a trap which acts as a barrier to the passage of air through the trap.

2.25 Fixture Unit — A quantity in terms of which the load producing effects on the plumbing system of different kind of plumbing fixtures are expressed on some arbitrarily chosen scale.

3. PRELIMINARY DATA FOR DESIGN

3.1 In order to design a soil and waste pipes system above ground, information on the following items should be collected:

a) *New Work* — In the initial stages, there should be consultation

between the local authority, owner, architect and engineer concerning the following matters:

1) Number, position and types of appliances to be installed;
2) Position and size of sewers and any precautions necessary to ensure satisfactory working of the drainage system and to avoid flooding of the premises; and
3) Requirements of local authority.

b) *Existing Work* — Any report on existing work should include the following:

1) Results of tests,
2) Details of appliances connected to the drainage system,
3) Description of the condition of the pipework and fittings, and
4) Particulars of the ventilation of the drainage system.

c) *Information Required by Local Authorities*

1) Notification on the appropriate forms and particulars of the propossd work, and
2) Drawings.

d) *Information Required by the Plumbing Contractor*

1) *Drawings* — The architect or engineer should advise the plumbing contractor of the acceptance of the proposal by the local authority and provide an exact copy of the approved drawings. These drawings should show any special annotations made by the local authority, also notes as to any preparatory constructional work which may be required to accommodate the pipework. The plumbing contractor should be provided with sufficient copies of the large scale working drawings of the installation containing notes of any special requirements and giving all necessary dimensions.

2) *Specification* — The plumbing contractor will require copies of the relevant clauses of the main specification which should include the following:

1) General description of the work,
2) Information as to 'statutory authorities' requirements, if any,
3) Description of materials required,
4) Methods of fixing and jointing, and
5) Any special requirements.

3.2 The work shall be carried out by a plumber duly licensed by local authorities in conformity with the rules laid down for the purpose.

4. TIME SCHEDULE

4.1 A time schedule for the installation of the soil and waste pipework should be prepared and co-ordinated with the programme of the main building work, particularly with that part of it dealing with the underground drainage system. This schedule may require adjustment from time to time to accord with the progress of the job. The following are important points to be considered in the preparation of a time schedule:

a) Dates when drawings are required,

b) Dates for the supply and delivery of materials, and

c) Dates for the start and completion of individual section of the work.

5. MATERIAL

5.1 Materials and components of the materials used in the construction work described in the code shall conform to the requirements laid down in the relevant Indian Standards. However, where no Indian Standard exists on the particular item, materials used shall be of satisfactory quality and workmanship acceptable to the owner.

5.2 Choice of Materials for Pipes and Fittings — The following material may be used for a sanitary pipework system:

a) Asbestos cement [conforming to IS : 1626 (Part 1)-1980*];

b) Cast iron (conforming to IS : 1536-1976†, IS : 1537-1976‡, IS : 1538-1976§, IS : 1729-1979‖, and IS : 3989-1970¶);

c) Salt glazed stoneware pipes (conforming to IS : 651-1980**);

d) Galvanized steel and wrought iron [conforming to IS : 1239 (Part 1)-1979††], and

e) Any other material as approved by the local authority.

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*Specification for asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings: Part 1 Pipe and pipe fittings (*first revision*).

†Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage (*second revision*).

‡Specification for vertically cast iron pressure pipes for water, gas and sewage (*first revision*).

§Specification for cast iron fittings for pressure pipes for water, gas and sewage (*second revision*).

‖Specification for sand cast iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (*first revision*).

¶Specification for centrifugally-cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories (*first revision*).

**Specification for salt-glazed stoneware pipes and fittings (*fourth revision*).

††Specification for mild steel tubes (*fourth revision*).

5.2.1 Care should be taken to select materials resistant to corrosion caused by the liquid carried, by atmospheric conditions, or by electrolysis.

6. DESIGN CONSIDERATIONS

6.1 Pipe Systems — The design to be adopted will depend on the type and planning of the buildings to which it is to be installed and will be one of the following:

a) The two-pipe system (*see* Fig. 2),

b) The one-pipe system (*see* Fig. 3), or

c) The single stack system (*see* Fig. 4A and 4B)

6.1.1 *Choice of Plumbing System* — Where the sullage from baths and kitchens can be dealt with separately for use in gardening or any other such purposes, the two pipe system is advantageous. Obviously, the one-pipe system is more economical and has application where all types of waste waters are taken in a common sewer line to the place of disposal or treatment. Both these systems are fully ventilated by a system of ventilating pipe. However, these days the single-stack system without any vent pipe system, where the stack itself is made to serve the vent requirements also by restricting the flow in the stack, is being used. This system is recommended with 100 mm diameter stack for up to 5 storey buildings. Not more than two toilet units can discharge to the single stack at each floor level. For any different case, the permission of the local authority shall be obtained. In high-rise buildings, a partially ventilated one-pipe system is being used where the vent stack is connected to the drainage stack or the WCs at each or alternate floors. The safeguards for the single stack system are stipulated in **6.9.2.** The fully ventilated system does not demand any special safeguards.

6.2 Pipe Capacities — Pipe diameter should be calculated according to **4.5.1** of IS : 1742-1983*.

6.2.1 Branches and stacks which receive discharges from WC pans should not be less than 100 mm, except where the outlet from the siphonic water closet is 80 mm in which case a branch pipe of 80 mm may be used; for outlet of floor traps 75 mm diameter pipes may be used.

6.2.2 The gradient of a horizontal branch should not be flatter than 1 in 50 and not steeper than 1 in 10.

6.3 Layout of Pipes — Pipe work and appliances should be so arranged as to allow close grouping of connections preferably with a water closet near to the main soil pipe. The level of the trap outlet of an appliance shall be studied in relation to the level of the floor and the branch pipe.

*Code of practice for building drainage (*first revision*).

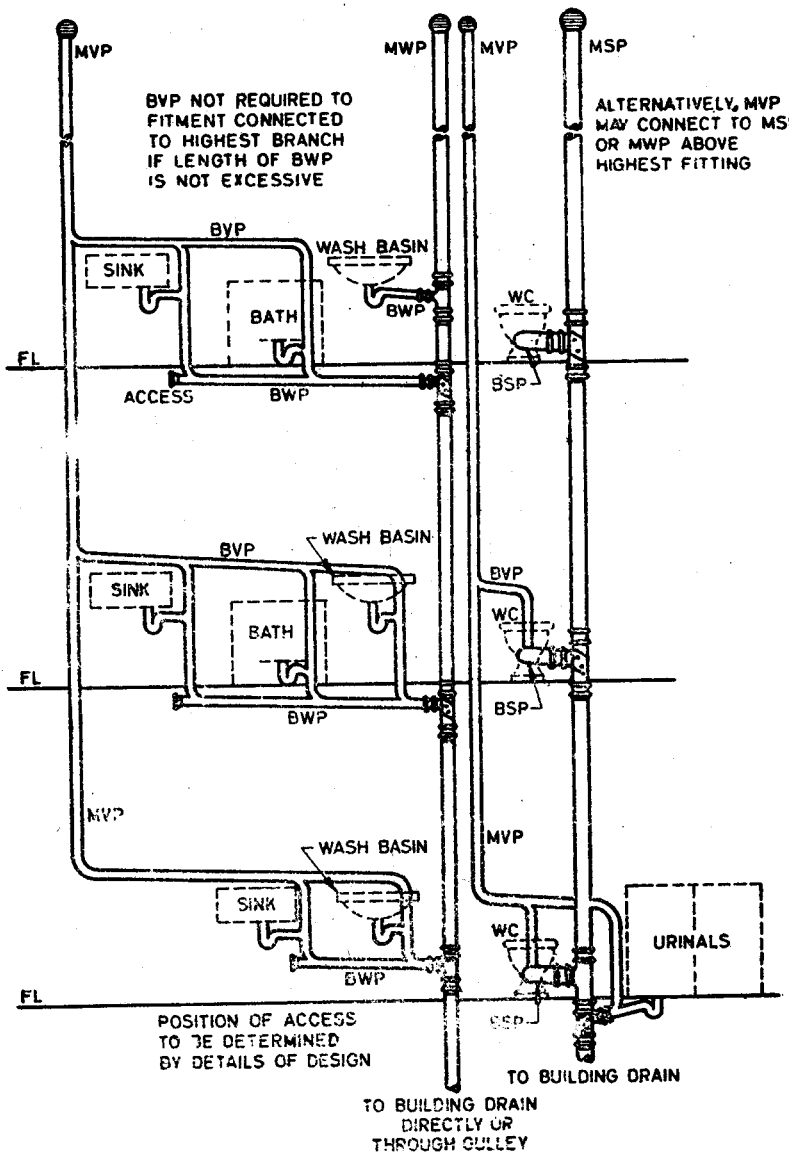

FIG. 2 DIAGRAM OF TWO-PIPE SYSTEM

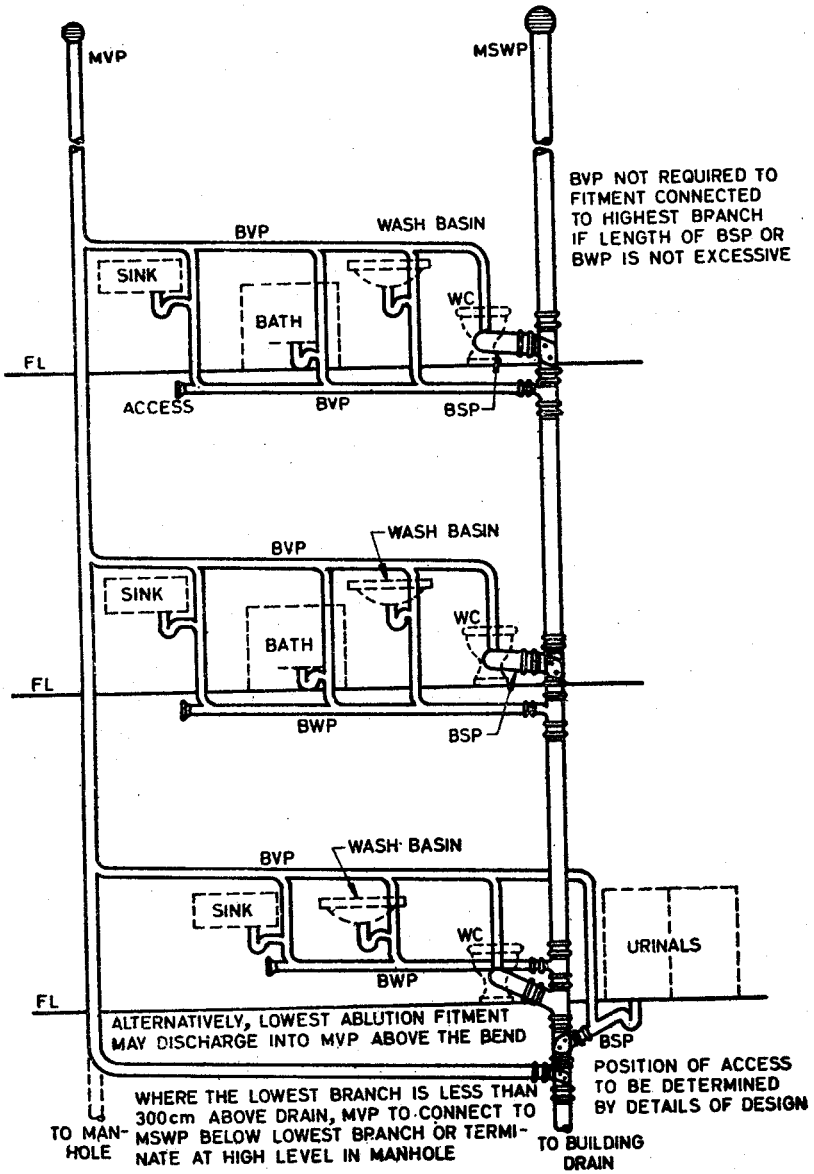

FIG. 3 DIAGRAM OF ONE-PIPE SYSTEM

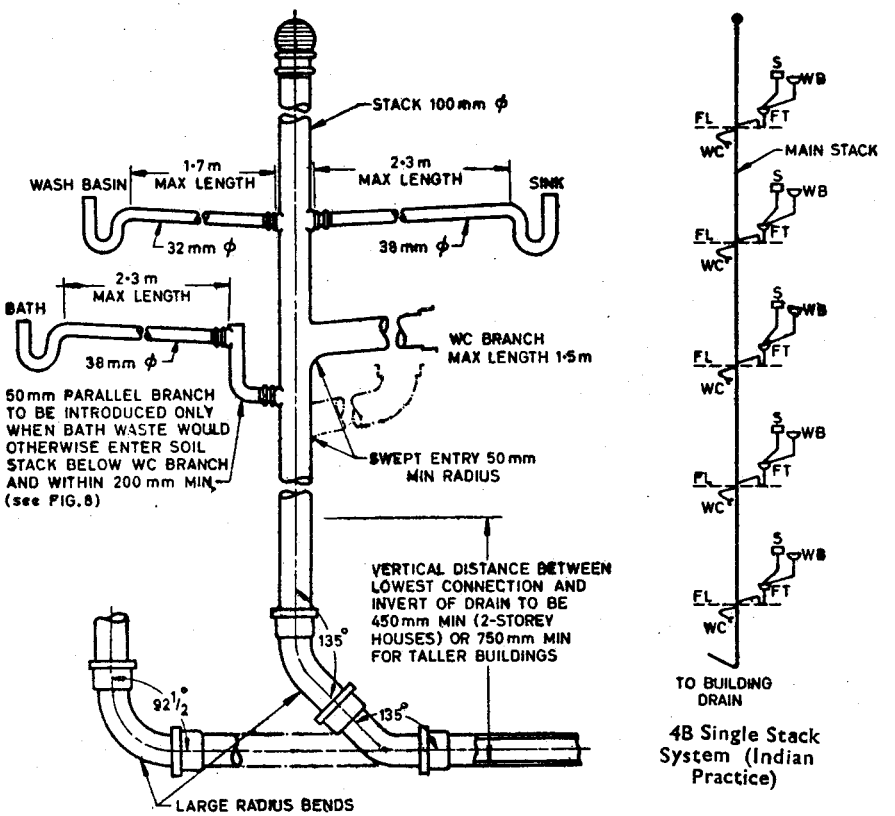

FIG. 4 MAIN FEATURES OF DESIGN OF SINGLE STACK SYSTEM

6.3.1 Pipes should be placed, fixed and jointed so as to avoid risk of damage through variations in temperature. Unless suitable precautions are taken, the jointing of pipes exposed to unduly high temperatures may become unsatisfactory. Small waste pipes are particularly liable to damage caused by the freezing of water from a leaking tap in places where freezing normally occours.

6.3.2 The pipework in branch connections should always be arranged to allow free drainage of the system. Connections to main or branch pipes should be so arranged as to prevent cross flow from one appliance to another. Connections should be made with an easy sweep in the direction of flow particularly in connection in the 'single stack' system (*see* Fig. 4).

6.3.2.1 When the pipes are concealed, inaccessible or laid exposed along with the internal face of the walls, they should preferably be of cast iron. In the ground floor all the pipes, including those laid on the external face of the walls, should be of cast iron.

6.3.2.2 All joints in pipework and of pipework to appliance should be made in such a manner as to be airtight and watertight and to remain so during use. Care should be taken to ensure that no jointing material projects inside the bore of the pipe. Some flexibility is desirably where there is possibility of movement between the pipes or between the pipes and the appliances.

6.3.2.3 The joint shall be made of neat cement paste well caulked like lead (with water content not exceeding 30 percent) preferably with asbestos or hemp fibre; cement joints should be avoided where the joints are likely to be exposed to direct sunlight or heat. Where rubber rings are used for the jointing of external pipes, the annular space in the socket above ring should be filled with a suitable mastic compound.

6.3.3 Bends should be of long radius where practicable. In the case of bends in the bottom most pipes they should necessarily be of long radius and should preferably be made of 135° (1/8) bends.

6.3.4 Ample provision should be made for access to all pipework and the embedding of joints in walls should be avoided as far as possible.

6.3.5 All pipework adjacent to living or sleeping quarters should be insulated against sound transmission and steps should be taken to avoid the transmission of noise from one apartment to another by way of the pipe system (*see* IS : 1950-1962*).

6.4 Connection of Fixtures — Fixtures may preferably be connected to the stack directly or through floor traps.

6.5 Traps

6.5.1 *General* — The entry of foul air to the building should be prevented by suitable traps, properly sited.

6.5.2 Traps should always be of a self-cleansing pattern. A trap which is not an integral part of an appliance should be directly attached to its outlet, and the pipe bore should be uniform throughout and have a smooth surface.

6.5.3 Traps for use in domestic waste installations and all other traps should be conveniently accessbile and provided with cleaning eyes, or other means of cleaning.

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*Code of practice for sound insulation of non-industrial buildings.

6.5.4 *Selection of Traps for Various Purposes* — The factors given in Tables 1 and 2 should receive consideration in relation to attached traps.

TABLE 1 MINIMUM INTERNAL DIAMETERS FOR WASTE APPLIANCES

ITEM	DIAMETER mm
Drinking fountains	25
Wash basins	30
Bidets	30
Domestic sinks and baths	40
Showerbath trays	40
Domestic bath tubs	50
Hotel and canteen sinks	50
Urinals :	
Stall urinals (with not more than 1·20 m of channel drainage)	50
Lip urinals	40
Floor traps (outlet diameter)	65

TABLE 2 DEPTH OF SEALS FOR DIFFERENT PLUMBING SYSTEM

(*Clause* 6.5.4)

SL No.	ITEM	TWO-PIPE mm	ONE-PIPE mm	SINGLE STACK mm
i)	Water closets	50	50	50
ii)	Floor traps	50	50	50
iii)	Other fixtures, directly connected to the stack:			
	a) Where attached to branch waste pipes of dia 75 mm or more	40	40	40
	b) Where attached to branch waste pipe of less than 75 mm dia	40	40	75

NOTE — When connection is made through floor trap, no separate seals are required for individual fixtures.

6.6 Soil Pipe

6.6.1 A soil pipe conveying to a drain any solid or liquid filth shall be circular and shall have a minimum diameter of 100 mm.

6.6.2 Except where it is impracticable, the soil pipe shall be situated outside the building or in suitably designed pipe shafts and shall be continued upwards without diminution of its diameter, and (except where it is unavoidable) without any bend or angle, to such a height and position as to afford by means of its open end a safe outlet for foul air. The position of the open end with its covering shall be such as to comply with **6.8** relating to ventilating pipe. Even if the pipes are laid in external chases, the soil pipes shall not be permitted on a wall abutting a street unless the Authority is satisfied that it is unavoidable. Where pipe shafts are provided the cross-sectional area shall be such as to allow free and unhampered access to the pipes to be installed in the shaft and in no case shall the cross section be less than a square of 1 metre side. All pipe shafts shall be provided with an access door at ground level and facilities for ventilation.

6.6.3 Soil pipes, whether inside or outside the building, shall not be connected with any rain water pipe and there shall not be any trap in such soil pipe or between it any drain with which it is connected.

6.6.4 Soil pipes shall preferably be of cast iron. Asbestos cement building pipes may also be used as soil pipes only above ground level.

6.6.5 The soil pipe shall be provided with heel rest bend which shall rest on sound footing. It shall be fixed at least 50 mm clear of the finished surface of the wall by means of suitable clamps of approved type.

6.7 Waste Pipe

6.7.1 Every pipe in a building for carrying off the waste or overflow water from every bath, wash basin or sink to a drain shall be of 32 to 50 mm diameter, and shall be trapped immediately beneath such wash basin or sink by an efficient siphon trap with adequate means for inpection and cleaning. Such traps shall be ventilated into the external air whenever such ventilation is necessary to preserve the seal of the trap. Waste pipes, traps, etc, shall be constructed of iron, head, brass, stoneware, asbestos cement or other approved material. The overflow pipe from wash basins, sinks, etc, shall be connected with the waste pipe immediately above the trap. Vertical pipes carrying off waste water shall have a minimum diameter of 75 mm.

NOTE — Wherever wash basins and sinks have in-built overflow arrangements, there is no need to provide overflow pipes in such cases.

6.7.2 Every pipe in a building for carrying off waste water to a drain shall be taken through an external wall of the building by the shortest practicable line, and shall discharge below the grating or surface box of the chamber but above the grating of a properly trapped gully. The waste pipe shall be continued upwards without any diminution in its diameter and (except when unavoidable) without any bend or angle to

such a height and position as to afford by means of the open end of the waste pipe, a safe outlet for foul air, the position of the open end and its covering being such as to comply with the condition.

6.7.3 Except where it is impracticable, the common waste pipe shall be situated outside the building and shall be continued upwards without diminution of its diameter (except where it is unavoidable) without any bend or angle being formed to such a height and position as to afford by means of the open end a safe outlet for foul air, the position of the open end and the covering thereafter being such as to comply with the conditions set out in ventilated pipe.

6.7.4 The waste pipe shall be finally attached to the wall atleast 5 cm clear of it, if the waste pipe is of cast iron, the pipe shall be secured to the walls properly fixed holderbats or equally suitable and efficient means.

6.8 Ventilating Pipe

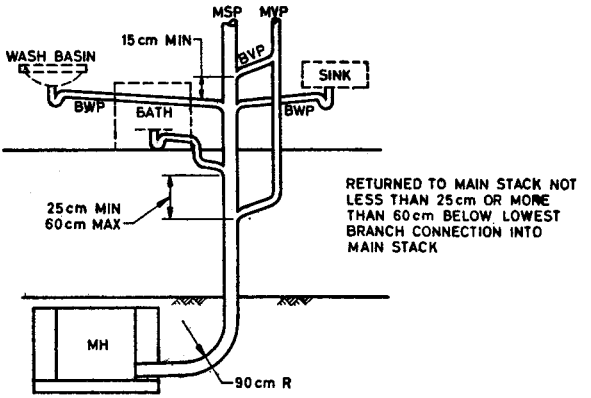
6.8.1 Ventilating pipes should be so installed that water cannot be retained in them. They should be fixed vertically. Whenever possible horizontal runs should be avoided. Ventilating pipe shall be carried to such a height and in such a position as to afford by means of the open end of such pipe or vent shaft, a safe outlet for foul air with the least possible nuisance.

6.8.2 The upper end of the main ventilating pipe may be continued to the open air above roof level as separate pipe, or it may joint the MSP and/or MWP above the floor level of the highest appliance. Its lower end may be carried down to join the drain at a point where air relief may always be maintained. Four typical methods of jointing the main ventilating pipe at the lower end are given in Fig. 5.

6.8.3 Branch ventilating pipes should be connected to the top of the BSP and BWP between 75 mm and 450 mm from the crown of the trap.

6.8.4 The ventilating pipe shall always be taken to a point 150 cm above the level of the eaves or flat roof or terrace parapet whichever is higher or the top of any window within a horizontal distance of 3 m. The least dimension shall be taken as a minimum and local conditions shall be taken into account. The upper end of every ventilating pipe shall be protected by means of a cowl.

6.8.5 In case the adjoining building is taller, the ventilating pipe shall be carried higher than the roof of the adjacent building, wherever it is possible.



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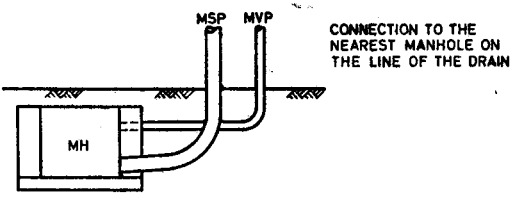

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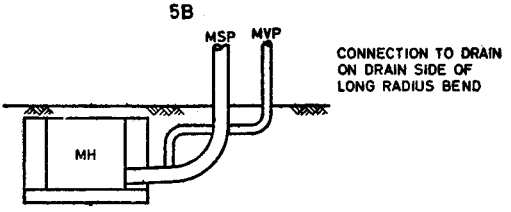

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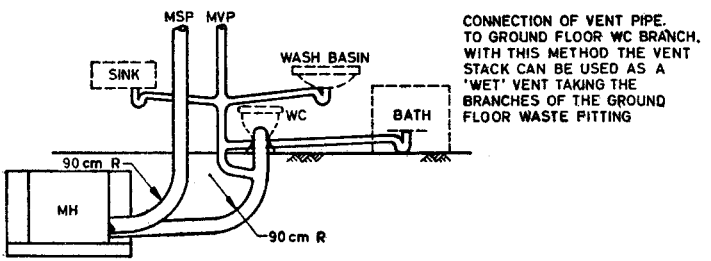

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FIG. 5 END CONNECTIONS OF VENT PIPE

6.8.6 *Sizes*

6.8.6.1 The building drain ventilating pipe shall be of not less than 75 mm diameter. When, however, it is used as MSP or MWP, the upper portion, which does not carry discharges, shall not be of lesser diameter than the remaining portion.

6.8.6.2 The diameter of the main ventilating pipe shall not be less than 50 mm.

6.8.6.3 A branch ventilating pipe on a waste pipe in both one and two-pipe systems shall be of not less than two-thirds the diameter of the branch waste ventilated subject to a minimum of 25 mm.

6.8.6.4 A branch ventilating pipe on a soil pipe in both one- and two-pipe systems shall be not less than 32 mm in diameter.

6.9 Design Data for Single Stack Plumbing

6.9.1 The following recommendations are conditional upon those given in Table 3:

a) The appliance should be grouped as closely as possible round the main stack so as to keep the branch pipes short and reduce noise.

b) Branch connections should be of large radius along the invert (*see* Fig. 6).

c) Flat gradients reduce self-siphonage and noise; waste pipes should fall at between 1 : 50 and 1 : 10.

d) A typical method of single stack system of plumbing is shown in Fig. 4A and 4B.

6.9.2 *Safeguards for Single Stack System*

a) As far as practicable, the fixtures on floors shall be connected to stack in order of increasing discharge rate in the downward direction.

b) The vertical distance between the waste branch (from floor trap or from the individual appliance) and the soil branch connection, when soil pipe is connected to stack above the waste pipe, shall be not less than 200 mm.

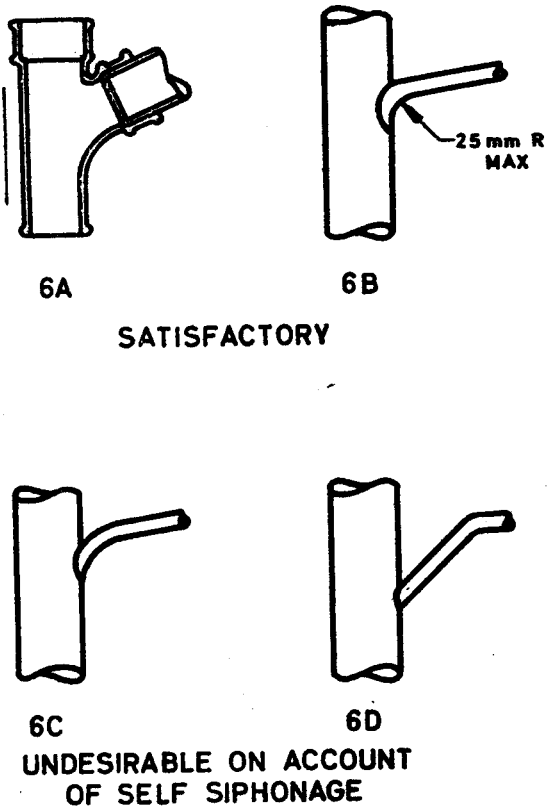

FIG. 6 SINGLE STACK SYSTEM — WASTE-PIPE CONNECTIONS

c) Depth of water seal traps for different fixtures shall be as below:

Water closets	50 mm
Floor traps	50 mm

Other fixtures directly connected to the stack:

1) Where attached to branch waste pipes of dia 75 mm or more — 40 mm
2) Where attached to branch waste pipes of less than 75 mm dia — 75 mm

NOTE — When connection is made through floor trap no separate seals are required for individual fixtures.

d) Branches and stacks which receive discharges from W.C. pans should not be less than 100 mm, except where the outlet from the siphonic water-closet is 80 mm in which case a branch pipe of 80 mm may be used; for outlet of floor traps 75 mm dia pipes may be used.

e) The horizontal branch distance for fixtures from stack bend(s) at the foot of stack to avoid back pressure as well as vertical distance between the lowest connection and the invert of drain shall be as shown in Fig. 4A.

f) For tall buildings, ground floor appliances are recommended to be connected directly to manhole/inspection chamber.

6.9.2.1 *Additional requirements* — The pipes shall be laid in straight lines as far as possible in both vertical and horizontal plans. Anything that is likely to cause irregularity of flow, such as abrupt changes of direction, shall be avoided. No bends and junctions whatsoever shall be permitted in the sewers except at manholes and inspection chambers.

6.9.3 *Stack Size* — The size shall be 100 mm diameter.

6.9.4 *Single Branches and Fittings* — Table 3 gives recommendations for the design of single stack system. All appliances directly connected to stacks are trapped.

6.9.4.1 Pipes should fall gradually and continuously in the direction of flow.

6.9.5 *Combined Bath and Basin Waste* — When the basin and bath are at some distance from the stack, it may be cheaper and simpler to combine the waste pipes into one than to run each separately to the stack. Alternatively, a 32 mm dia trap with a short 32 mm tail pipe may be arranged to discharge into 38 mm or 50 mm waste pipe. Any bends in the waste should be of large radius.

7. INSPECTION AND TESTING

7.1 Inspection — Work should be inspected during installation and tests applied on completion, care being taken that all work which is to be encased or concealed is tested before it is finally enclosed.

7.1.1 Pipe systems should be tested for gas-tightness, and for hydraulic performance (*see* **7.2**). Inspection should be carried out to ensure the following:

a) Work accords with the drawings and specification;

b) All pipe brackets, clips, etc, are securely fixed;

c) Fixing are correctly spaced;

d) Pipe is protected where necessary by thermal insulation;

e) Embedded pipework is properly protected before sealing-in;

f) All access covers, caps or plugs:

1) are accessible,
2) are so made that the internal faces truly complete the internal bore,
3) cause no obstruction in the pipe bore, and
4) are well jointed.

TABLE 3 RECOMMENDATIONS FOR DESIGN OF SINGLE STACK SYSTEM

(*Clause* 6.9.4)

Sl No.	Component	Action to be Guarded Against	Design Recommendations
(1)	(2)	(3)	(4)
i)	Wash basin waste	Self-siphonage	75 mm seal P-trap to be used. The maximum slope of a 40 mm waste pipe to be determined from Fig. 7 according to the length of the waste pipe. Any bends to be not less than 75 mm radius to centre line. Waste pipes longer than the recommended maximum length of 165 cm should be vented, or a larger diameter waste pipe or approved resealing trap should be used
ii)	Bath and sink wastes 38 mm trap and 38 mm waste pipe	Self-siphonage	75 mm seal traps to be used. Self-siphonage not important. Length and slope of waste branch not critical, but long waste pipes may be troubled by sedimentation and access for cleaning should be provided
		Backing up of discharge from W.C. branch into bath branch	Position of entry of bath waste into stack to be as in Fig. 8, the bath waste pipes may be connected to the stack so that its centre line meets the centre line of the stack at or above the point where the centre line of the WC branch meet the centre line of the stack, or at least 20 cm below it

(*Continued*)

TABLE 3 RECOMMENDATIONS FOR DESIGN OF SINGLE STACK SYSTEM — *Contd*

Sl No.	Component	Action to be Guarded Against	Design Recommendations
(1)	(2)	(3)	(4)
iii)	Soil branch connection to stack	Induced siphonage lower in the stack when W.C. is discharged	W.C. connections should be swept in the direction of flow. Fittings should have a minimum sweep of at least 5 cm radius
iv)	Bend at foot of stack (*see* Fig. 4A and 4B)	Back pressure at lowest branch. Build-up of detergent foam	Bend to be of large radius or two 135° bends to be used. Vertical distance between lowest branch connection and invert of drain to be at least 750 mm (450 mm for 2 storeyed houses with 100 mm stack)
v)	Offsets in stacks	Back pressure above offset	There should be no offsets in stacks below the topmost appliances unless venting is provided to relieve any back pressure. Offsets above the topmost appliances are of no significance.
vi)	Floor traps and 75 mm branch pipe	Induced siphonage	50-mm seal trap to the used. Slope of the branch pipe may vary from 1 in 50 to 1 in 10

NOTE — The recommendations apply to systems with swept-inlet WC branches. With straight inlet branches a 100 mm stack with no vents has been found satisfactory for up to four storeys, a 150 mm stack with no vents has been found satisfactory for up to 15 storeys.

7.2 Testing of System

7.2.1 *Water Test* — The water test may be applied before the appliances are connected and may be carried out in sections so as to limit the static head to 4·5 m. It is necessary to seal all openings affected by the test and provide support to the plugs used as stoppers.

7.2.2 *Air Test* — The air test may be applied by inserting expanding rubber testing plugs in the lower and upper ends of the main soil pipe and main ventilating pipe and sealing the plugs with water, where possible.

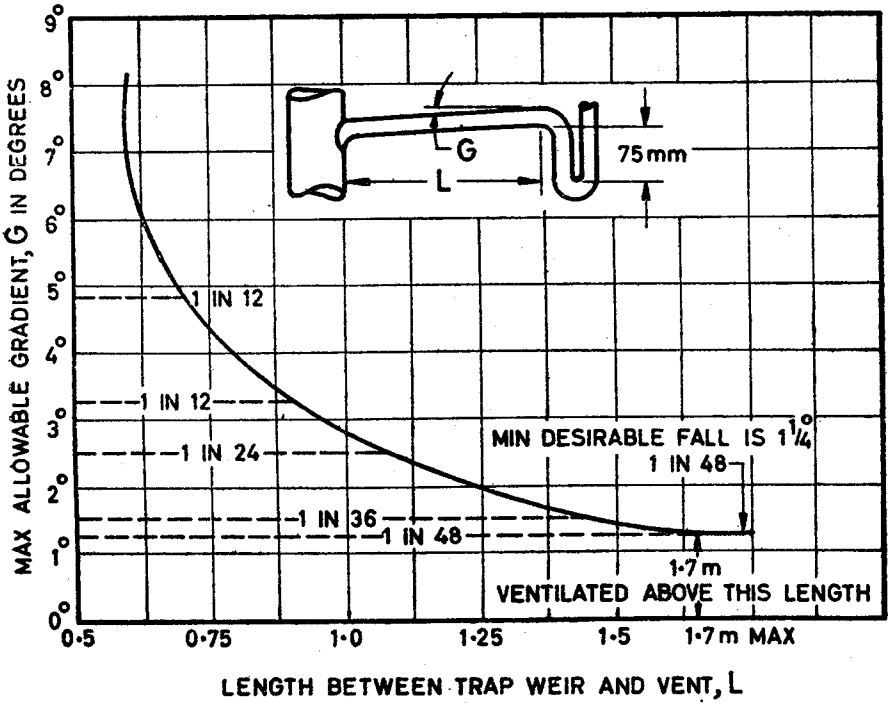

FIG. 7 LENGTH AND FALL OF BASIN WASTE DESIGN CURVE FOR 32 mm WASTE AND 75 mm SEAL P-TRAPS CONNECTED TO SINGLE WASH BASIN

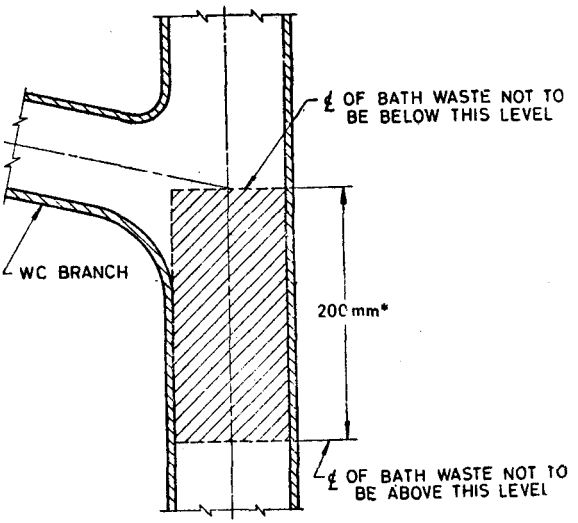

FIG. 8 CONNECTION OF BATH WASTE TO STACK

7.2.2.1 The testing plug at the upper end of the ventilating pipe should be fitted with a tee-piece with a cock on each branch, one branch being connected by a flexible tube to a manometer. Air pressure is then introduced into the system through the other branch of the tee-piece until the desired pressure is shown on the manometer scale. The pressure applied should be equal to 65 mm water gauge and should remain constant for a period of three minutes to prove the soundness of the installation.

7.2.2.2 Alternatively, the air pressure may be applied by passing a flexible tube from a tee-piece attached to a manometer through the water seal of the trap of the sanitary appliance, the test then being carried out as described in **7.2.2.1**.

7.2.3 *Smoke Test* — Faults indicated by the air test may be located by pumping smoke into the system with a smoke machine. Care should be taken to ensure that the system is filled with smoke before sealing with plugs.

7.2.4 *Hydraulic Performance* — Discharge tests should be made from all the appliances, singly and collectively. Obstruction in any of the pipe lines should be traced and the whole system examined for proper hydraulic performance, including the retention of an adequate water seal in each trap.

7.2.4.1 Any defects revealed by the tests should be made good, and the tests repeated until a satisfactory result is obtained.

7.3 Testing the Efficiency of the Design

7.3.1 A soil and/or waste pipe system should, under tests, withstand any condition of discharge of its appliances which may occur in practice, without the discharge from one appliance being forced up into another, and every trap should retain at least 25 mm of its seal under these conditions. The tests should be designed to make full allowance for the maximum suction and pressure effects which may occur as given below:

a) In small installations when all the appliances are discharging together, and

b) In large installations when sufficient appliances are simultaneously discharged to simulate peak conditions.

7.3.2 When testing the seals of traps fitted to ablutionary appliances, the latter should be filled to overflow level and allowed to discharge in the normal way.

7.3.3 Tests similar to the above should also be carried out by discharging some appliances, while others are empty with plugs out.

7.3.4 Each test should be carried out at least three times and the maximum loss of seal in any of the tests should be taken as the significant result.

(*Continued from page* 2)

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