ENGINEERING STANDARD

FOR

SANITARY PIPEWORK

ORIGINAL EDITION

JAN. 1995

This standard specification is reviewed and updated by the relevant technical committee on Oct. 1999(1), Dec. 2006(2) and Jan. 2016(3). The approved modifications are included in the present issue of IPS.

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1. SCOPE

This Part of the Standard gives guidance for the design of above ground non-pressure sanitary pipework for domestic, commercial and public buildings. The term "above ground" includes all such pipework within or on the building including any basement (s), but excluding any pipework which has entered the ground, either externally or as the result of penetrating the lowest floor level or an outer wall of the building.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Oct. 1999. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 98 on Oct. 1999. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant Technical Committee on Jan. 2016. The approved modifications by TC were sent to IPS users as amendment No. 3 by circular No 473 on Jan. 2016. These modifications are included in the present issue of IPS.

2. REFERENCES

In this Part of the Standard the following standards and/or publications are referred to and to the extent specified from a part of this Standard:

BSI (BRITISH STANDARDS INSTITUTION)

BS 5572:1978 "Sanitary Pipework"

MHUD (MINISTRY OF HOUSING AND URBAN DEVELOPMENT)

Research Center "Plumbing Systems in Building"

Report No. 122:1992

3. DEFINITIONS AND TERMINOLOGY

The following definitions together with definitions of Part One apply:

3.1 Criterion of Satisfactory Service

The percentage of time during which the design discharge flow loading will not be exceeded.

3.2 Crown of Trap

The topmost point of the inside of a trap outlet.

3.3 Depth of Water Seal

The depth of water which would have to be removed from a fully charged trap before air could pass freely through the trap.

3.4 Ventilating Pipe

A pipe provided to limit the pressure fluctuations within the discharge pipe system.

3.5 Ventilating Pipes and Stacks

a) Single stack system

System in which a single stack or a number of discharge stacks is extended to the atmosphere.

b) Ventilated stack system

- Ventilated stack

Discharge stack that is vented by a ventilating stack cross-connected to the discharge stack in each storey.

- Branch ventilating pipes

Ventilating pipes that vent the branch discharge pipes and connect to ventilating stack or are extended to the atmosphere.

- Relief venting

Venting of a branch or bypass pipe by connecting it to the associated stack or to a vented building drain.

- Secondary venting

Additional venting of each branch pipe by connecting its trap to a separate ventilation system.

3.6 Frost-free Depth

The frost-free depth is a variable based on the local climatic conditions and is specified as the distance between ground level and the water level in the trap or the soffit of the building drain.

3.7 Access Cover

A removable cover on pipes and fittings providing access to the interior of pipework for the purposes of inspection, testing and cleansing.

3.8 Branch Discharge Pipe

A discharge pipe connecting sanitary appliances to a discharge stack.

3.9 Discharge Pipe

A pipe which conveys the discharges from sanitary appliances.

3.10 Trap

A fitting or part of an appliance or pipe arranged to retain water or fluid so as to prevent the passage of foul air.

3.11 Stack

A main vertical discharge or ventilating pipe.

4. PERFORMANCE CRITERIA

4.1 Discharge

Requirements for the discharge rates from appliances should be a primary consideration of the designer. Typical discharge rates are listed in Table 3 of Part one. The sizes of outlets, traps and pipework should be such that the discharge from sanitary appliances is not unduly restricted below such values.

Pipes serving more than one appliance should be sized taking account of simultaneous discharge. A value of 99% is recommended as a minimum criterior of satisfactory service for such calculations.

4.2 Exclusion of Foul Air

Conventional gravity discharge systems rely on water filled traps at the appliances for the exclusion of foul air from buildings. The water seal depth should, therefore, be large enough, after possible loss due to evaporation and pressure fluctuations, to prevent foul air from the discharge pipe system or drain from entering the building.

For WCs there should be sufficient trap water for the containment of excreta. In this Standard trap seal depths of 75 mm are recommended for traps with diameters of up to and including 50 mm and for traps with diameters larger than 50 mm, trap seal depths of 50 mm can be acceptable. Additional information on trap performance is given in Table 9. Pressure fluctuations should be limited in order to retain these water seals and thereby prevent foul air from entering the building. The discharge pipe systems should be so designed that positive and negative pressures do not exceed 38 mm water gage and that at least 25 mm of water seal is retained in the traps. These limitations are based on the worst likely discharge conditions.

Note:

For some situations where the pressure and loss criteria are likely to be exceeded resealing traps are given as a design solution.

TABLE 9 - TRAP PERFORMANCE DATA

TYPICAL SEAL LOSS (due to negative pressure (suction) of 375 N/m^2 (38 mm water gage) in discharge system)		**TYPICAL EVAPORATION LOSS**	
Trap details	Approximate seal loss	Trap detail	Accepted average figure per week
Typical washdown WC, 50 mm seal depth	25 mm	Small and large bore traps	2.5 mm
Small diameter tubular trap, 75 mm seal depth	19 mm		

4.3 Limitation of Noise

The discharge from sanitary appliances and pressure fluctuations in the pipework causing seal loss, are important sources of noise. The pipework designed to limit pressure fluctuations, as per Clause 4.2 will tend to be quiet. Another source of noise is the flow of water in discharge branches and

stacks. This can be reduced by sound insulation of the pipework from the structure and of the containing ductwork.

4.4 Hydraulics and Pneumatics of Discharge Systems

The sanitary discharge systems comprising of branch discharge pipes,discharge stacks and the ventilated stack system should be designed as per design guidances and properly executed in accordance with standard drawings referred in Clauses 5 and 6.

4.5 Classification of Discharge Systems

The discharge systems in this Standard is classified as follows and adoption of any one of them depending on particular arrangement of sanitary appliances is acceptable. See Std. Drg. No. IPS-D-CE-500.

a) Ventilated system

A ventilated system can be used in situations where there are large numbers of sanitary appliances in ranges or where it is impracticable to provide discharge stack(s) in close proximity to the appliances. Trap seals are safeguarded by extending the discharge and ventilating stacks to atmosphere and providing individual branch ventilating pipes for each and all appliances.

b) Ventilated stack system

The ventilated stack system can be used in situations where close grouping of appliances makes it practicable to provide branch discharge pipes without the need for branch ventilating pipes. Trap seals are safeguarded by extending the stack(s) to the atmosphere and by cross-connecting the ventilating stack to the discharge stack.

c) Single stack system

The single stack system can be used in situations as described in (b) but only where the discharge stack is large enough to limit pressure fluctuations without the need for a ventilating stack.

5. DESIGN OF SANITARY PIPEWORK

5.1 General

In this Standard design guidances are given for the domestic and non-domestic buildings:

a) Domestic buildings include bungalows, houses, multi-storey flats and halls of residence. Typical features of these installations are single appliances connected to, and often closely grouped round, a discharge stack;

b) Non-domestic buildings such as offices, factories, schools and other types of public buildings. Typical features of these installations are ranges of appliances connected to the discharge stack by main branch discharge pipes. Generally, appliances cannot be so closely grouped round the stack as in domestic buildings.

5.2 Traps (See Fig. 7)

5.2.1 General

A trap which is not an integral part of an appliance should be attached to, and be immediately beneath its outlets and be self-cleansing. The internal surface of the trap should be smooth throughout.

All traps should be accessible and capable of being readily removed or dismantled.

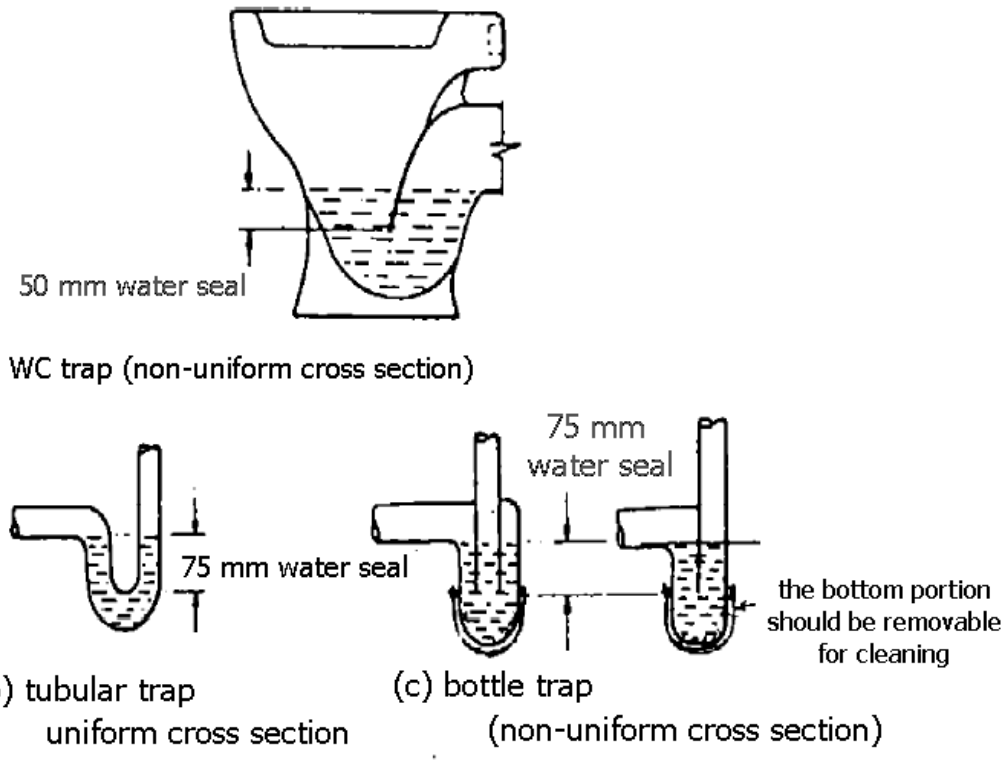
5.2.2 Depth of seals

a) Traps with outlets for pipes up to and including 50 mm size should have a minimum water seal of 75 mm (see Clause 4.2).

b) Traps with outlets for pipes over 50 mm size should have a minimum water seal of 50 mm (see Clause 4.2).

5.2.3 Diameters of tubular traps

The size of tubular traps should be not less than those given in Table (10).



TRAP TYPES (DIAGRAMMATIC)

Fig. 7

TABLE 10 - MINIMUM SIZES OF TUBULAR TRAPS

TYPE OF APPLIANCE	SIZE OF TRAP, mm	TYPE OF APPLIANCE	SIZE OF TRAP, mm
Wash basin	32	Drinking fountain	32
Bidet	32	Barwell-Beverages	32
Sink	40	Hotel or restaurant kitchen sink	40
Bath	40	Urinal (bowl)	40
Shower bath tray	40	Urinal (stall, 1 TO 6)*	65
Wash tub	50	Food-Waste disposal unit (industrial type)	50
Food-Waste disposal unit (domestic)	40	Sanitary towel macerator	40

*** Where there are more than six stalls in one range, more than one outlet should be provided.**

5.2.4 Bottle traps

This type of trap in which the division between the inlet and outlet legs is formed by a dip tube or vane within the body of the trap , should meet the requirements of 5.2.1 and 5.2.2. The size of inlet and outlet should be as given in 5.2.3 and there should be no reduction in flow area through the trap. This type of bottle traps are often used in conjunction with wash basins where the trap is exposed, or where there may be difficulty in fitting a tubular trap.

5.2.5 Resealing traps

These are specially designed traps for unventilated small size discharge pipes fitted to appliances where, because of the arrangement of the pipework, siphonage would otherwise occur.

5.2.6 Floor drainage gullies

Trapped floor drainage gullies are normally connected to branch pipes of 75 mm size or larger and are therefore not subject to seal loss due to self-siphonage. Infrequent use can however lead to total loss of seal due to evaporation. consequently, these traps should only be specified for areas where the usage will ensure that the trap seal is maintained (Clause 4.2).

5.3 Discharge Pipes and Stacks

5.3.1 General

Because of their different performance characteristics the branch discharge pipes and discharge stacks are dealt with separately.

5.3.2 Branch discharge pipes

5.3.2.1 Diameter

Sizes are given in clauses 6 and 7. Oversizing branch pipes to avoid self-siphonage problems can be uneconomic and can lead to an increased rate of deposit accumulation.

5.3.2.2 Gradients

The gradient of a branch discharge pipe should be uniform and adequate to drain the pipe efficiently. Practical considerations usually limit the minimum gradient to 1" or 1¼" (18 mm/m or 22 mm/m), but flatter gradients down to ½" (9 mm/m), when space is restricted, may be imposed on long runs of pipes with 100 mm and 150 mm diameter. Selfcleansing of pipes laid in flat gradients is only possible with high flow rates (e.g. of not less than 2.5 1/s).

Pipe sizes, gradients and pipe capacities are inter-related as discussed in Clause 6 and this relationship is vital for the 32 mm branches normally connected to wash basins. Vertical 32 mm branch pipe to wash basins with "s" traps often run full bore and ventilating pipework may be needed to prevent self-siphonage and noisy discharge (Clause 4.2 and 4.3).

5.3.2.3 Lengths

Branch discharge pipes, especially those serving wash basins and urinals, should be kept as short as practicable to reduce both self-siphonage effects and the accumulation of deposits. Large diameter branches serving WCs present fewer problems in these respects.

5.3.2.4 Branch pipe bends and junctions

Bends in branch discharge pipes should be avoided, especially for single and ranges of wash basins, as they can cause blockages and increase self-siphonage effects. When they are unavoidable they should be of large radius. Junctions between branch discharge pipes of about the same diameter, should be swept in the direction of flow using swept entry branches, with a 25 mm minimum root radius, see Std. Drg.: IPS-D-CE-503; otherwise 45° branches should be used.

5.3.2.5 Branch pipe connections to discharge stacks

For swept or unswept branch discharge pipe connections to discharge stacks of different permissible sizes and gradients refer to standard drawing No. IPS-D-CE-500, sheet 1 of 2.

5.3.2.6 Prevention of cross flow

Opposed small diameter branch discharge pipes without swept entries should be arranged so that the risk of the discharge from one branch into the other is avoided. For restricted and permitted connections refer to Std. Drg. IPS-D-CE- 501, sheet 2 of 2.

5.3.2.7 Direct connections to an underground drain

a) Gullies

It is often convenient in low rise houses, bungalows and ground floor flats, to discharge the waste water from some appliances, e.g. baths, wash basins and sinks, into an external gully. The appliances should be fitted with suitable traps and the discharge pipes should terminate below the grating but above the water level in the gully. To avoid self-siphonage of the trap seals and noisy discharges, provision of venting is recommended.

b) WC connections

WCs can be connected directly to a drain, without individual venting, provided that the vertical distance from the crown of the trap to the invert of the drain is not more than 1.5 m (Clause 4.2).

c) Stub stacks

A stub stack consists of a short, straight, 100 mm discharge stack with the top closed, preferably with an access fitting. It can be used for single storey buildings to connect one each of bath, wash basin, sink, washing machine and WC, directly to the drain provided that the crown of the WC trap is not more than 1.5 m from the invert of the branch drain and that the distance between the topmost connection to the stub stack and the invert of the branch drain is not more than 2 m. The method can also be used for ground floor appliances of buildings where it may be considered undesirable to connect them to the main discharge stack because of the effects of positive pressure at the base of the stack (Clause 4.2).

Note:

Direct connection to a drain for individual appliances or for stub stacks should only be made when the drain is adequately ventilated to safeguard trap seals.

5.3.3 Discharge stacks

5.3.3.1 Diameter

The internal diameter of a discharge stack should be not less than that of the largest trap or branch discharge pipe connected to it. The discharge stack above the topmost appliance connection should be continued without any reduction of diameter to the point of termination (see 5.3.3.5).

5.3.3.2 Bends and branches at the base of stacks

For recommended bend connections at the base of a discharge stack refer to Std. Drg. No. IPS-D-CE-503.

5.3.3.3 Offsets (see Std. Drg. IPS-D-CE-501)

Offsets in the wet portion of a discharge stack should be avoided. When they have to be fitted, large radius bends should be used.

5.3.3.4 Surcharging of the drain

If the drain, to which the discharge stack is connected, is likely to be surcharged, a ventilating pipe or stack should be connected to the base of the stack above the likely flood level. Ventilated systems may require larger ventilating stacks. Sizes are given in Clause 6 .

5.3.3.5 Termination of discharge stacks

The outlet of every discharge stack to the open air should be at such a height and position that foul air does not cause a nuisance or health hazard. For diagrammatic details refer to Std. Drg. IPS-D-CE--501.

5.4 Ventilating Pipes and Stacks

5.4.1 Branch ventilating pipes (see Std. Drg. IPS-D-CE-502)

5.4.1.1 Size

The size of ventilating pipes to branches from individual appliances can be 25 mm but, if they are

longer than 15 m or contain more than five bends, a 32 mm pipe should be used.

If the connection of the ventilating pipe is liable to blockage due to repeated splashing or submergence on a WC branch it should be 50 mm, but it can be reduced when above the spill-over level of the appliance.

5.4.1.2 Connections to stacks

For branch discharge pipes requiring relief venting the ventilating pipes can be connected to the ventilation stack in a ventilated system.

5.4.1.3 Connections to discharge pipes

Connections of ventilating pipes to the appliance discharge pipe should normally be as close to the crown of the trap as practicable but within 300 mm. Connections to the end of branch runs i.e. end venting, should be to the top of the branch pipe, away from any likely backflow which could cause blockage.

5.4.1.4 Installation

Ventilating pipes should be installed so that there is a continuous fall back into the branch discharge pipe system as a safeguard against the possibility of a condensation waterlock preventing the movement of air through the ventilating system and to minimize the risk of internal corrosion.

5.4.2 Ventilating stacks (see Std. Drg. IPS-D-CE-502)

5.4.2.1 Size

Sizes of ventilating stacks are given in Clause 6.3 and Table 11.

5.4.2.2 Connections

In ventilated and ventilated stack systems (Clauses 4.5a 4.5b)the ventilating stack can be joined to the discharge stack by cross-connections, usually on each floor. These cross-connections should slope upwards from the discharge stack

(67½° maximum) to prevent discharge water from entering the vent system and should be of the same diameter as the ventilating stack.

The lowest end of the ventilating stack should normally be connected to the discharge stack at or below the lowest branch connection; the upper end can be connected to the discharge stack above the spillover level of the topmost appliance, or pass through the roof to the atmosphere.

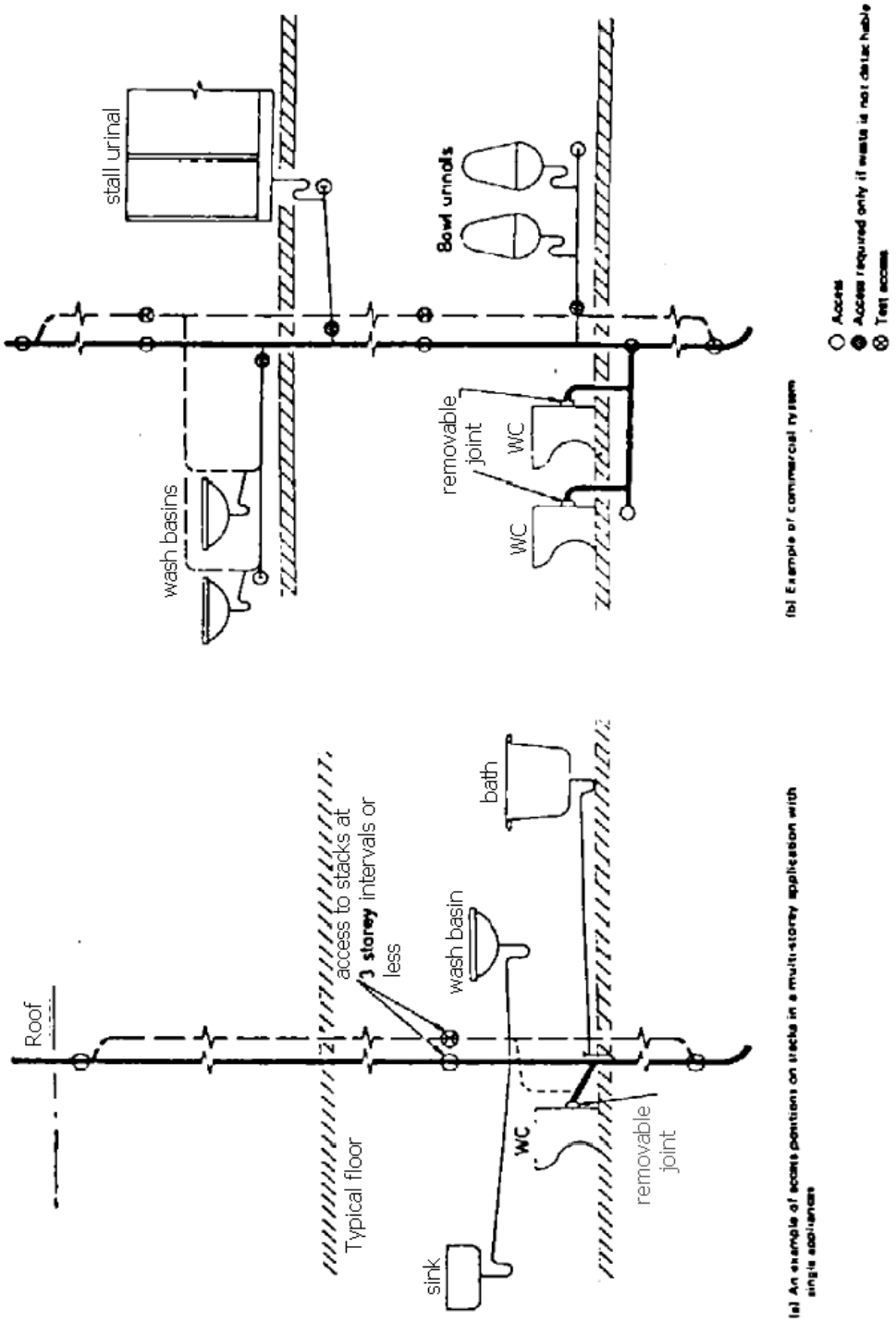
5.4.3 Termination of ventilating pipes and stacks

Ventilating pipe and stack outlets should be positioned as described for discharge pipe outlets (see Sub-Clause 5.3.3.5). 5.5 Access (see Fig. 8)

5.5.1 General

Sufficient and suitable access should be provided to enable all pipework to be tested and maintained effectively. The access covers, plugs or caps should be sited so as to facilitate the insertion of testing apparatus and the use of equipment for cleaning and/or for the removal of blockages. Their use should not be impeded by the structure or other services. Access points should not be located where their use may give rise to nuisance or danger if spillage occurs. This can be mitigated if they are above the spill-over level of the pipework likely to be affected by a

blockage and/or are extended to suitable positions at the face of a duct or casing, or at floor level.



ACCESS FOR CLEANING AND TESTING PURPOSES (DIAGRAMMATIC)
Fig. 8

5.5.2 Discharge and ventilating stacks

Where the vertical discharge pipe has a relatively long connection to a manhole, access for rodding and testing should be provided at or near the foot of the stack.

For multi-storey domestic buildings, access to the ventilating and discharge stacks should be provided at about 3 storey intervals or less to facilitate cleaning and to enable pressure tests to be carried out. For the same reasons access to the ventilating and discharge stacks in multi-storey offices and similar more complex systems should be provided on each floor.

5.5.3 Restaurant kitchens

In restaurant kitchens the risk of pipe blockage is increased by the higher proportion of grease and suspended solids in the waste water. In addition to the normal provision of access points on the discharge stack above the spill-over level of the appliances and at the high end of the branch discharge pipes, access should be provided close to appliances such as food waste macerators and vegetable paring machines where there is a high risk of blockage.

It is also necessary to ensure that access points are located in positions which will be accessible after the appliances have been installed .

5.6 Materials

The choice of material depends on the size and function of the pipe- work, the temperature and constituents of the discharge and the ambient conditions including temperature. Other considerations are the weight, physical strength, ease of assembly and maintenance requirements of the pipework.

5.7 Special Design Requirements

5.7.1 Restaurant kitchens

The peak rate of waste discharge normally would occur during washing up periods rather than in food preparation phase. Crockery wash machines vary in size and according to the capacity of the machine may use water from 125 litres/ h with a peak flow rate in the order of 80 litres/min to in excess of 600 litres/h with a peak of 180 litres/min. The flow rate of waste discharge from kitchen appliances should, therefore, be calculated on the basis of the capacity and peak usage of the appliances.

As it is of primary importance that there should be no loss of water seal in the traps on kitchen appliances an adequate ventilated system of drainage is mandatory.

5.7.2 Specific design requirements

For specific design requirements of sanitary pipework concerning restaurant kitchens and hairdressing salons refer to clause 8.7 of BS 5572:1978.

6. COMMONLY USED PIPEWORK ARRANGEMENTS; LAYOUT AND SIZING DATA

6.1 General

This clause contains data on the sizing of discharge and ventilating pipework and shows commonly used pipework arrangements for buildings within the scope of this Standard. All sizes assume a reasonable degree of maintenance. The information in this clause is based on the design limits given in Clause 4 and in particular on the flow and usage data in Table 3 of Part 1.

For typical examples of pipe sizing procedures refer to Appendix B of BS 5572.

6.2 Commonly Used Arrangements of Branch Discharge Pipes

6.2.1 General

The information given below should be used in conjunction with the figures referred to in the text and the general design recommendations in Clause 5.

6.2.2 Branch discharge pipes to single appliances

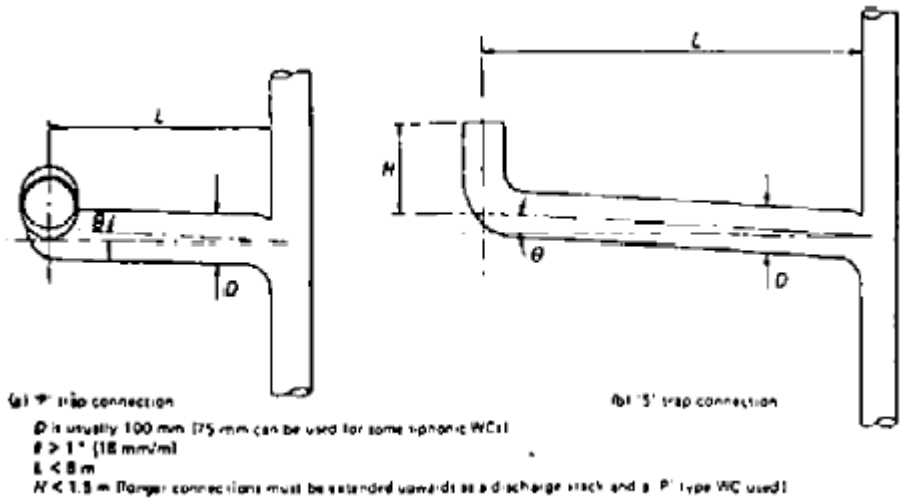
6.2.2.1 Water closets (see Fig. 9)

WC branches of 75 mm or 100 mm size do not normally require venting whatever the length or the number of bends included in the run. Bends, however, should have as large a radius as possible to prevent blockage.

6.2.2.2 Urinal (see Fig. 17 of BS 5572)

The large diameter branch pipes to stall urinals do not require venting. Branch pipes of 40 mm size serving single urinal bowls are unlikely to run full bore but, should siphonage occur, the trail off at the end of the cistern discharge will refill the trap, making venting unnecessary (Clause 4.2).

Because of the build-up of deposits all urinal branches should be as short as possible and should not exceed 3 m.



BRANCH DISCHARGE PIPES FOR SINGLE WCs

Fig. 9

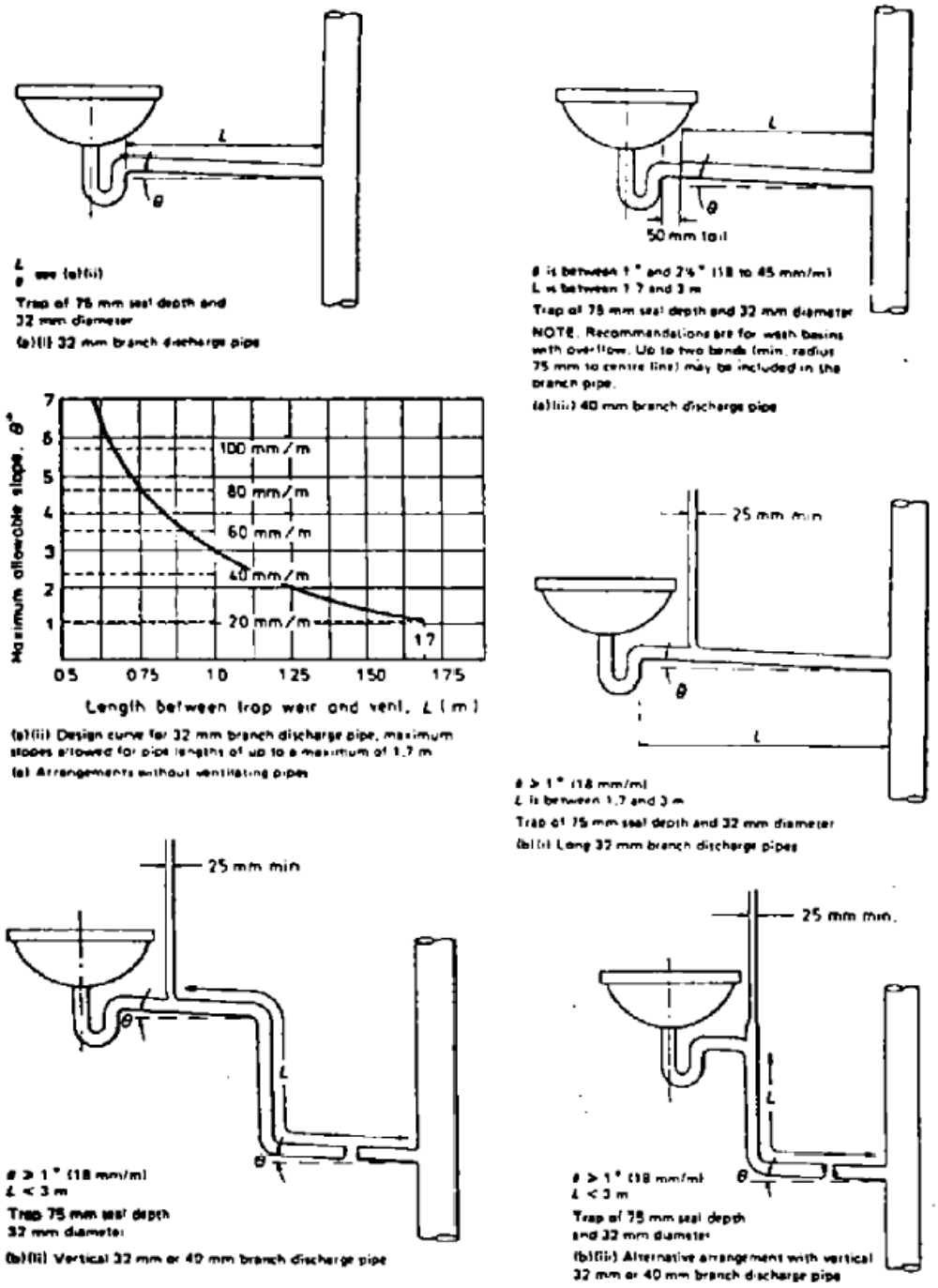
Note:

Any additional bends should be of large radius and the WC trap should have a 50 mm seal depth (see also Clause 5.3.2.5 forbranch connection to stack).

6.2.2.3 Wash basin, with plug waste (see Fig. 10)

Wash basins are normally fitted with 32 mm discharge pipes. The length and slope of the discharge pipes and the number and design of bends, should be strictly controlled if venting is to be avoided. Detailed information is given in Fig. 10(a)(i) and (ii). Arrangements outside these strict design limits should be vented or a larger diameter pipe used (see

Fig. 10 (a)(iii) and 10 (b). In situations where it is impracticable to comply with these conditions a suitable resealing trap may be fitted. If a vertical 32 mm discharge pipe is used with a "P" or "S" trap, venting or a resealing trap will probably be necessary.



L see (a)(ii)
Trap of 75 mm seal depth and 32 mm diameter
(a)(i) 32 mm branch discharge pipe

θ is between 1° and 2½° (18 to 45 mm/m)
L is between 1·7 and 3 m
Trap of 75 mm seal depth and 32 mm diameter
NOTE. Recommendations are for wash basins with overflow. Up to two bends (min. radius 75 mm to centre line) may be included in the branch pipe.
(a)(ii) 40 mm branch discharge pipe

(a)(ii) Design curve for 32 mm branch discharge pipe, maximum slopes allowed for pipe lengths of up to a maximum of 1·7 m
(a) Arrangements without ventilating pipes

θ ≥ 1° (18 mm/m)
L is between 1·7 and 3 m
Trap of 75 mm seal depth and 32 mm diameter
(b)(i) Long 32 mm branch discharge pipes

θ ≥ 1° (18 mm/m)
L < 3 m
Trap 75 mm seal depth
32 mm diameter
(b)(ii) Vertical 32 mm or 40 mm branch discharge pipe

θ ≥ 1° (18 mm/m)
L < 3 m
Trap of 75 mm seal depth and 32 mm diameter
(b)(iii) Alternative arrangement with vertical 32 mm or 40 mm branch discharge pipe

BRANCH DISCHARGE PIPES FOR SINGLE WASH BASINS

Fig. 10

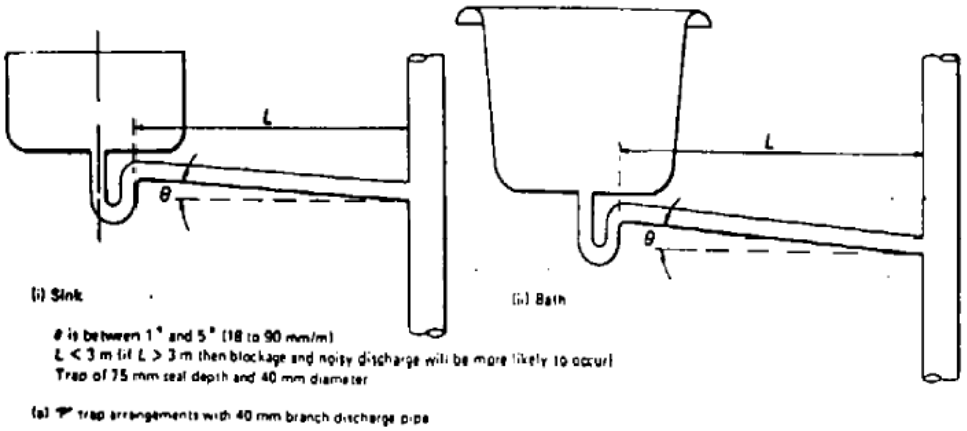
Notes:
1) Venting also required for more than two bends in the horizontal plane in the branch pipes shown in (a).
2) In all the arrangements shown in (a) and (b) above the traps may be mounted in a plane at 90 to that shown; for 'P' traps a bend may then be required (75 mm min. radius to center line for arrangements in (a)).

6.2.2.4 Bidets
Branch discharge pipes to bidets should be designed to the recommendations as given for wash

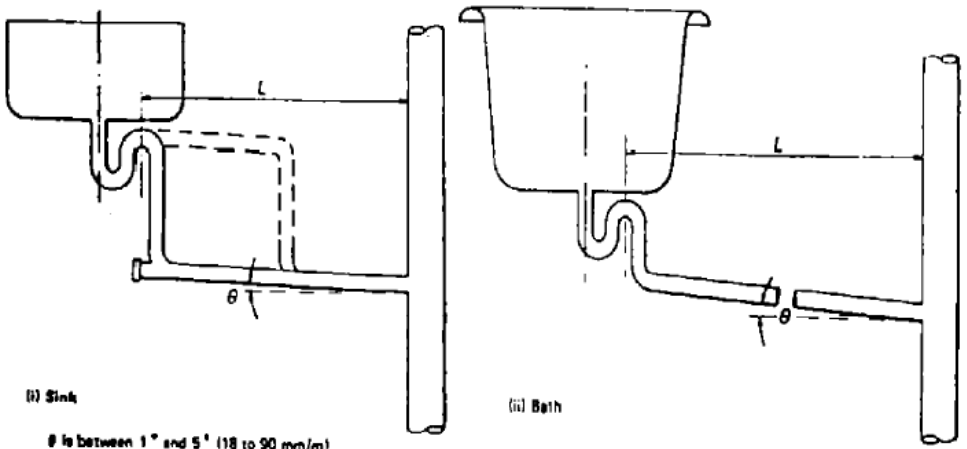
basins with plug wastes (sub-Clause 6.2.2.3).

6.2.2.5 Sinks and baths (see Fig. 11)

These appliances are normally fitted with 40 mm discharge pipes. Self-siphonage is not a problem because of the trap seal replenishment which occurs at the end of the discharge due to the flat bottom of the sink or bath. Therefore length and slope of the discharge pipe are not so critical and venting is not normally required although the maximum length should be restricted to 3 m to reduce the likelihood of blockage from deposits.



(a) 'P' trap arrangements with 40 mm branch discharge pipe



(b) 'P' and 'S' trap arrangements with vertical 40 mm diameter branch discharge pipes

BRANCH DISCHARGE PIPES FOR SINGLE BATHS AND SINKS

Fig. 11

Note:

Traps may be mounted in a plane at 90° to that shown; for "P" traps a bend (75 mm min. radius to center line) may then be required.

6.2.2.6 Showers

Flow rates from showers are small so that the 40 mm discharge pipe usually fitted does not require venting. However difficulties may arise in achieving a self-cleansing velocity and adequate provision should be made for cleaning (Clause 4.2).

6.2.2.7 Domestic automatic washing machines and dish washing machines (see Fig. 12)

Requirements may vary slightly but the arrangements shown in Fig. 12 should suit most machines.

A 40 mm size discharge pipe is necessary, which can be connected either directly to a discharge stack or gully, or to a sink branch pipe. Normally a trap should be fitted in the horizontal section of the discharge pipe but this is not required for connections via a sink branch pipe, when made at the inlet of a sink trap using a suitable fitting (Clause 4.2).

Note:

Some of the arrangements in Fig. 12 show loose connections between the machine drain hose and discharge pipe. Some machines require this air break to prevent siphonage of water from the machine during operation. However, if the discharge pipe develops a blockage, water will overflow during the emptying cycle. This can also occur with the method in which the sink discharge pipe is used. The vented arrangement for machines in dwellings not exceeding four storeys avoids this disadvantage.

6.2.2.8 Floor drainage gullies

Branch pipes to floor drainage gullies are normally 75 mm size or larger and do not generally run full. Consequently, venting is not normally required and the slope and length of the branch is not critical (Clause 4.2).

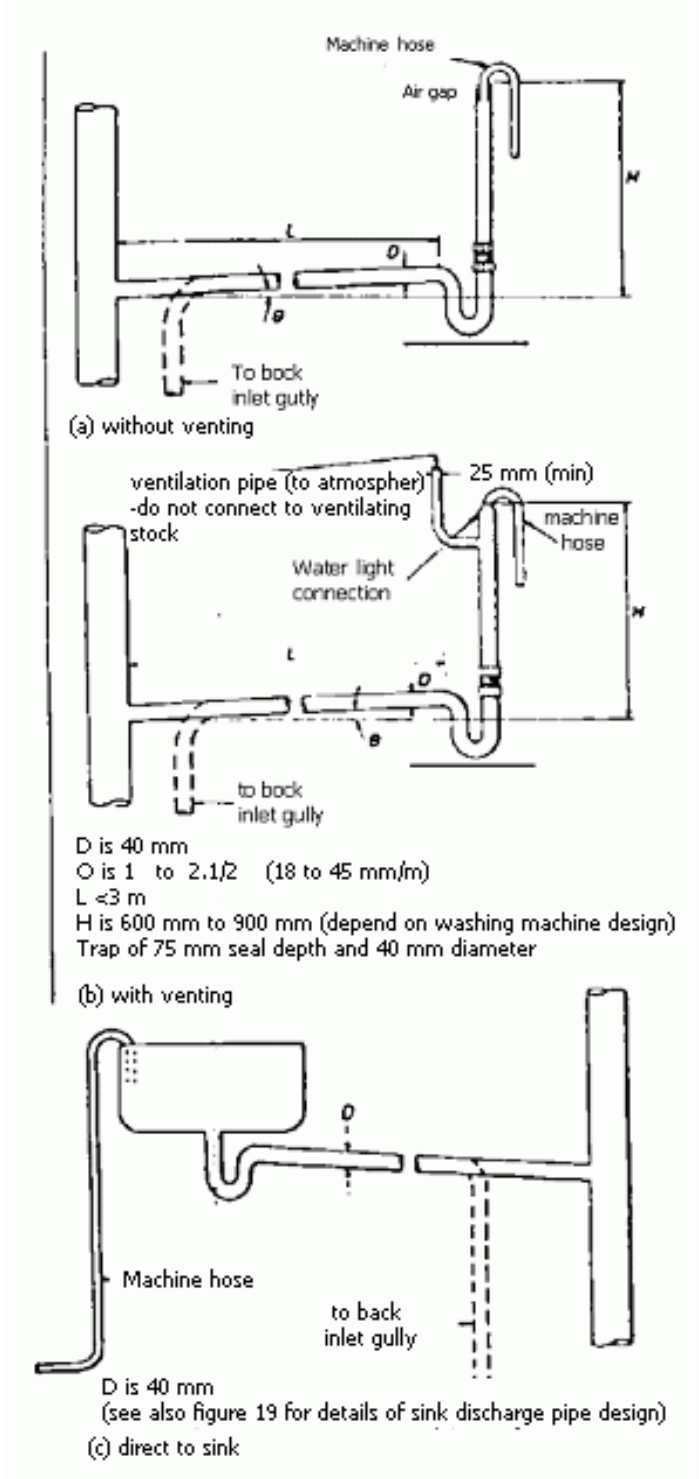
6.2.3 Branch discharge pipes to ranges of appliances

6.2.3.1 Ranges of WCs (see Std. Drg. IPS-D-CE-503)

Branch pipes serving ranges of WCs are normally 100 mm size and there is usually no need for branch venting. Length and slope are not critical but venting may be necessary where there are several bends in the branch pipe or more than eight WCs are connected (Clause 4.2).

6.2.3.2 Ranges of urinals (see Fig. 23 of BS 5572)

Because of the large size main branch pipes (50 mm to 75 mm) normally used with ranges of stall and bowl urinals, no venting is needed. However, the 40 mm branch joining a bowl urinal to the main branch pipe (50 mm size min.) should be kept as short as possible (Clause 4.2).

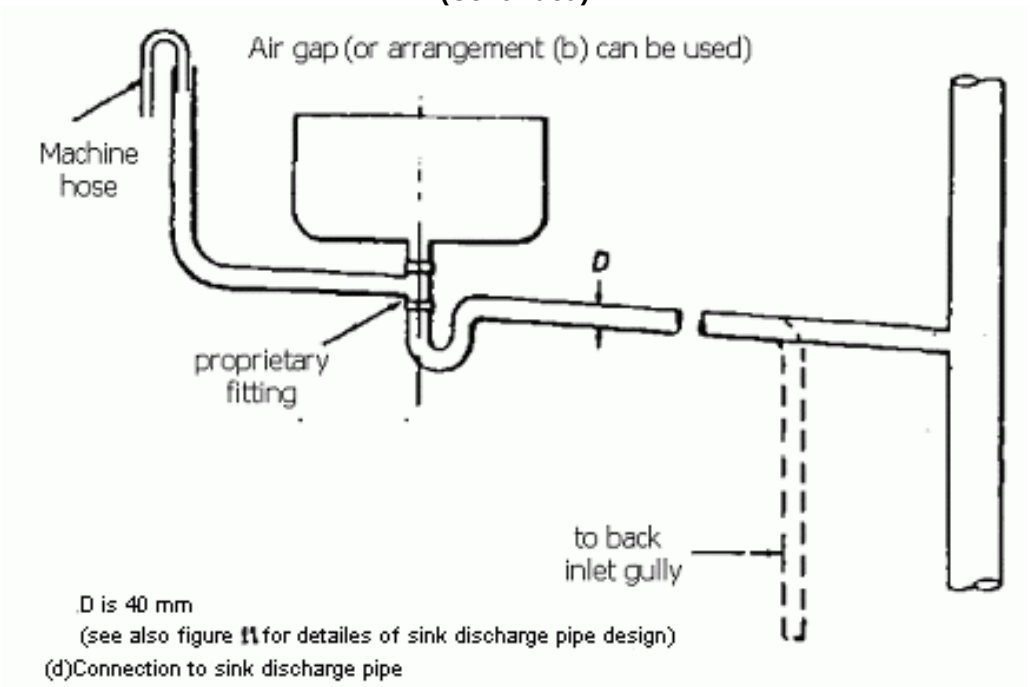


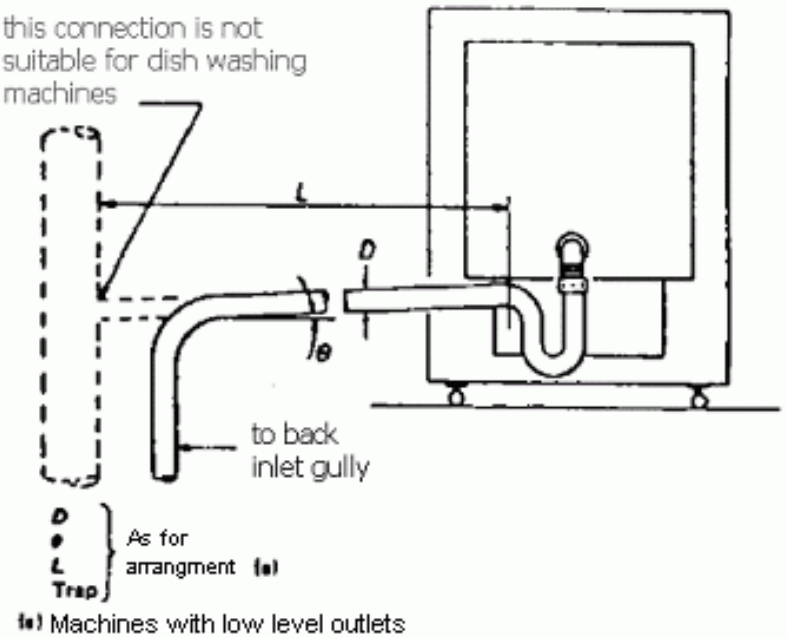
BRANCH DISCHARGE PIPES FOR WASHING AND DISH WASHING MACHINES

Fig. 12

(to be continued)

(Continued)





BRANCH DISCHARGE PIPES FOR WASHING AND DISH WASHING MACHINES (concluded)
Fig. 12

Note:
In arrangement (a), blockage in branch or trap will cause overflow through air gap. In arrangement (b) blockage in branch or trap will cause water to be discharged through the ventilating pipe. Hence terminate ventilating pipe outside building or over another appliance. In arrangement (d), blockage in branch or trap will cause machine water to back up into the sink.

6.2.3.3 Ranges of wash basins

Venting is often needed with ranges of wash basins but some arrangements requiring no venting

are also shown in the Std. Drg. IPS-D-CE-503.

6.3 Commonly Used Arrangements of Discharge Stacks and Branches

6.3.1 Stack sizing table

Table 11 gives sizes of discharge and ventilating pipes and stacks for various appliance arrangements. These arrangements, lettered from A to E, are shown in Fig. 13.

Note:

The ventilation stack requirements are affected not only by the number of appliances but sometimes also by the branch pipe design detail (e.g. whether 'S' or 'P' traps are used).

6.3.1.1 Assumptions

The following assumptions apply together with those given in 6.1 and 6.2.1:

a) A criterion of satisfactory service of 99 %;

b) there are no offsets in the discharge stack below the topmost appliance connection and the stack is truly vertical; the additional ventilating pipework needed with offsets is given in Clause 6.3.2;

c) WCs with 9 litres cisterns are used;

d) the drain serving the base of the stack is not likely to be surcharged and an intercepting trap is not fitted;

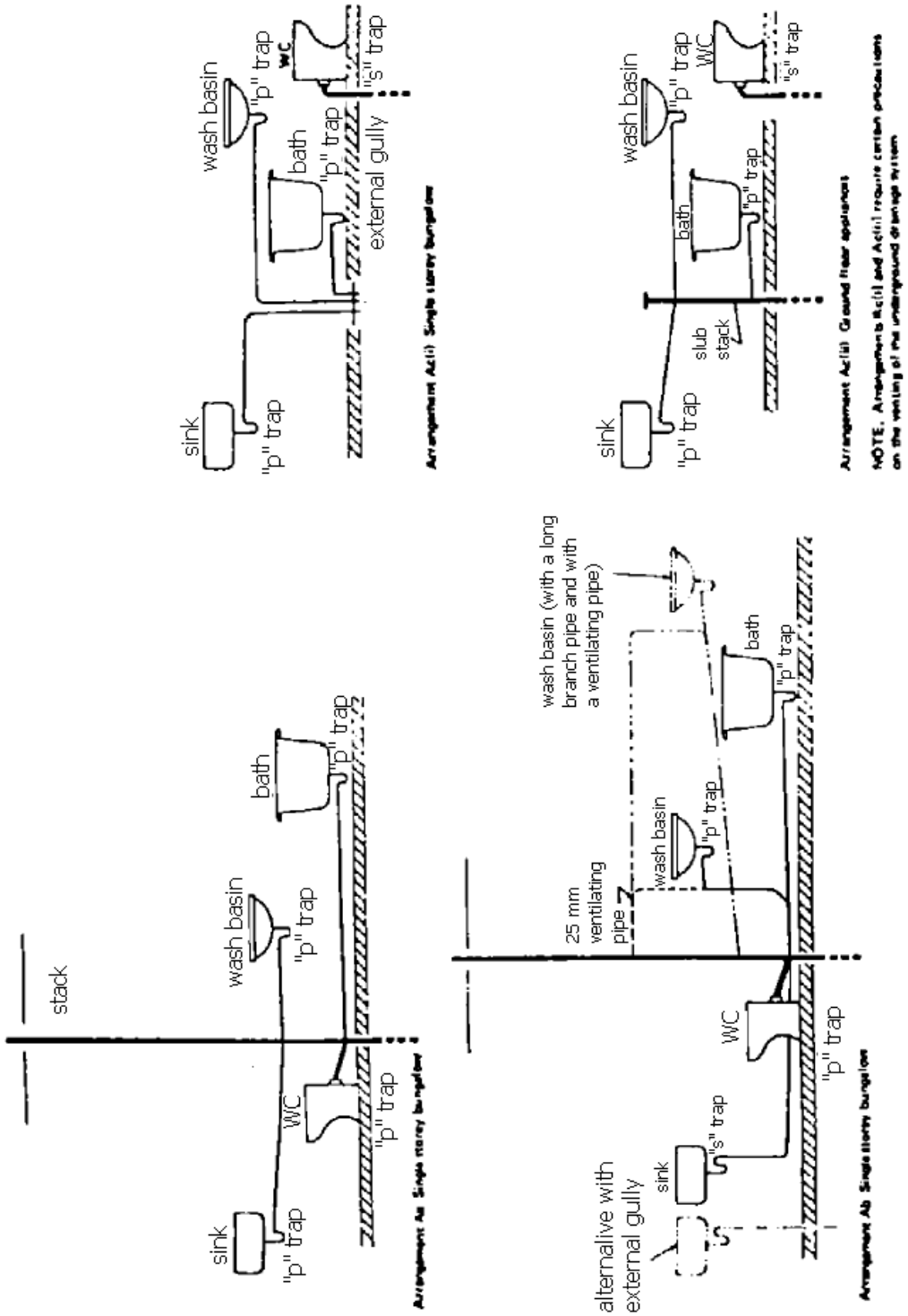
e) the branch discharge pipe sizes are as given in Clause 6.2.

A 'Group of appliances' is as follows:

1) In a domestic building, one WC
one wash basin one sink and one bath (and/or shower);
also one washing machine in buildings up to three floors;

2) in a hall of residence, one WC, one wash basin and one shower;

3) in a commercial building, one WC, one wash basin (see conversion table for urinals).



OMMON ARRANGEMENTS OF DISCHARGE STACKS AND BRANCHES (DIAGRAMMATIC)

Fig. 13

(to be continued)

(continuation)

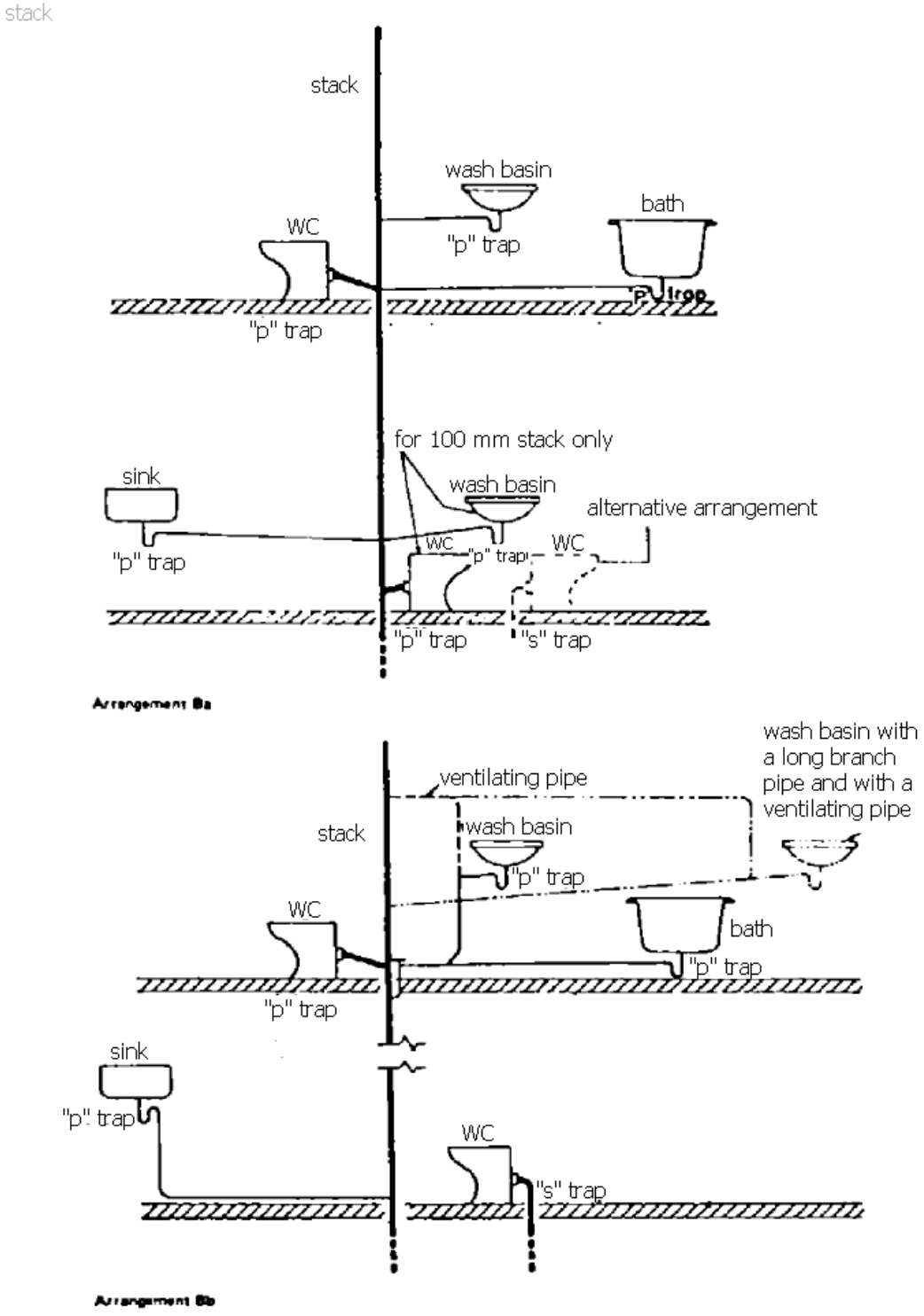
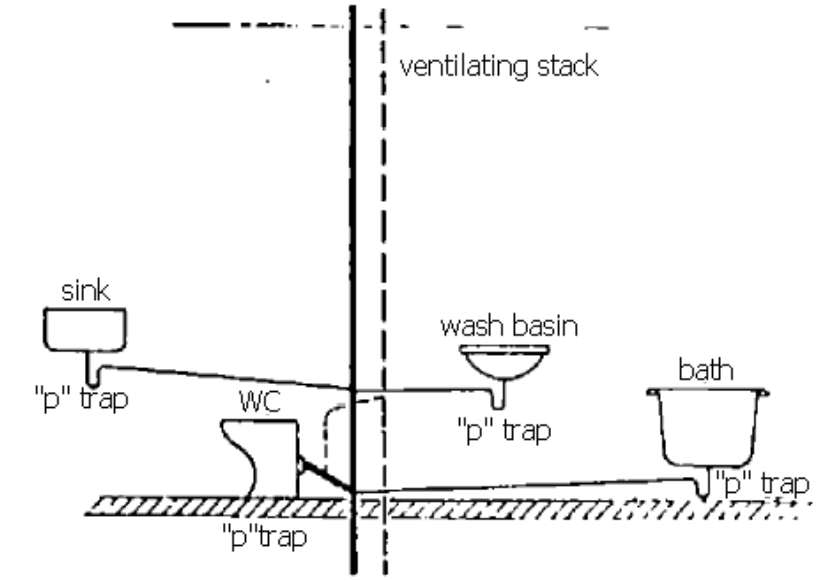


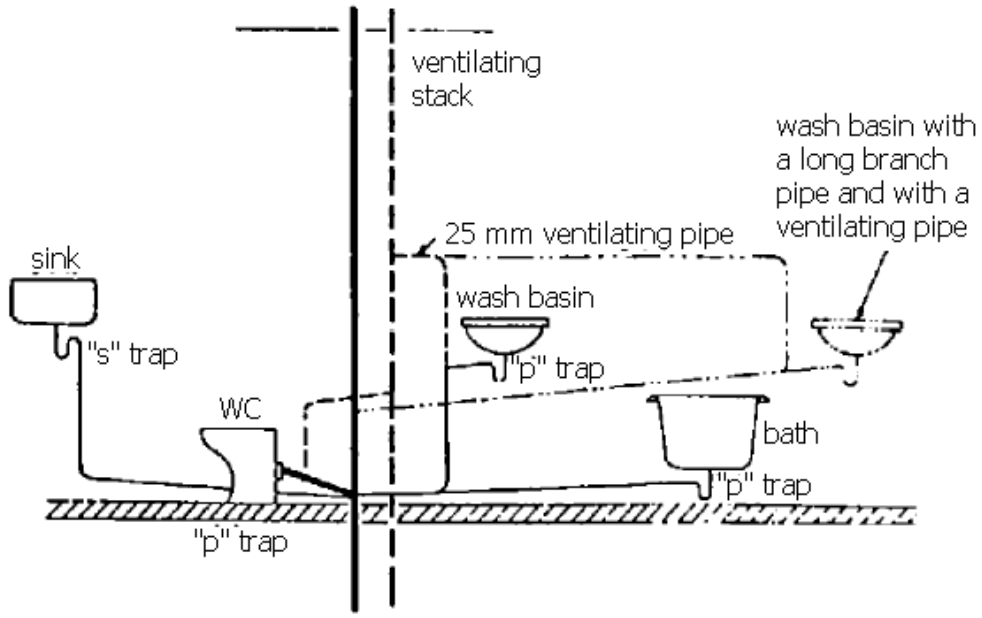
Fig. 13

(to be continued)

(continuation)



Arrangement Ca



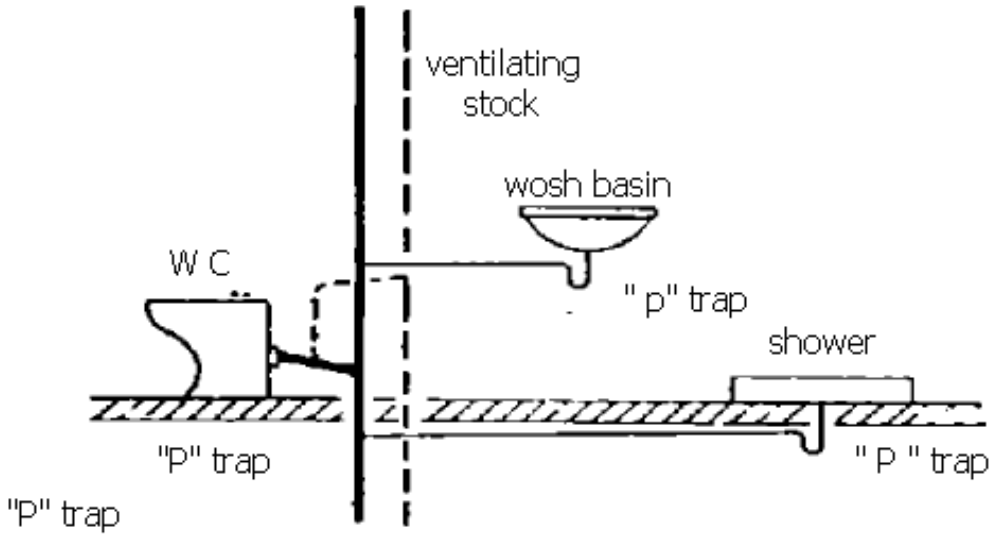
Arrangement Cb

Multi-storey flats

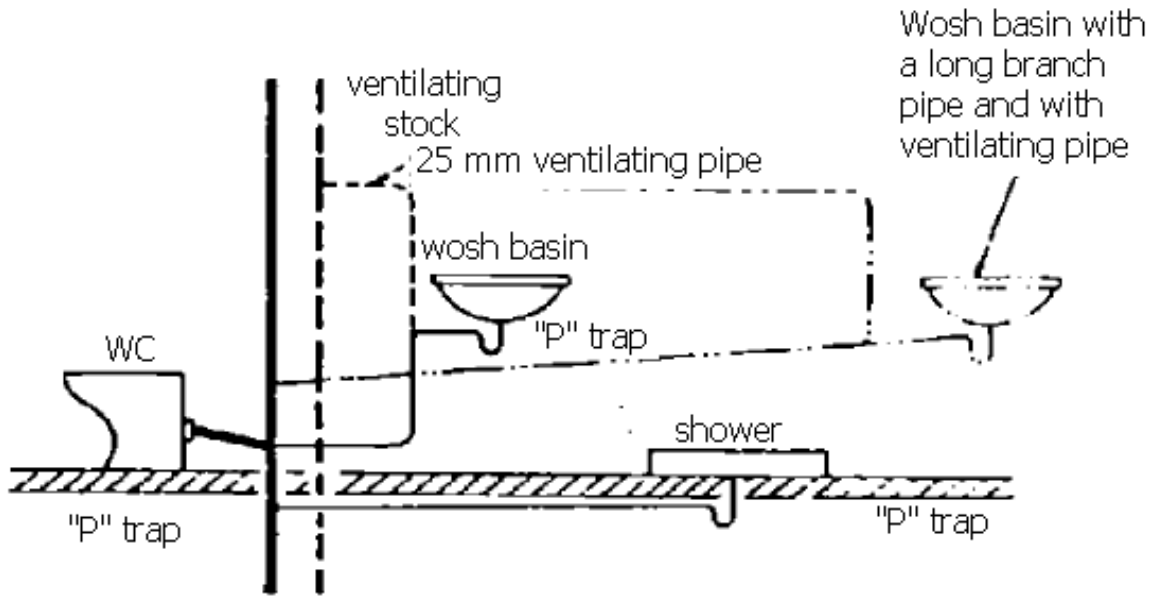
Fig. 13

(to be continued)

(continuation)



Arrangement Da



Arrangement Db

Multi-storey halls of residence

Fig. 13

(to be continued)

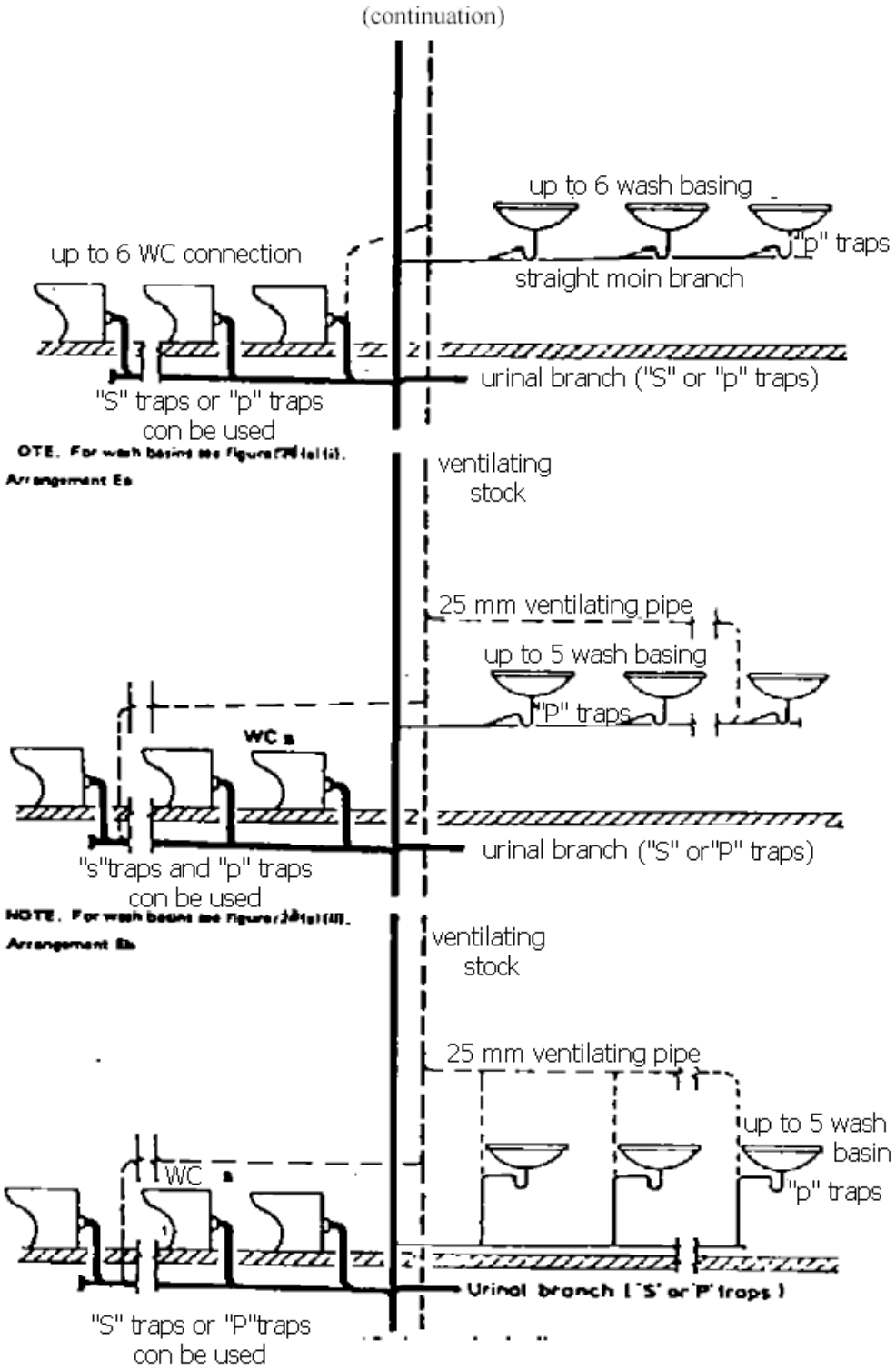


Fig. 13 (concluded)

Note:

1) Only 5 WCs and 5 wash basins per floor are referred to in table 4 on ventilating stack sizes. Arrangement Ec Commercial and public buildings

TABLE 11 - VENTILATING STACK SIZES (in mm) FOR COMMONLY USED ARRANGEMENTS OF DISCHARGE STACKS AND SWEPT ENTRY BRANCHES

Discharge stack size		75 mm	100 mm																150 mm											
Frequency of use		20 min	20 min				10 min									5 min						20 min	10 min			5 min			
Usage description		Domestic	Domestic				Hall of residence				Commercial					Congested						Domestic	Hall of residence	Commercial		Congested			
Number of floors		1 to 2	1 to 3	1 to 10		11 to 15	1 to 8		9 to 12		1 to 4		5 to 8		9 to 12	1 to 4		5 to 8		9 to 12		1 to 30	1 to 30	1 to 8	9 to 24	1 to 8		9 to 16		17 to 24	
Arrangements (see figure 26)		Aa Ab Ba Bb	Aa Ab Ac Ba Bb	Ca	Cb	Ca	Cb	Da	Db	Da	Db	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ca	Cb	Da	Db	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec	Ea	Eb Ec
Number of appliance groups (per floor)	1	0	0	0	32*	50	50	0	32*	32	32	0	32*	0	32*	32	32	0	32*	0	32*	32	32	0	32*	0	32*	0	32*	0	32*	0	32*	0	32*	0	32*
	2		0	0	32*	50	50	0	32*	32	32	0	32*	0	32*	32	32	0	32*	50	50	50	50	0	32*	0	32*	0	32*	0	32*	0	32*	0	32*	0	32*
	3											0	32*	32	32	40	40	0	32*	50	50							0	32*	0	32*	0	32*	0	32*	65	65
	4											0	32*	40	40	40	40	32	32*									0	32*	75	75*	0	32	75	75	75	75
	5											0	32*	40	40				32*									0	32*	75	75*	0	32	75	75	75	75

*Modified single stack arrangement (see **8.4.2.3**).
NOTE 1. See **9.3** for design assumptions and definition of the term 'appliance groups'.
NOTE 2. Connections from the ventilating stack to the discharge stack required on each floor level except where indicated by '*'
NOTE 3. With non-swept WC branch connections to a stack, a single stack system can be used for appliance layouts Aa, Ab, Ba, Bb, Ca and Cb when restricted to not more than two groups of appliance per floor in the following situations:
up to 4 floors with 100 mm discharge stack;
up to 15 floors with 150 mm discharge stack.
For pipe sizing other systems with non-swept connections, see **10**.
NOTE 4. the following are conversions to be used with the above table (see **9.3.1.2**).

WC		Urinal		Wash basin		WC		Wash basin
2	+	1	+	2	Equivalent to	2	+	2
2	+	2	+	3		3	+	3
3	+	3	+	4		4	+	4
4	+	4	+	5		5	+	5

6.3.1.2 Conversion table for stacks serving WCs, basins and urinals

Table 11 includes a conversion table to enable systems serving wash basins, WCs and urinals to be sized for commercial or congested usage. It gives four examples of WC/urinal/wash basin combinations that may be taken as hydraulically equivalent to WC/wash basin combinations in Table 11.

6.3.2 Ventilating stack sizes for offsets in discharge stacks (see Sub-Clause 5.3.3.3)

Offsets in the "wet portion" of a discharge stack generally require the connection of a ventilating stack, the diameter of which should be half the diameter of the discharge stack. The distance between the center lines of the nearest branch connections and the offset should be at least 750 mm.

6.3.3 Ventilating pipe sizes for systems subjected to drain surcharging

Discharge stacks connected to drains which are likely to surcharge, generally require large diameter ventilating pipes, at least 75 mm size for a 100 mm discharge stack and 100 mm size for a 150 mm discharge stack (Clause 4.2).

7. PIPE SIZING USING DISCHARGE UNIT METHOD

7.1 General

This method can be used for special installations, e.g. systems for very tall or large buildings, not covered by the data in Clause 6.3.

For engineering guidances refer to clause 10 of BS 5572:1978.