BRITISH STANDARD

BS 5572:1994

Code of practice for

Sanitary pipework

UDC 696.14:696.12.621.643.2

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/505, Wastewater Engineering, to Subcommittee B/505/21, Roof drainage and sanitary pipework, upon which the following bodies were represented:

Association of Building Component Manufacturers
Brewers Society
British Bathroom Council
British Plaster Federation
British Plumbing Fittings Manufacturers' Association
British Pump Manufacturers' Association
Clay Pipe Development Association
Consumer Policy Committee of BSI
Department of the Environment (Building Research Establishment)
Department of the Environment (Construction Directorate)
Department of the Environment (TBV Consult)
Institute of Building Control
Institute of Clerks of Works of Great Britain
Institute of Plumbing
Institution of Water and Environmental Management
METCOM
National Association of Plumbing, Heating and Mechanical Services
Royal Institute of British Architects
Scottish Office (Building Directorate)

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Contents

Foreword

This British Standard has been prepared under the direction of Technical Committee B/505 "Wastewater Engineering". It supersedes BS 5572:1978, which is withdrawn.

The recommendations on design and workmanship are based on improved technology in plumbing and research undertaken by the Building Research Establishment and product manufacturers, the results of which have been proved in practice. In particular, the sizing of pipework, the grouping of appliances for drainage purposes, the calculation of discharge flows, the jointing of pipes and fittings of varying materials and maintenance aspects have all been covered in greater detail.

This revision has come at a time when changes are likely in the ranges of pipe sizes available. This should not cause difficulty as, generally, small variations from the stated internal diameter do not critically affect performance. An exception is an unvented branch pipe serving a single wash basin, the size of which does have a pronounced effect on performance. The type of basin and trap also has an influence. Consequently, a minimum size has been quoted for this arrangement, for a particular basin and trap design. Work is in hand to provide more data for a range of pipe sizes, basin and trap types.

A new clause (**5**) dealing with the performance requirements of discharge pipe systems has been included and it is hoped that this can be enlarged in future revisions of this standard to enable performance to be included in more detail than is possible at present.

The drawings contained in this standard are only diagrammatic, their purpose being to complement the text and portray design principles.

The normative references are currently all British Standards. As European Standards are published they will replace the relevant British Standards and be the subject of amendment to this publication.

BSI recognizes that the European committee CEN/TC 165 is in the process of drafting a performance specification for drainage systems inside buildings, for publication in late 1995. The UK has participated in this work and expects this code of practice to be fully consistent with the requirements of the European Standard. The UK will willingly withdraw those parts of BS 5572 that are found to be either in conflict with, or the same as, the published European Standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 76, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard gives recommendations for the design, installation, testing and maintenance of above ground gravity sanitary pipework and fittings for domestic, commercial and public buildings, with the exception of trade waste discharges and any special requirements of buildings such as hospitals or research laboratories.

NOTE The term above ground includes all 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.

2 References

2.1 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 76. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on page 76, but reference should be made to the latest editions.

2.3 Materials, appliances and components

All materials, appliances and components used in the discharge system described should conform to the relevant British Standards listed in Annex A.

3 Definitions

For the purposes of this British Standard, the definitions given in BS 6100-2.7:1992 and Section 3.3:1992 apply, some of which have been reproduced below, together with the following.

NOTE For the purposes of this standard, pipes and pipework include fittings.

3.1
access cover

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

3.2
branch discharge pipe

a *discharge pipe* connecting sanitary appliances to a discharge stack

NOTE Repeated from BS 6100.

3.3
branch ventilating pipe

ventilating pipe connected to a *branch discharge pipe*

NOTE Repeated from BS 6100.

3.4
criterion of satisfactory service

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

3.5
crown of trap

the topmost point of the inside of a trap outlet

3.6
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

3.7
discharge pipe

pipe which conveys the discharge from a sanitary appliance

NOTE Repeated from BS 6100.

3.8
discharge unit

a unit so chosen that the relative load-producing effect of sanitary appliances can be expressed as multiples of that unit

NOTE The discharge unit rating of an appliance depends on its rate and duration of discharge, on the interval between discharges and on the chosen criterion of satisfactory service. It is not a simple multiple of a rate of flow.

3.9
sanitary pipework

arrangement of *discharge pipes,* with or without *ventilating pipes,* connected to a drainage system

NOTE Repeated from BS 6100.

3.10
size

the term used in this standard to indicate the nominal internal diameter of pipes regardless of specific materials and their classification or description in other publications

NOTE The relationship between size as used in this standard and as in other publications is shown in Table 1.

3.11
stack

a main vertical *discharge* or *ventilating pipe*

3.12
stack vent

extension of a vertical *discharge pipe* above the highest *discharge pipe* connection that terminates in an end open to atmosphere

NOTE Repeated from BS 6100.

3.13
trap

pipe fitting or part of a sanitary appliance that retains liquid to prevent the passage of foul air

NOTE Repeated from BS 6100.

3.14
anti-syphon trap

a trap that includes a self-closing valve, which permits air to enter when suction occurs during discharge, to prevent siphonage

NOTE Also known as anti-vacuum trap.

3.15
resealing trap

a trap that retains sufficient liquid during a discharge to ensure a seal of at least 25 mm depth after siphonage has occurred

3.16
ventilating pipe

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

NOTE Repeated from BS 6100.

4 Exchange of information

4.1 General

Consultation is essential between clients, architects and engineers at all stages of the design of buildings to ensure efficient and economic planning of the sanitary installations and the discharge system and the provision and positioning of ducts, in relation to the building as a whole.

Details of sewers and any precautions necessary to ensure satisfactory working of the discharge systems, for example information on the possibility of surcharging and details of statutory regulations, should be obtained from the local authority. Specific requirements of the water companies should be ascertained.

Alterations or extensions to existing work will probably need a survey and report which should include the following:

a) the type of drainage system in use and drain and sewer loadings;

b) details and positions of appliances connected to the system;

c) a description of the pipework and its condition;

d) particulars of the ventilation of the pipework system;

e) the results of tests (see **10.3**).

4.2 Statutory requirements

Attention is directed to the following statutory requirements relating to matters dealt with in this standard.

a) Public Health Act 1936 and 1961 and London Government Act 1963 [1].

b) Building Act 1984 [2].

c) Current Building Regulations for England and Wales, Northern Ireland and Scotland [3].

d) Sewerage (Scotland) Act 1968 [4].

e) Food Act 1984 [5].

f) Food Hygiene (General) Regulations 1970 [6].

g) Health and Safety at Work etc. Act 1974 [7].

h) Control of Substances Hazardous to Health (COSHH) Regulations 1988, 2nd edition [8].

i) Workplace (Health, Safety and Welfare) Regulations 1992 and approved code of practice [9].

j) Current Education (School premises) Regulations [10].

k) Technical Regulations for Places of Public Entertainment in Greater London 1965 [11].

Users of this standard should ensure that they are referring to the latest editions of the statutory regulations mentioned.

Local authorities are responsible for the enforcement of most of the regulations and information required by them may include the following:

1) information on the number, position and types of appliances to be installed (BS 6465-1) and details of the proposed use of the premises;

2) notification on the appropriate forms and particulars of the proposed work;

3) drawings and specifications.

NOTE Some local authorities may have special powers or requirements in local Acts.

Before commencing the work the contractor should be in possession of copies of the drawings as approved by the appropriate authorities, together with the specification and any further working drawings and information necessary to enable the work to be carried out.

Table 1 — Equivalence between size as defined in this standard and as in other publications

Size	Iron		Copper	Steel		Plastics				Borosilicate glass	Stainless steel
	BS 416	BS 437	BS 2871	BS 1387	BS 3868	BS 3506	BS 4514 See note 2	BS 5254 See note 2	BS 5255 See note 2		
	Nominal bore	Nominal bore	Size of tube	Nominal bore	Nominal bore	Nominal size	Nominal size	Nominal size	Nominal size	Nominal bore	Nominal size
mm	mm	mm	mm	mm	mm	in	mm	in/mm	in/mm	mm	mm
25	—	—	28	25	—	1	—	—	—	25	—
32	—	—	35	32	32	1¼	—	1¼/32	1¼/32	—	—
40	—	—	42	40	40	1½	—	1½/40	1½/40	40	—
50	50	50	54	50	50	2	—	2/50	2/50	50	50
65	65	—	67	65	65	2½	—	—	—	—	—
75	75	75	76.1	80	80	3	82.4	—	—	80	75
90	90	—	—	—	—	—	—	—	—	—	—
100	100	100	108	100	100	4	110	—	—	100	100
125	125	—	133	125	125	5	—	—	—	—	—
150	150	150	159	150	150	6	160	—	—	150	160

NOTE 1 Exact pipe internal diameters can be ascertained by reference to the appropriate British Standards.

NOTE 2 These pipes are unsuitable for pumped discharges. The pressurized pipework for pumped discharges should be made from pipes of a specification intended for pressure applications. In some instances this may involve using a pipe capable of taking higher pressures than are necessary.

5 Performance

5.1 General

Discharge pipe systems should comprise the minimum of pipework necessary to carry away the discharges from sanitary appliances in the building quickly, quietly and with freedom from nuisance or risk of injury to health. It is essential that air from the discharge pipes or drainage system be prevented from entering the building.

Where one or more stub stack connections discharge to a drain, the head of that drain should be ventilated by a ventilating stack or discharge stack that terminates externally to atmosphere.

5.2 Discharge

5.2.1 *General*

Required discharge rates from appliances should be a primary consideration of the designer. Typical discharge rates for the UK are listed in Table 2. 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. Table 2 also gives information on the duration and frequency of use of appliances that may be used in calculations of simultaneous discharge. A value of 99 % is recommended as a minimum criterion of satisfactory service for such calculations.

5.2.2 *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. Additional data on traps is given in Table 3.

Pressure fluctuations should be limited in order to retain these water seals and thereby prevent foul air from entering the building. Systems designed in accordance with this standard have positive and negative pressures that do not exceed 38 mm water gauge and 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 recommended as a design solution.

5.2.3 *Limitation of noise*

Noise generated by discharge systems should be limited so as to maintain environmental quality in buildings. The discharge from sanitary appliances and pressure fluctuations in the pipework causing seal loss are important sources of noise, but systems designed to limit pressure fluctuations, as in **5.2.2**, will tend to be quiet. Noise may be reduced by sound insulation of the pipework from the structure and of the containing ductwork. Secure fixing of pipes will contribute to noise limitation.

5.2.4 *Containment of water and air*

The discharge pipework system should prevent the leakage of contaminated water and foul air into the building.

5.2.5 *Resistance to blockage*

The discharge pipework should be so designed as to minimize the risk of blockage.

5.2.6 *Durability*

The discharge system including materials, joints, supports and fixings should be durable under operating conditions.

5.2.7 *Access for maintenance*

Discharge pipework should be easily accessible and traceable. Access covers and/or cleaning eyes should be positioned to allow cleaning and maintenance equipment to be easily inserted into the pipework, and to permit cleaning or clearing of all parts of the system.

5.2.8 *Replacement*

The pipework system and fittings should be designed and installed so that defective parts can be replaced without undue difficulty.

5.2.9 *Accessibility for testing*

Systems should be capable of being tested to ensure that the required performance is attained. Adequate access should be provided to enable tests to be carried out.

Table 2 — Flow and usage data of some sanitary appliances

Appliance	Specified capacity	Maximum discharge rate ls^{-1}	Duration of discharge (t) s	Minimum interval of discharge (T) s	Individual probability (p) of discharge $p = \frac{t}{T}$
Washdown WC with high level cistern	9 l[a]	2.0	7	1 200 600 300	0.0058 0.0117 0.0233
	7.5 l[a]	2.0	6	1 200 600 300	0.0050 0.0100 0.0200
	6 l	2.0	5.8	1 200 600 300	0.0048 0.0097 0.0193
Washdown WC with low level cistern	9 l[a]	1.8	7.1	1 200 600 300	0.0059 0.0118 0.0237
	7.5 l[a]	1.8	6.4	1 200 600 300	0.0053 0.0107 0.0213
	6 l	1.8	6.2	1 200 600 300	0.0052 0.0103 0.0207
Washdown WC with close coupled cistern	9 l[a]	1.2	9	1 200 600 300	0.0075 0.0150 0.0300
	7.5 l[a]	1.2	8	1 200 600 300	0.0067 0.0133 0.0267
	6 l[a]	1.2	6.5	1 200 600 300	0.0054 0.0108 0.0217
Washdown WC fitted with a macerator	9 l[a]	0.4	31	1 200 600 300	0.0258 0.0517 0.1033
	7.5 l[a]	0.4	30	1 200 600 300	0.0250 0.0500 0.1000
	6 l	0.4	29	1 200 600 300	0.0242 0.0483 0.0967

Table 2 — Flow and usage data of some sanitary appliances

Appliance	Specified capacity	Maximum discharge rate ls^{-1}	Duration of discharge (t) s	Minimum interval of discharge (T) s	Individual probability (p) of discharge $p = \frac{t}{T}$
Urinal (per person unit)	2.5 l	0.15	20	1 200	0.0167
Wash basin (32 mm branch)	6 l	0.6	10	1 200 600 300	0.0083 0.0167 0.0333
Sink (40 mm branch)	23 l	0.9	25	1 200 600 300	0.0208 0.417 0.0834
Food waste disposal unit		0.2	90	1 500	0.006
Bath (40 mm branch)	80 l	1.1	75	4 500 1 800	0.0167 0.0417
Spray tap basin		0.06			
Electric shower	7 kw to 8 kw	0.07	300	1 200 86 400	0.0250 0.0035
Low pressure shower (per Spray head)	⩽ 0.6 bar head[b]	0.15	300	1 200 86 400	0.0250 0.0035
High pressure shower (per Spray head)	> 0.6 bar head[b]	0.15 to 0.35	300	1 200 86 400	0.0250 0.0035
Automatic washing machine	4 kg to 5 kg dry load	0.6	30	240 Note 1 900 15 000	0.1250 0.0333 0.0200
Dish washing machine	12 to 14 place settings	0.25	20	180 Note 2 1 200 86 400	0.1110 0.0166 0.0002

NOTE 1 A washing machine will discharge at various intervals during any selected programme. The maximum number of discharges will be 6 and the volume discharged each time will be in the order of 20 l. Hence:

240 s represents the minimum time between rinses;

900 s represents a mean discharge interval of 15 min during the use of the machine;

15 000 s represents a 4.2 h interval between uses of the machine.

NOTE 2 A dishwasher will discharge at various intervals during any selected programme. The maximum number of discharges will be 5 and the volume discharged each time will be in the order of 6 l. Hence:

180 s represents the minimum time between rinses;

1 200 s represents a mean discharge interval of 20 min during the use of the machine;

86 400 s represents daily use of the machine.

The above data applies to 1990 models; older machines will generally discharge greater volumes at lower flow rates for longer periods e.g. a 1970s washing machine would discharge at about 0.1 l/s for around 3 min.

NOTE 3 For discharges from non-domestic appliances see **6.7.1.1**.

[a] British Standard WC cistern capacities have the following tolerances 9 l ± 0.5 l (BS 1125) $7.5^{+0}_{-0.5}$ l (BS 7357).

[b] 1 bar = 10^5 N/m^2 = 10^5 Pa.

5.3 Hydraulics and pneumatics of discharge systems

5.3.1 *General*

For design purposes it is convenient to consider separately the effects of the flow in branch discharge pipes and the flow in discharge stacks.

5.3.2 *Branch discharge pipes*

Loss of water seal from the trap of a discharging appliance may occur by self-siphonage if the branch discharge pipe flows at full bore. Traps on appliances not discharging may also suffer seal loss by induced siphonage if the branch discharge pipe to which they are connected is flowing full bore or if conditions of flow in the vertical stack create negative pressure. These seal losses (see Figure 1) will be affected by the following:

a) the design of the appliance, e.g. funnel-shaped appliances increase the chance of self-siphonage;

b) the length, slope and size of the pipe;

c) the type of trap and waste fittings, grid design and free cross-sectional area at the outlet;

d) whether or not the appliance has an overflow which is connected into the waste fitting or to the trap;

e) the design of pipework fittings, particularly bends;

f) the provision or not of a branch ventilating pipe.

5.3.3 *Discharge stacks*

Water flowing in discharge stacks will cause air pressure fluctuations. Suction can occur below discharging branch connections and offsets, causing water seal loss by induced siphonage from appliances connected to the stack. Back pressures or positive pressures can occur above offsets and bends in stacks causing foul air to be blown through the trap water seal and, sometimes, seal loss. These seal losses (see Figure 2) will be affected by the following:

a) the flow load, depending on the total number and type of appliances connected to the stack, their distribution on each floor of the building and the frequency with which they are used;

b) the height and diameter of the stack, excessive seal losses being prevented by selecting the size of stack appropriate to the number of appliances connected to it and the height of the building;

c) the design of pipe fittings, particularly the shape and size of branch inlets and the radius of the bend at the base of the stack connecting it to the drain;

d) changes of direction in the wet portion of the discharge stack;

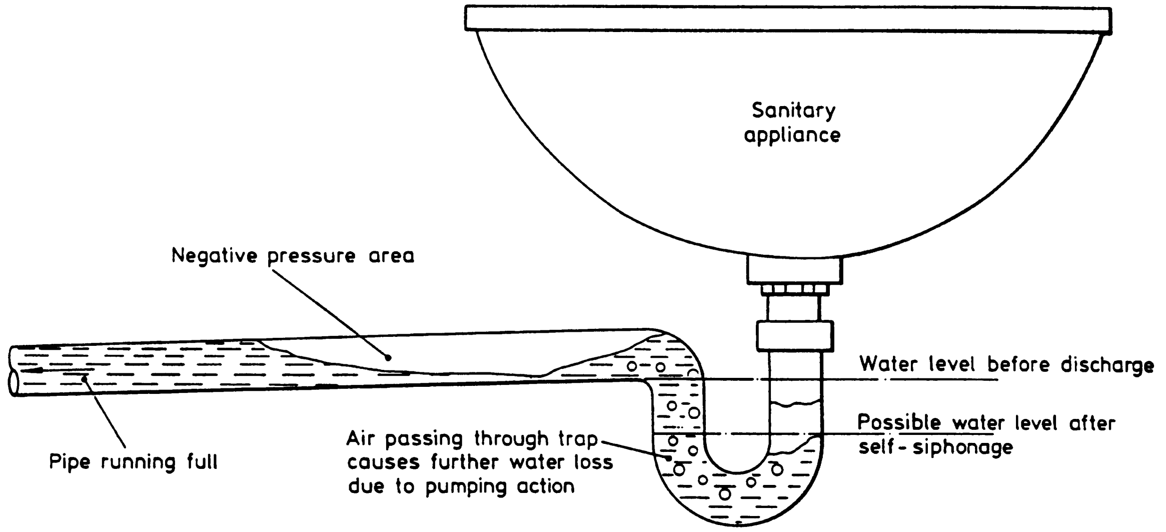
e) provision, or not, of a ventilating pipe;

f) surcharging of the drain;

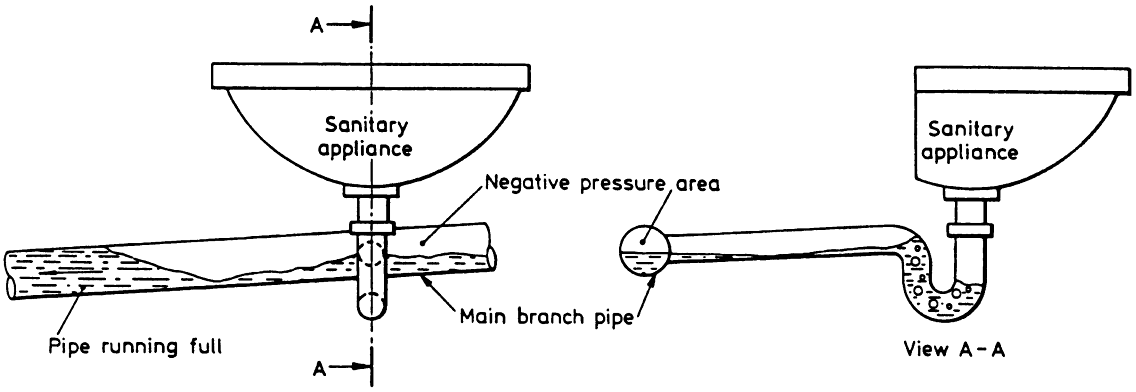
g) provision, or not, of an intercepting trap in the drain.

Table 3 —Trap seal loss data

Typical seal loss (due to negative pressure (suction) of 325 N/m^2 (38 mm water gauge) in discharge systems)		Typical evaporation loss	
Trap datails	**Approximate seal loss** mm	**Trap detail**	**Accepted average figure per week** mm
Typical washdown WC, 50 mm seal depth	25	Small and large bore traps	2.5
Small diameter tubular trap, 50 mm or 75 mm seal depth	19		

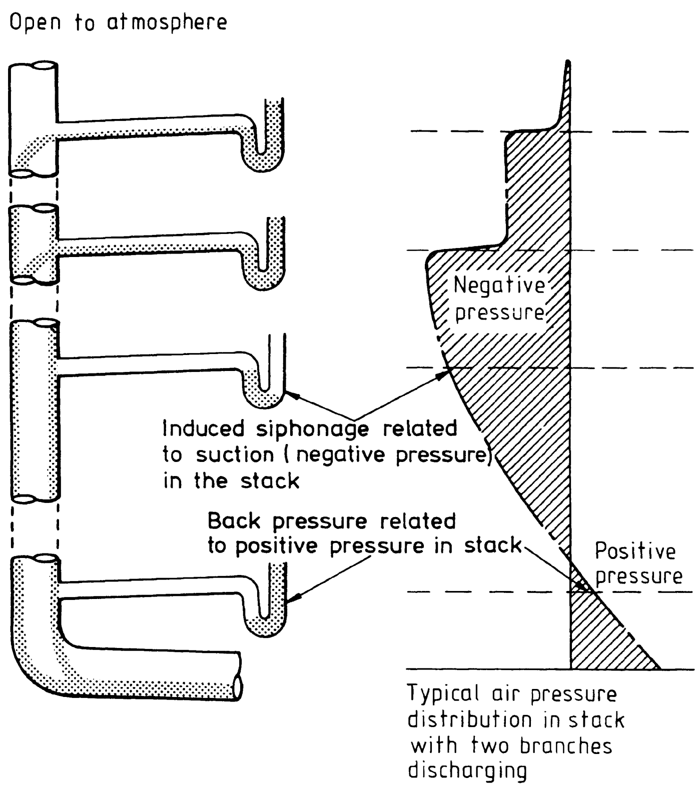


a) Self-siphonage (at the end of an appliance discharge)



b) Induced siphonage (due to full bore flow in a main branch discharge pipe)

Figure 1 — Seal loss due to flow in branch pipes



NOTE Connection close to base of stack is not recommended but is shown here to illustrate pressure effects.

Figure 2 — Pressure effects and seal losses due to water flow in a discharge stack

5.3.4 ***Additional information on discharge stacks***

5.3.4.1 *Shape and size of branch inlets*

Suction produced in the discharge stack below discharging branch inlets is affected by the radius or slope of the branch inlet. A large radius or a 45° entry will tend to minimize the amount of the suction but a near horizontal entry with a small radius will tend to have the opposite effect. Branch inlets which are significantly smaller in diameter than the stack are not so critical in this respect (see **6.3.2.5**).

5.3.4.2 *Bends and offsets*

Sharp bends at the base of a stack can cause large back pressures due to restriction of the stack air flow and, similarly, offsets of less than 3 m length in the wet part of a stack can produce large pressure fluctuations. Changes in stack direction can also cause foaming of detergents and consequent pressure fluctuations (see **6.3.3.2** and **7.3.2**).

5.3.4.3 *Surcharging of the drain*

If the drain to which the discharge stack is connected is surcharged, the normal flow of air down the stack during discharge is interrupted and high back pressures can occur. Under these conditions additional stack ventilation will be required (see **7.3.3**). Lightly loaded stacks, however, do not require additional stack ventilation, i.e. dwellings of no more than three storeys.

5.3.4.4 *Intercepting traps*

In a situation where a single discharge stack is connected to a drain fitted with an intercepting trap in close proximity, large pressure fluctuations can occur. Additional stack ventilation may then be necessary (see **7.3.3**).

5.3.4.5 *Wind effects*

Wind blowing across roofs can produce pressure fluctuations in the vicinity of parapets and corners of the building. If discharge or ventilation stacks are terminated in these areas unacceptable pressure fluctuations can be developed in the discharge system (see **6.3.3.7**).

5.3.4.6 *Admission of rainwater into discharge stacks*

In some areas with combined drainage systems, discharge stacks are permitted to receive rainwater from roof areas. However, rainwater pipes are not permitted to receive foul or waste discharges. The rainwater outlet should be trapped unless it is in a position where termination of a stack vent is permitted. In very long stacks, e.g. a 30 storey building, quite small continuous flows of rainwater can cause excessive pressure fluctuations. There is also the danger of flooding if a blockage occurs in the discharge stack or underground drain during a heavy rainstorm especially if the roof area served is large (see **6.3.3.5**, **6.3.3.6** and **6.3.3.7**).

Consequently it is generally recommended that the practice is limited to roof areas of not more than 40 m^2 per stack and to buildings of not more than 10 storeys in height. Within these limitations the appropriate data in Table 5 can be used with no increase in ventilating stack size (see **5.2.2**).

5.3.4.7 *Effects of pumped or ejected discharge*

Where it is necessary to pump or eject the effluent, the method of discharge to the building drainage system should be such that the rate of flow and the location of the discharge will not cause pressure fluctuations which might adversely affect the performance of the gravity system.

The exhaust compressed air from pneumatic ejectors should not be discharged into the gravity drainage ventilation system but should be discharged to atmosphere separately.

5.3.5 ***Description of discharge systems***

The discharge systems can conveniently be classified as follows.

a) *Ventilated system* (see Figure 3)

A ventilated system is used in situations where there are large numbers of sanitary appliances in ranges or where they have to be widely dispersed and 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.

b) *Ventilated stack system* (see Figure 4)

A ventilated stack system is 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* (see Figure 5 and Figure 6)

A single stack system is 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.

A modified single stack system, providing ventilating pipework extended to the atmosphere or connected to a ventilating stack, can be used where the disposition of appliances on a branch discharge pipe could cause loss of their trap seals. The ventilating stack need not be connected directly to the discharge stack and can be smaller in diameter than that required for a ventilated stack system.

6 Design

6.1 General

Recommendations in this standard are based, wherever possible, on appliances, pipes and fittings that conform to British Standards.

This clause and clauses **7** and **8** give detailed design data for the following:

a) domestic buildings including 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.

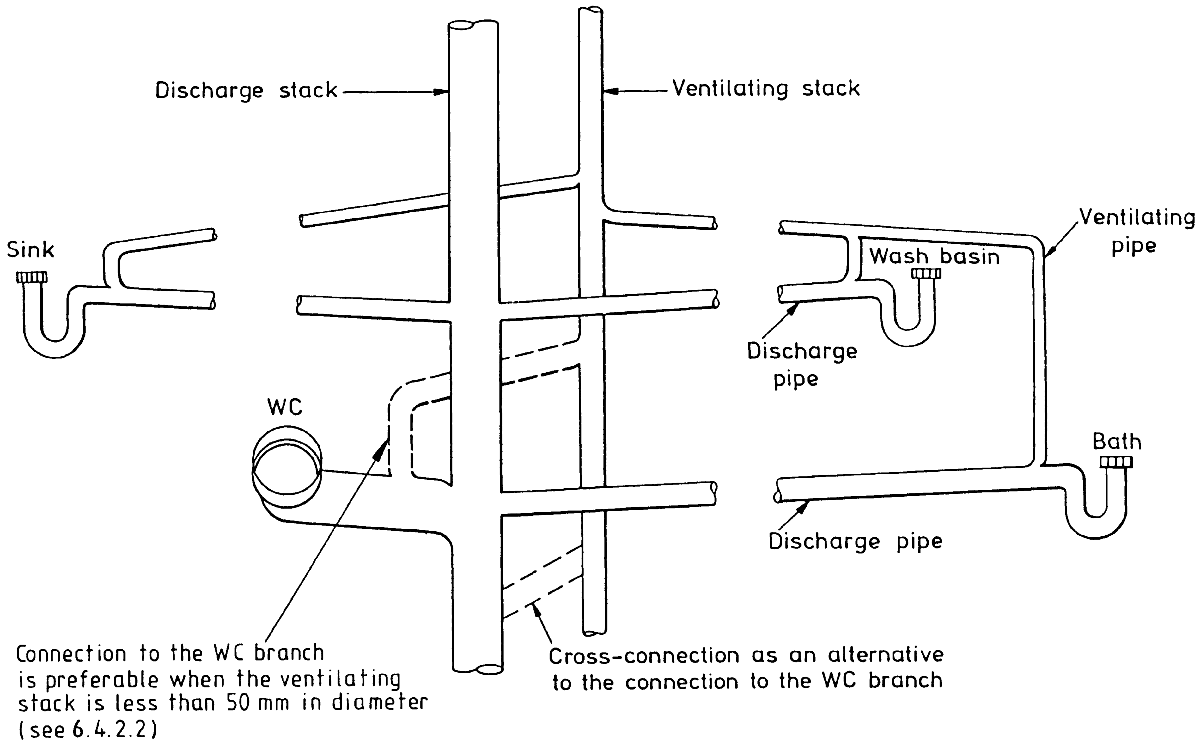
6.2 Traps (see Figure 7)

6.2.1 ***General***

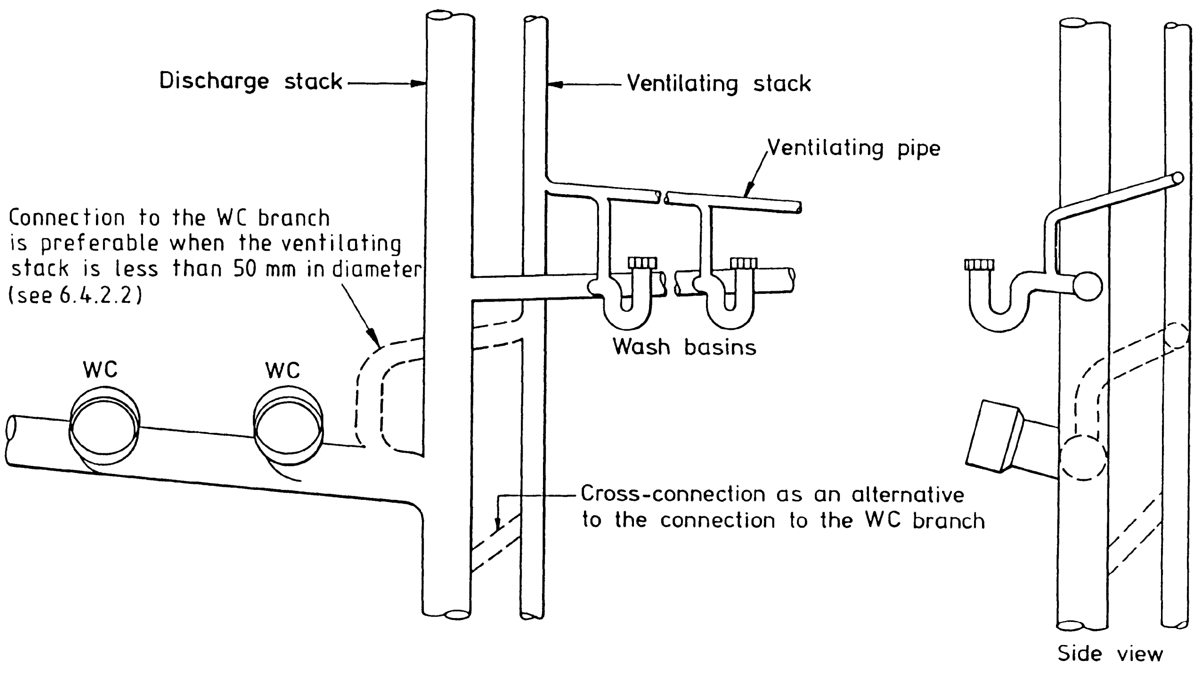
Designs in this standard are based on the use of traps with the basic dimensions as given in **6.2.2** and **6.2.3**.

Traps should be designed so that deposits do not accumulate. A trap which is not an integral part of an appliance should be attached to, and be immediately beneath, its outlet and be self-cleansing. The internal surface of the trap should be smooth throughout (see **5.2.5**).

All traps should be accessible and provided with an adequate facility for cleansing. There can be advantages in providing traps which are capable of being readily removed or dismantled (see **5.2.7**).



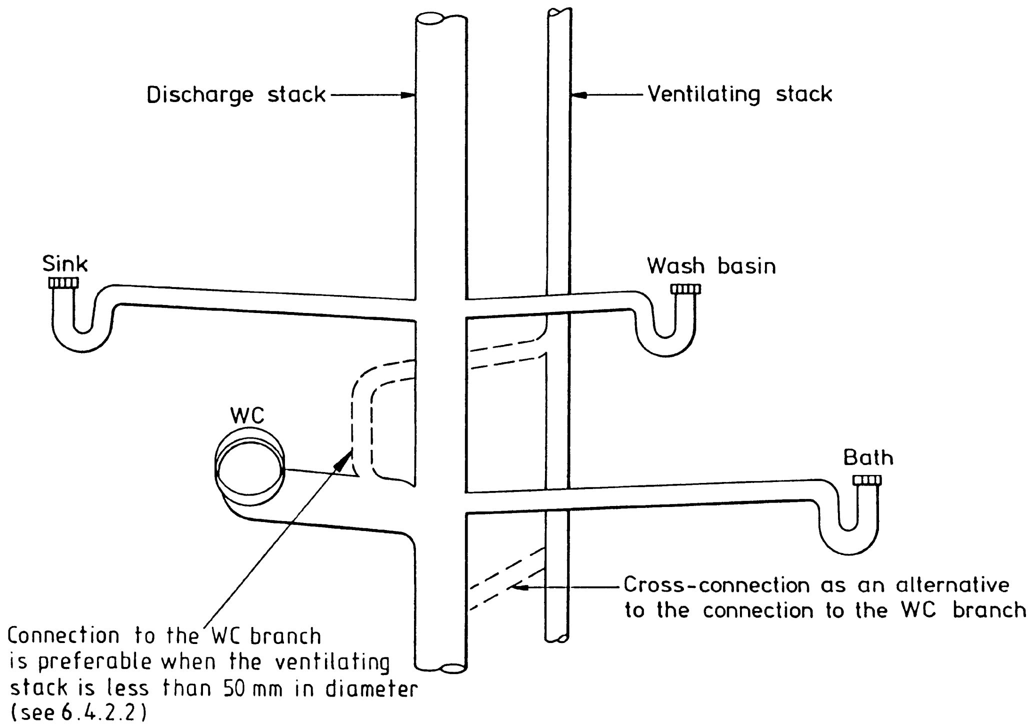
a) Single appliances



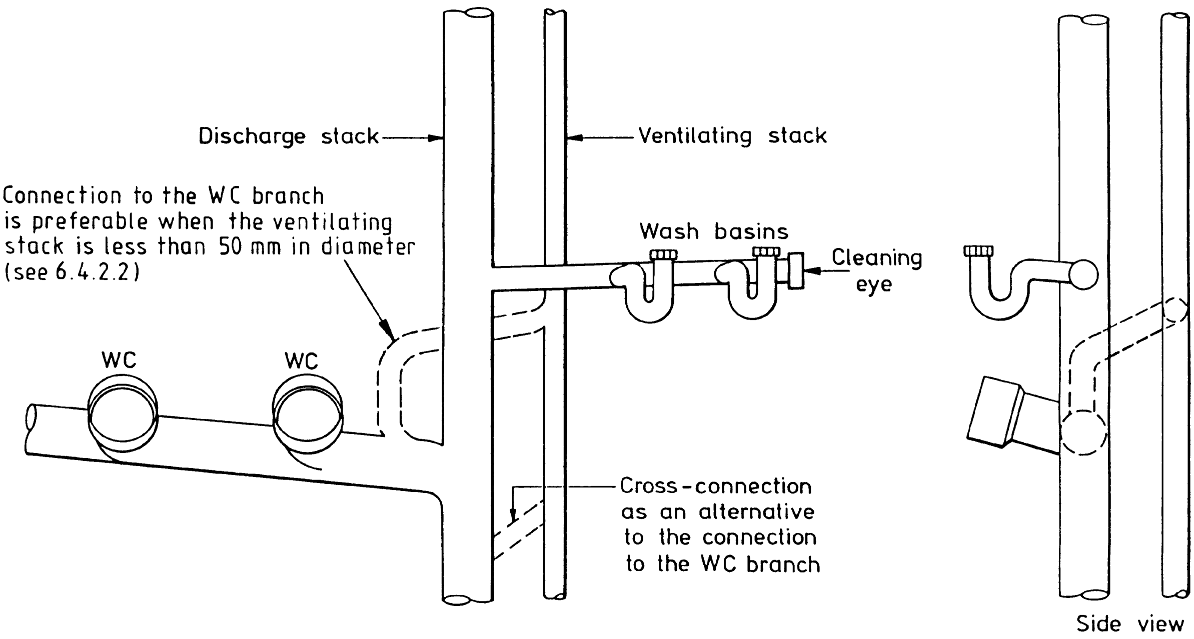
b) Multiple appliances

NOTE For use in situations where there are large numbers of sanitary appliances in ranges or where they have to be widely dispersed and it is impracticable to provide discharge stacks in close proximity to the appliances.

Figure 3 — Ventilated system



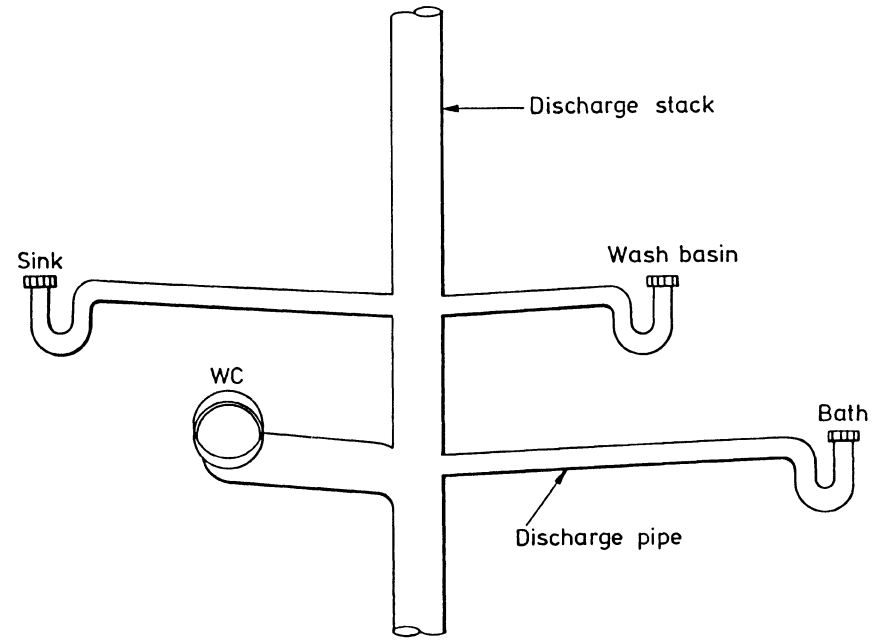
a) Single appliances



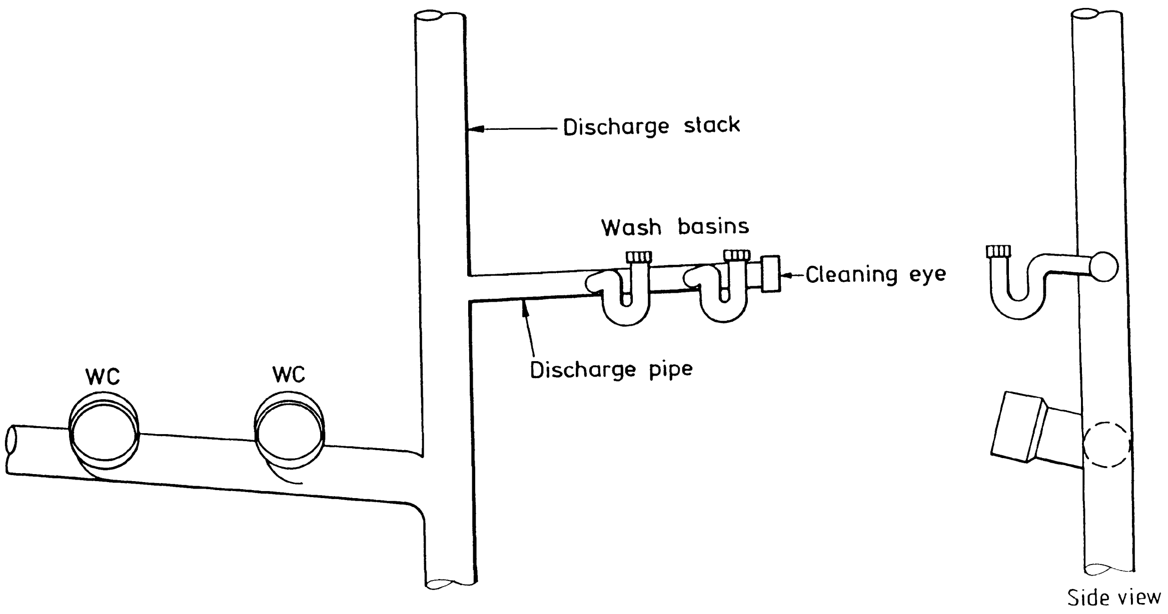
b) Multiple appliances

NOTE For use in situations where close grouping of appliances makes it practicable to provide branch discharge pipes without the need for branch ventilating pipes.

Figure 4 — Ventilated stack system



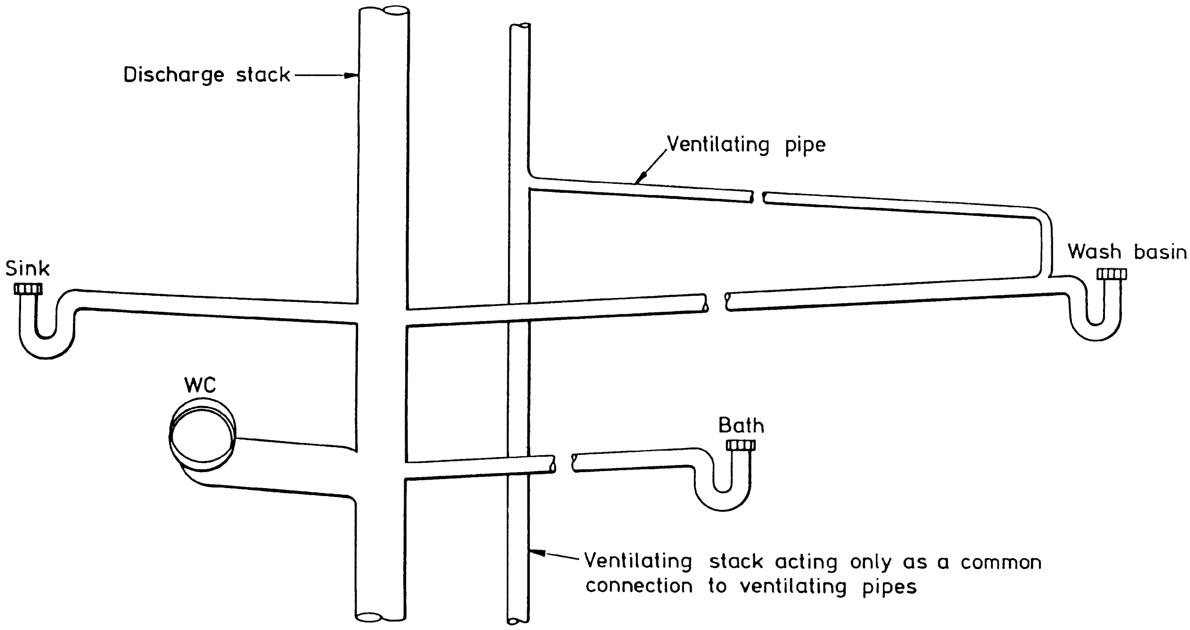
a) Single appliances



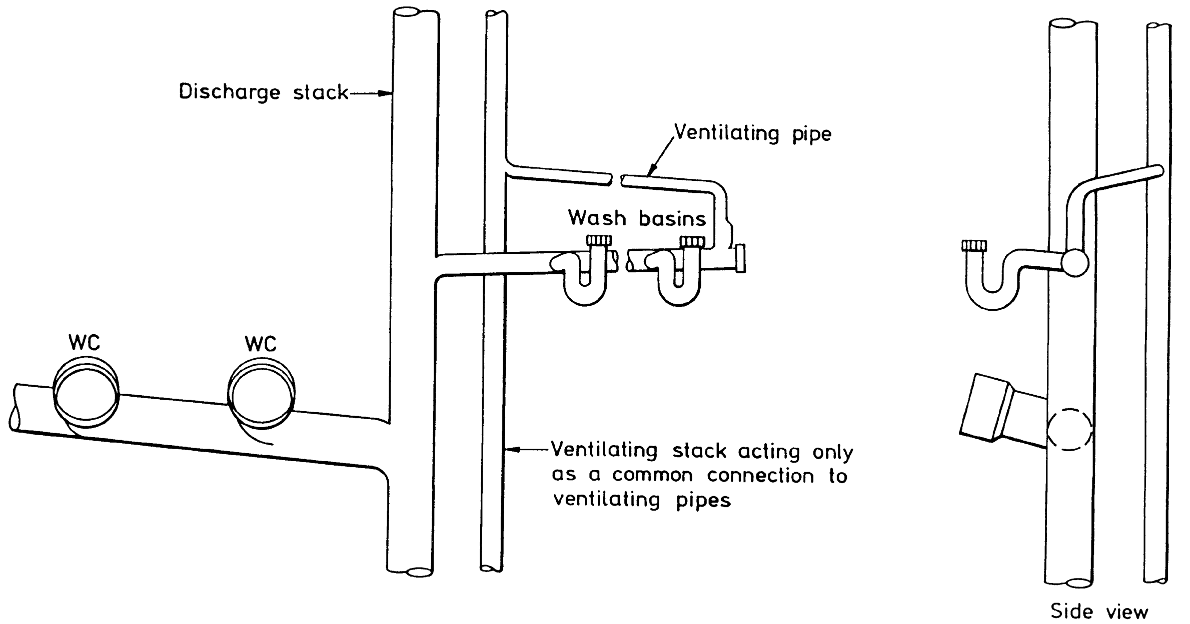
b) Multiple appliances

NOTE For use in situations described in the note to Figure 4, but where the discharge stack is large enough to limit pressure fluctuations without the need for a ventilating stack.

Figure 5 — Single stack system



a) Single appliances



b) Multiple appliances

NOTE For use in situations where the disposition of appliances on a branch discharge pipe could cause loss of their trap seals (by the provision of ventilating pipework extended to the atmosphere or connected to a ventilating stack).

Figure 6 — Modified single stack system

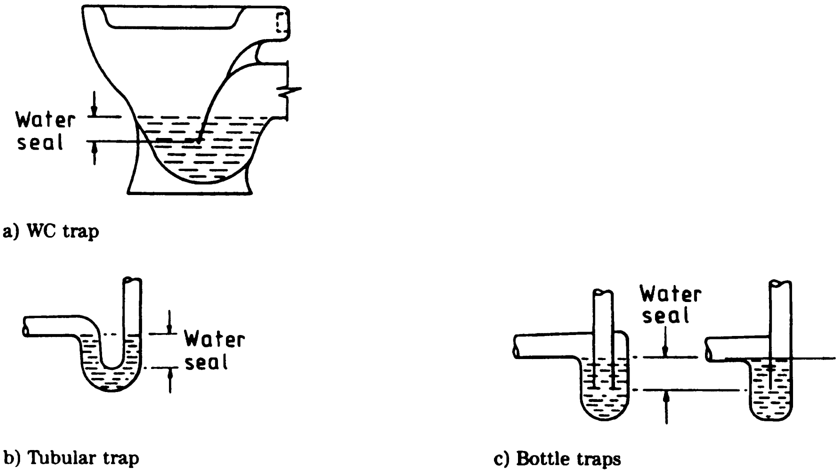


Figure 7 — Trap types

6.2.2 ***Depth of seals***

Traps with outlets for pipes up to and including 50 mm size should have a minimum water seal of 50 mm on baths and shower trays, and on spray-tap basins provided they are fitted with flush-grated wastes without plugs, and 75 mm on all other appliances (see **5.2.2**).

Traps with outlets for pipes over 50 mm size should have a minimum water seal of 50 mm (see **5.2.2**).

Traps used on appliances with a trailing waste discharge and installed on ground floors and discharging to an external gully may have a reduced water seal of not less than 38 mm (see **5.2.2** and **6.3.2.7**).

Table 4 —Minimum sizes of tubular traps

Type of appliance	Size of trap mm	Type of appliance	Size of trap mm
Wash basin	32		
Bidet	32		
Sink	40		
Bath	40		
		Urinal (bowl)	40
Shower bath tray	40	Urinals (1 to 7 stalls or slab of equivalent length)[a]	65
Drinking fountain	32	Food-waste disposal unit (domestic)	40
Bar well	32	Food-waste disposal unit (industrial type)	50
		Sanitary towel macerator	40

[a] Where there are more than seven stalls or a slab of equivalent length in one range, more than one outlet should be provided.

6.2.3 ***Diameters of tubular traps***

The sizes of tubular traps should be not less than those given in Table 4 (see **5.2**).

6.2.4 ***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, the lower part of the trap being removable for access, should be designed to conform to **6.2.1** and **6.2.2**. The size of inlet and outlet should be as given in **6.2.3** and there should be no reduction in flow area through the trap. 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.

6.2.5 ***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. They will become less efficient in resealing if the recommendations of **6.2.1** are not met. Resealing traps should be regularly inspected and maintained. Some types can be noisy in operation (see **5.2.3**).

The depth of seals should be as given in **6.2.2**, the sizes at inlet and outlet should be as given in **6.2.3** and there should be no reduction in flow area through the trap.

6.2.6 ***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 (see **5.2.2**).

6.2.7 ***Sinks and washing machines***

It is preferable that traps are positioned immediately beneath sink waste outlets, however a single trap may receive the discharges from two adjacent sinks and also from a domestic washing machine and/or dishwasher provided the total length of pipework joining the waste outlet of the sinks to the trap inlet does not exceed 750 mm.

6.3 Discharge pipes and stacks

6.3.1 ***General***

It is convenient to deal with branch discharge pipes and discharge stacks separately because of their different performance characteristics.

Branch discharge pipes and discharge stacks should be installed inside buildings but for buildings up to three storeys, discharge stacks and branch discharge pipes may be installed externally.

6.3.2 ***Branch discharge pipes***

6.3.2.1 *Diameter*

Branch pipes should not be reduced in diameter in the direction of flow. Sizes are given in clauses **7** and **8**. Oversizing branch pipes to avoid self-siphonage problems can be uneconomic and can lead to an increased rate of deposit accumulation (see **5.2.1** and **5.2.5**).

6.3.2.2 *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 1 ¼° (18 mm/m or 22 mm/m), but flatter gradients down to ½° (9 mm/m) may be imposed on long runs of 100 mm and 150 mm size pipe when space is restricted. This can be undesirable and adequate self-cleansing of such an arrangement is only possible with high flow rate (e.g. of not less than 2.5 l/s) and workmanship of a high standard (see **5.2.5**).

Pipes sizes, gradients and pipe capacities are inter-related as shown in clause **7** and this relationship is vital for the 32 mm branches normally connected to wash basins. Vertical 32 mm branch pipe from wash basins with "s" traps often run full bore and ventilating pipework may be needed to prevent self-siphonage and noisy discharge (see **5.2.2** and **5.2.3**).

6.3.2.3 *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 (see **5.2.2** and **5.2.5**).

6.3.2.4 *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. Precise information on bend radii for branch pipe arrangements to various appliances is given in clause **9** (see **5.2.2** and **5.2.5**).

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, e.g. Figure 22; otherwise 45° branches should be used. To minimize the risk of blockage, branches up to 40 mm size joining larger diameter horizontal branches of 100 mm or over should, if practicable, connect to the upper part of the pipe wall of the larger branch. For the same reason, opposed branch connections in the horizontal plane to a main branch discharge pipe should be avoided (see **5.2.5**).

For a combined branch to which a wash basin is connected, the shape of a tee junction fitting can have an especially significant effect on performance, unless swept in the direction of flow (see **5.2.2** and **7.2.2.7**).

6.3.2.5 *Branch pipe connections to discharge stacks*

6.3.2.5.1 *General* (see Figure 8)

Small diameter branch discharge pipes up to 65 mm size may be connected to stacks of 75 mm or larger by swept or unswept branch connections and some change in gradient close to the stack is permissible to allow the use of a standard 87½° branch boss. However, for 32 mm pipes serving wash basins the root radius should be not greater than 25 mm (see Figure 8 b) and the change in gradient should be within 250 mm from the stack (see **5.2.2**).

A branch inlet of 75 mm to 150 mm size joining a discharge stack of equal diameter should be swept in the direction of flow with a radius of not less than 50 mm for angles of 89½° to 67½° (see Figure 8 c) i) (see **5.2.2**).

Branch pipe connections at 45° or less do not need swept inlets (see Figure 8 c) ii).

Branch inlets of 75 mm size joining 100 mm or 150 mm discharge stacks and branch inlets of 100 mm joining 150 mm stacks may be swept or unswept (see Figure 8 c) iii).

Branch discharge pipes should not discharge over a hopper head.

6.3.2.5.2 *Waste manifolds*

Branch discharge pipes may connect to a waste manifold [see Figure 8 d)] providing there is no restriction of cross-sectional area of the pipework connecting to it and it is designed to prevent cross flow of the discharge. Pipework connecting to waste manifolds should be installed in such a manner as to prevent self-siphonage (see **5.3.1** and **7.2.2**).

6.3.2.6 *Prevention of cross flow* (see Figure 9)

Where small diameter branch discharge pipes without swept entries are opposed, they should be arranged so that the risk of the discharge from one branch into the other is avoided (see **5.2.5**).

To prevent the discharge from a large diameter branch (e.g. a WC branch) backing up a smaller diameter branch (e.g. a bath branch) the latter should be connected to the stack so that its centre line meets the centre line of the stack at or above the level at which the centre line of the large branch meets the centre line of the stack, or at least 200 mm below it. Similar rules apply to opposed small diameter branches (see Figure 9) (see **5.2.5**).

A branch creates a no connection zone on a stack, as shown shaded in Figure 9. No other branch may be fitted such that its centre line falls inside a zone, but its centre line may be on the boundary of the zone.

6.3.2.7 *Direct connections to an underground drain*

6.3.2.7.1 *Gullies*

It is often convenient on the ground floor of buildings 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.

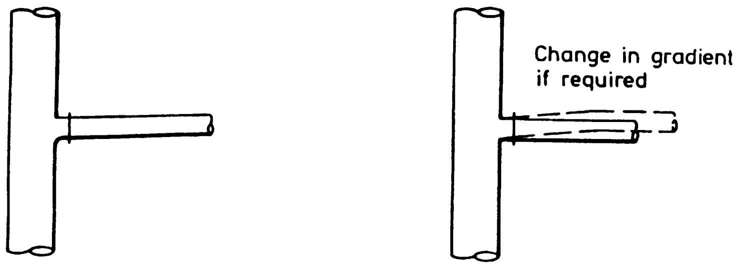
This arrangement usually requires a length of vertical, or near vertical, discharge pipe which can cause self-siphonage of the trap seals and some noise. The former is not so likely with baths and sinks because trail off at the end of discharges will refill the traps sufficiently but wash basins branches may require venting. However, in suitable circumstances a resealing trap may be fitted. Noisy discharges can only be prevented by venting (see **5.2.2** and **5.2.3**).

6.3.2.7.2 *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 (see **5.2.2**).

6.3.2.7.3 *Stub stacks*

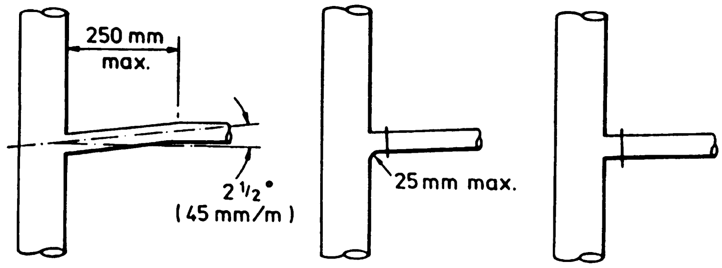
A stub stack consists of a short straight 100 mm discharge stack with the top closed, preferably with an access fitting. It can be used to connect various appliances to a drain or discharge stack providing the total loading does not exceed 17 discharge units and the centre line of the WC branch is not more than 1.5 m and the centre line of the topmost connection is not more than 2.5 m above the invert level of the drain or branch discharge pipe (see Figure 10 a). Where one or more stub stack connections discharge to a drain, the head of that drain should be ventilated by a ventilating stack or discharge stack that terminates externally to atmosphere.



i) With radius

ii) Without radius

a) For branch discharge pipes of up to 65 mm diameter (except 32 mm branches serving wash basins)



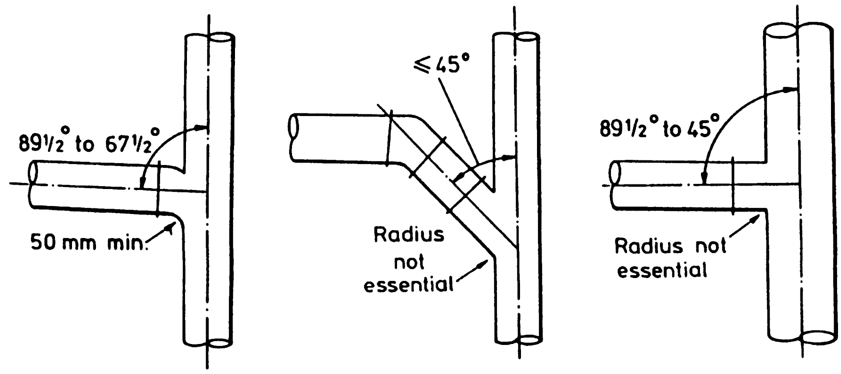
i) Using 87½° boss when pipe gradient has to be less than 2½° (45 mm/m)

ii) With small radius

iii) Without radius

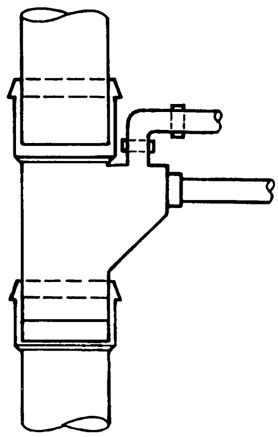
b) For branch discharge pipes of 32 mm diameter serving wash basins

Figure 8 — Branch discharge pipe connections to discharge stacks



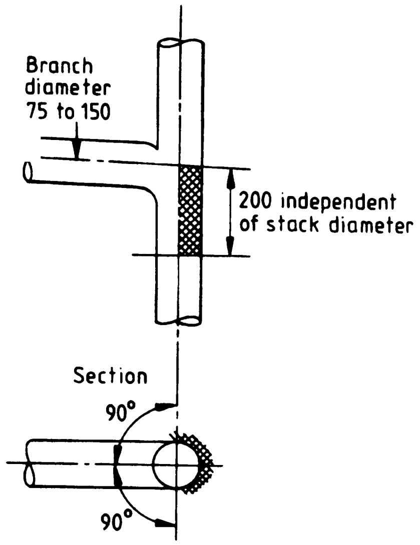
i) Equal branch ii) Equal branch iii) Unequal branch

c) For branch discharge pipes of 75 mm to 150 mm diameters (connected to stacks of up to 150 mm diameter)

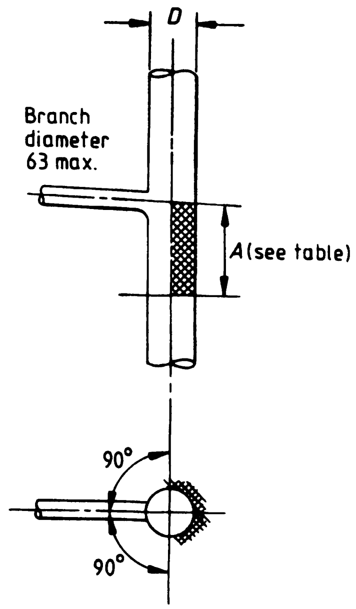


d) Typical waste manifold

Figure 8 — Branch discharge pipe connections to discharge stacks (*concluded*)



i) No connection zone opposite a large branch



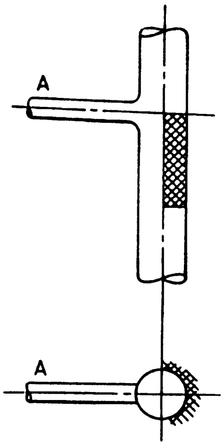
Stack dia. *D*	Height of zone *A*
75	90
100	110
125	210
150	250

ii) No connection zone opposite a small branch

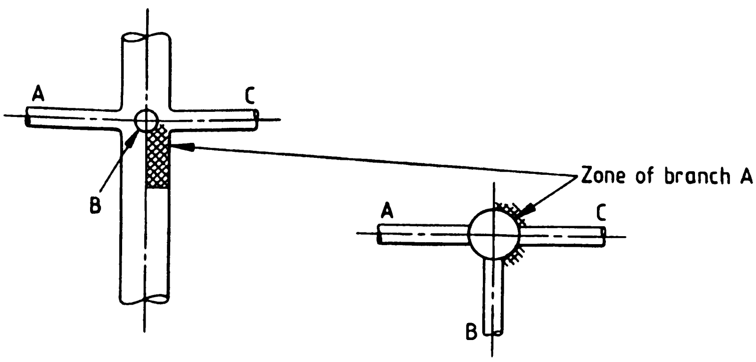
Linear dimensions in millimetres.

a) No connection zones for prevention of cross flow

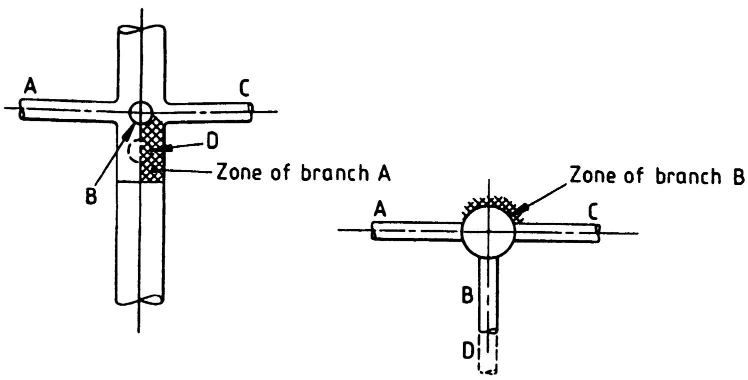
Figure 9 — Prevention of cross flow



i) Consider a stack with branch A and its no connection zone, shown shaded.



ii) Other branches may be fitted at the same level as A, as shown at B and C. Each branch creates its own no connection zone. Only that of branch A is shown in this diagram.



iii) A branch may also be fitted at D, or elsewhere on the same vertical centre line. Although this would be on the boundaries of the no connection zones of branches A and C its centre line would not be inside either of them. But as branch B has a no connection zone on the far side of the stack it would not be possible to fit a branch opposite branch D.

b) Examples of permitted connections for prevention of cross flow

Figure 9 — Prevention of cross flow *(concluded)*

6.3.3 ***Discharge stacks***

6.3.3.1 *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 stack vent should be continued to the point of termination without any reduction in size to the discharge stack (see **6.3.3.6**), except for one and two storey housing where, in certain cases, economies can be made by using a 75 mm stack vent without detriment to the performance of the system. Sizes of discharge stacks are given in clause **7** (see **5.2** and **5.2.5**).

6.3.3.2 *Bends at the base of stacks* (see Figure 10 b)

Bends at the base of a discharge stack should be of large radius, but preferably two 45° large radius bends should be used. Increasing the diameter of the bend at the base of a stack is an alternative but this may oversize the drain and be uneconomic (see **5.2.2** and **5.2.5**).

6.3.3.3 *Branches at the base of stacks (single stack system)*

Generally, for systems up to five storeys, the distance between the lowest branch connections and the invert of the drain should be at least 750 mm, but for low rise single dwellings 450 mm is adequate. For larger multi-storey systems it is better to connect the ground floor appliances into their own stack or the horizontal drain and not directly to the main stack. For buildings over 20 storeys high it may be necessary for both the ground and first floor appliances to be so connected (see **5.2.2** and **5.2.5**).

6.3.3.4 *Offsets* (see Figure 11)

Offsets in the wet portion of a discharge stack should be avoided. When they have to be fitted, large radius bends should be used as described in **6.3.3.2** but a ventilation stack may still be necessary with connection to the discharge stack above and below the offset. Sizes of vent stack for this purpose are given in **7.3.2** and Figure 11. Offsets above the topmost appliance or branch connection do not require venting (see **5.2.2** and **5.2.5**).

6.3.3.5 *Surcharging of the drain*

If the drain, to which the discharge stack is connected, is likely to be affected by surcharging, a ventilating pipe or stack should be connected to the base of the stack above the likely flood level (see **5.3.3.3**). Ventilated systems may require larger ventilating stacks. Sizes are given in **7.3.3** (see **5.2.2**).

6.3.3.6 *Intercepting traps*

Intercepting traps are generally no longer used except for rodent control measures, but if a stack is to be connected to a drain in which an intercepting trap is fitted, the size of ventilating stack should be as for a surcharged drainage system (see **6.3.3.5** and **5.2.2**).

6.3.3.7 *Termination of stack vents* (see Figure 12)

Stack vents should terminate with a durable domical cage, or other cover which does not unduly restrict the flow of air, at such a height and position that foul air does not cause a nuisance or health hazard. In general this is achieved if the stack vent is not less than 900 mm above the head of any window or other opening into a building within a horizontal distance of 3 m. Stacks should also be positioned away from parapets and corners of buildings (see **5.2.2**).

6.3.3.8 *Air admittance valves (AAVs)*

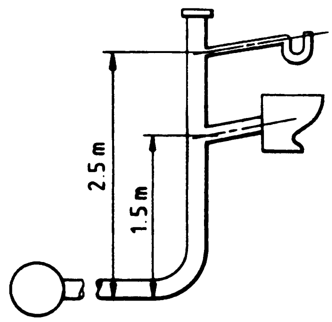
Underground drainage systems are ventilated through traditional ventilating pipes and these should preferably be installed where practicable. Where termination of stack vents or ventilating pipes proves difficult the use of AAVs may be considered.

Their installation (see note) should conform with the manufacturer's instructions. Dust laden atmospheres (i.e. caused by industrial processes) may cause AAVs to malfunction. To aid clearance of blockages, AAVs should be removable.

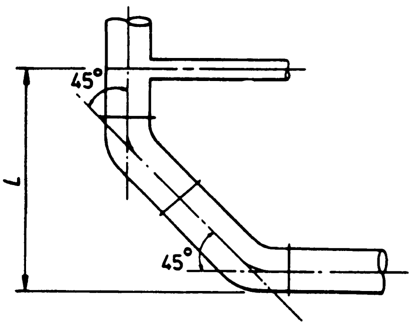
NOTE Approved Document H of The Building Regulations 1991 [3] only permits AAVs that are subject to a current British Board of Agrément Certificate and for their installation to be in accordance with the terms of the certificate. Part M of the technical standards for compliance with the Building Standards (Scotland) Regulations 1990 [3] also has restrictions on their use.

6.3.3.9 *Discharge stacks serving only urinals*

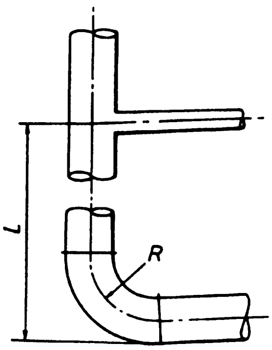
A stack carrying only discharges from urinals is likely to become rapidly encrusted with sediment and special attention to access and regular cleaning is necessary. It is an advantage to connect other appliances, such as WCs and hot water discharges, to a urinal stack to reduce this encrustation (see **5.2.5**, **5.2.7**, **6.3.2** and **7.2.3.2**).



a) Stub stack



i) Preferable arrangement

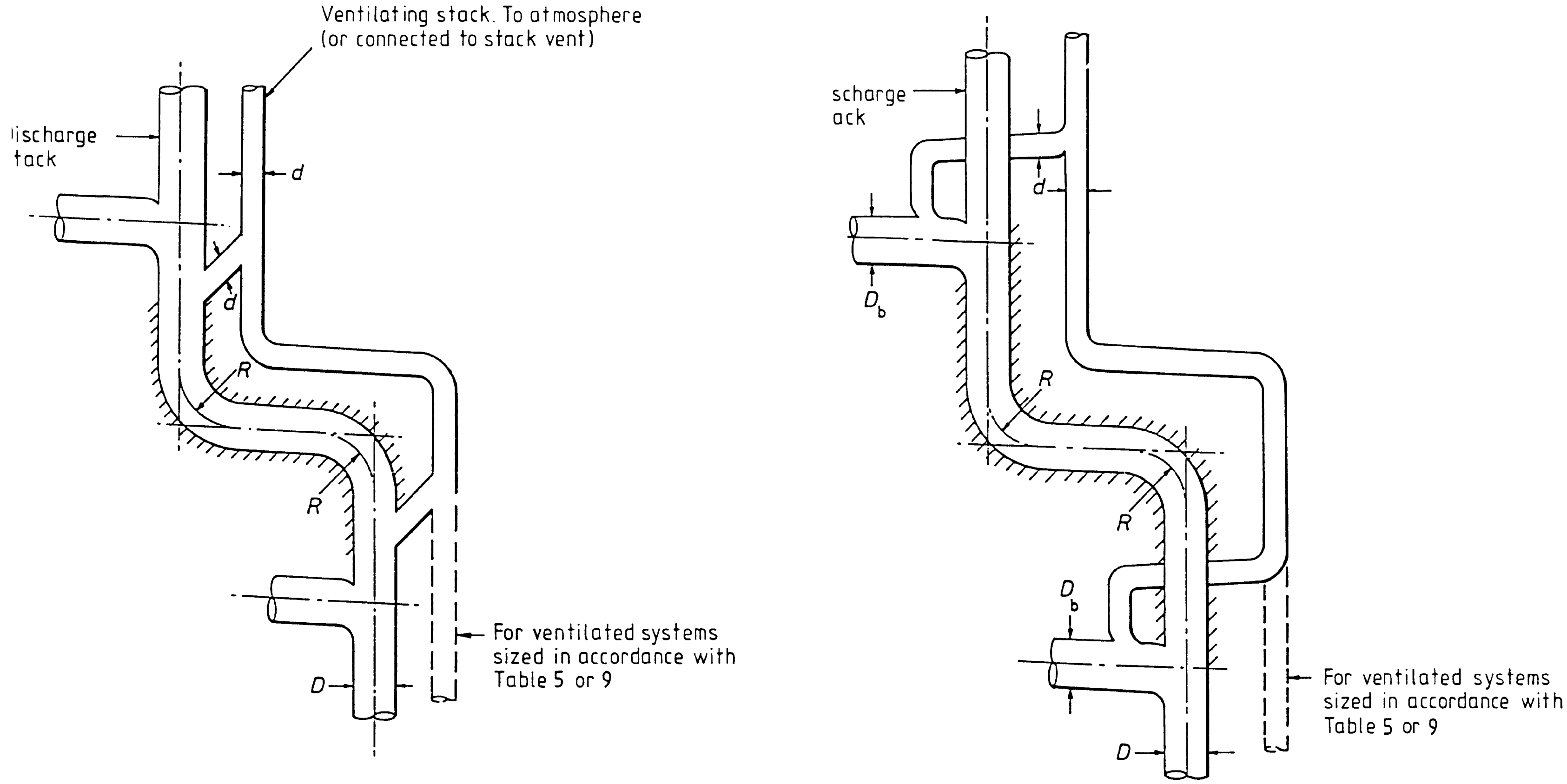


ii) Alternative arrangement

$L \geq$ 450 mm (for single houses up to three storeys high)
or $L \geq$ 740 mm (for multi-storey systems up to five storeys high)
or $L \geq$ one storey height (for multi-storey systems higher than five storeys) i.e. no connections on ground floor level
R is as large as possible (twice internal diameter ($ID \times 2$))

b) Bend and branch connections at base of discharge stack

Figure 10 — Discharge from stub stack



a) Direct connection to ventilation stack

b) Indirect connection to ventilation stack

R is as large as possible (*ID* × 2 min.)

d *D*/2, or for ventilated systems as required in table 5 if larger than *D*/2

D_b ≥ 75 mm (see note 2 below)

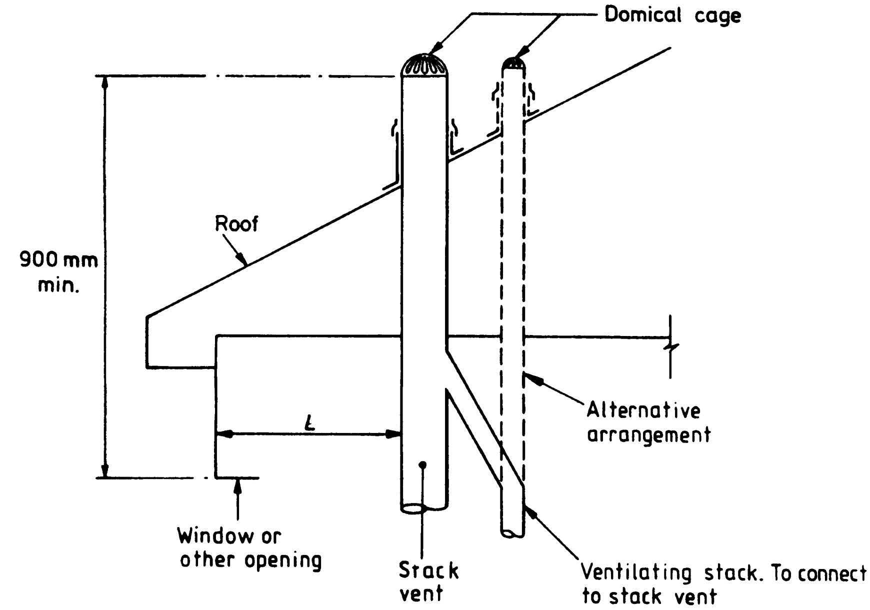
NOTE 1 No branch connections in shaded area unless vented.

NOTE 2 Arrangement (b) is only possible D_b is 75 mm or larger.

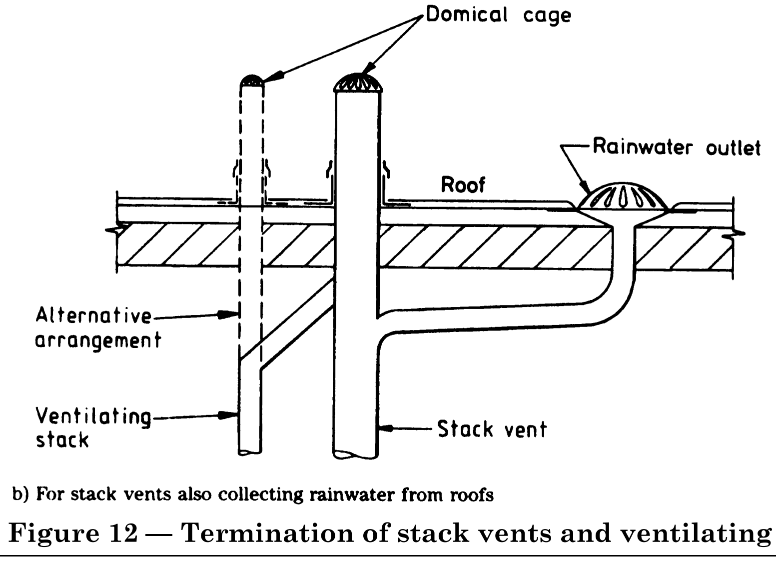
NOTE 3 No offset venting is required is lightly loaded systems of up to three storeys in height.

NOTE 4 Offsets above highest branch connections do not require venting.

Figure 11 — Offsets in discharge stacks



a) Requirement if *L* is less than 3 m



b) For stack vents also collecting rainwater from roofs

Figure 12 — Termination of stack vents and ventilating stacks

6.3.3.10 *Discharge stacks serving only sinks and/or washing machine*

In some multi-storey flat layouts it may be convenient to connect the kitchen sinks or laundry appliances to a separate stack. This arrangement can give rise to very heavy stack deposits especially with soft water, which will require frequent removal if partial blockage is to be avoided. Foaming, due to excessive detergent use, may occur at the base of the stack and cause ventilation problems. If such arrangements cannot be avoided, ready access to the stack should be provided (but not in food preparation and storage areas) and regular maintenance arranged (see **5.2.5** and **5.2.7**).

6.4 Ventilating pipes and stacks

6.4.1 ***Branch ventilating pipes*** (see Figure 13)

6.4.1.1 *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 (see Figure 22) it should be larger, but it can be reduced when above the spill-over level of the appliance (see **5.2.5** and **5.2.7**).

6.4.1.2 *Connections to stacks*

For branch discharge pipes requiring relief venting the ventilating pipes can be connected to the ventilating stack in a ventilated system. For a modified single stack system where the discharge stack does not need a ventilating stack, the ventilating pipes can be run to the open air either directly or, in multi-storey systems, via a common connecting ventilating stack. Connections between the branch ventilating pipes and any vertical stack should normally be above the spill-over level of the highest fitting served. An alternative solution for situations where such a pipe run would be unsightly is shown in Figure 13 c) (see **5.2.2** and **5.2.6**).

6.4.1.3 *Connections to discharge pipes*

Connections to the appliance discharge pipe should normally be as close to the trap as practicable but within 750 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 (see **5.2.2** and **5.2.6**).

6.4.1.4 *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. An exception is the venting method shown in Figure 13 c) in which the fall is towards the vent stack (see **5.2.2** and **5.2.6**).

6.4.2 ***Ventilating stacks*** (see Figure 14)

6.4.2.1 *Size*

Sizes of ventilating stacks are given in clause **7**.

6.4.2.2 *Connections*

In ventilated systems and ventilated stack systems (see Figure 3 and Figure 4) 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. Another method of connection is via large size (75 mm min.) branches at each floor level. These connections should be the same size as the ventilating stack and should be made to the branch discharge pipe as close to the stack as practicable. The latter method is preferable for ventilating stacks smaller than 50 mm (see **5.2.2** and **5.2.6**).

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 should preferably be connected to the stack vent, or pass through the roof to the atmosphere.

6.4.2.3 *Installation*

Bends and offsets in ventilating pipes do not normally affect performance, but they should be of large radius.

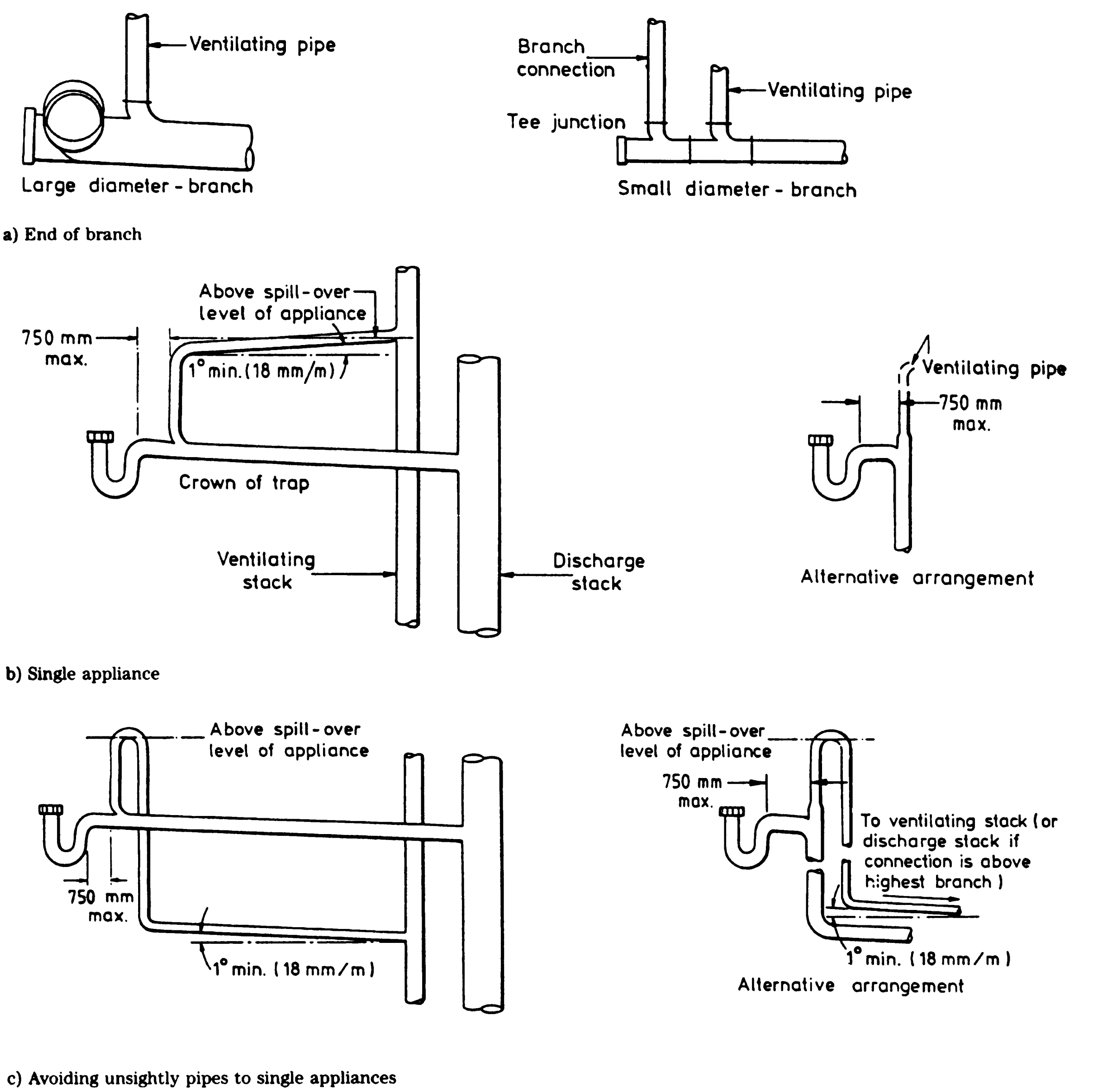
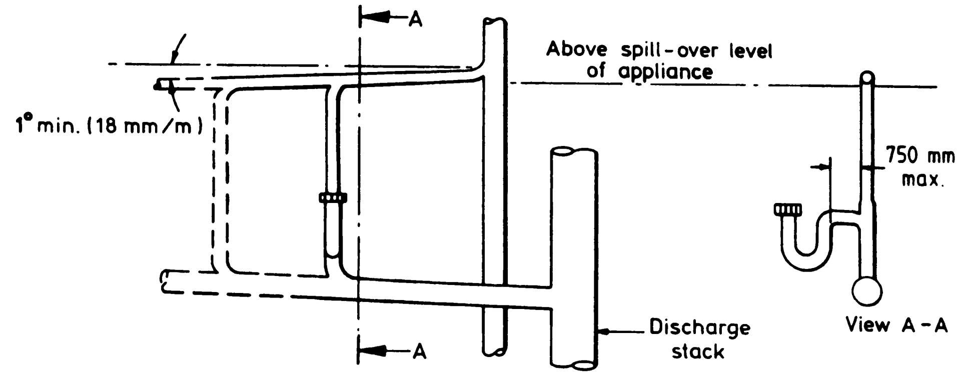


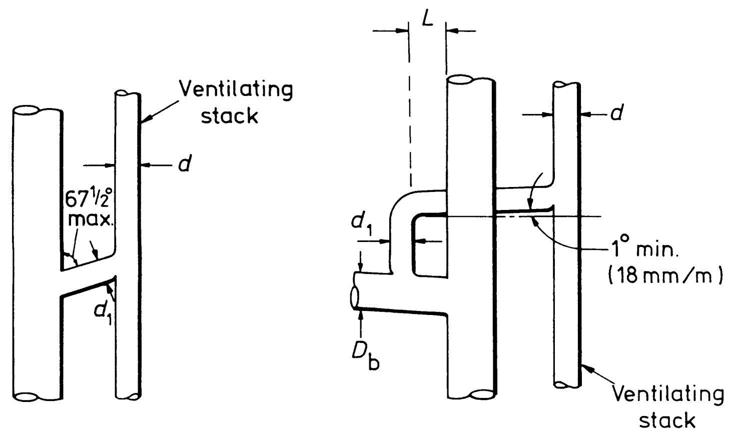
Figure 13 — Ventilating pipes to branches



d) Ranges of appliances

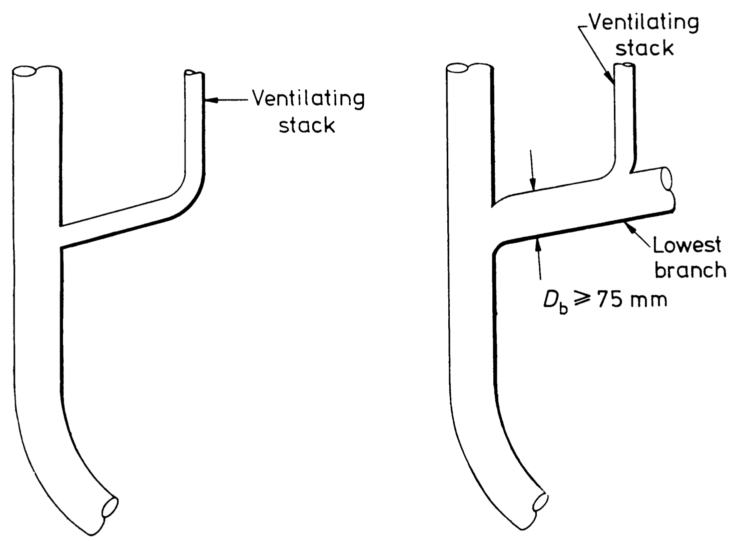
NOTE Alternatively, air admittance valves may be used.

Figure 13 — Ventilating pipes to branches (*concluded*)



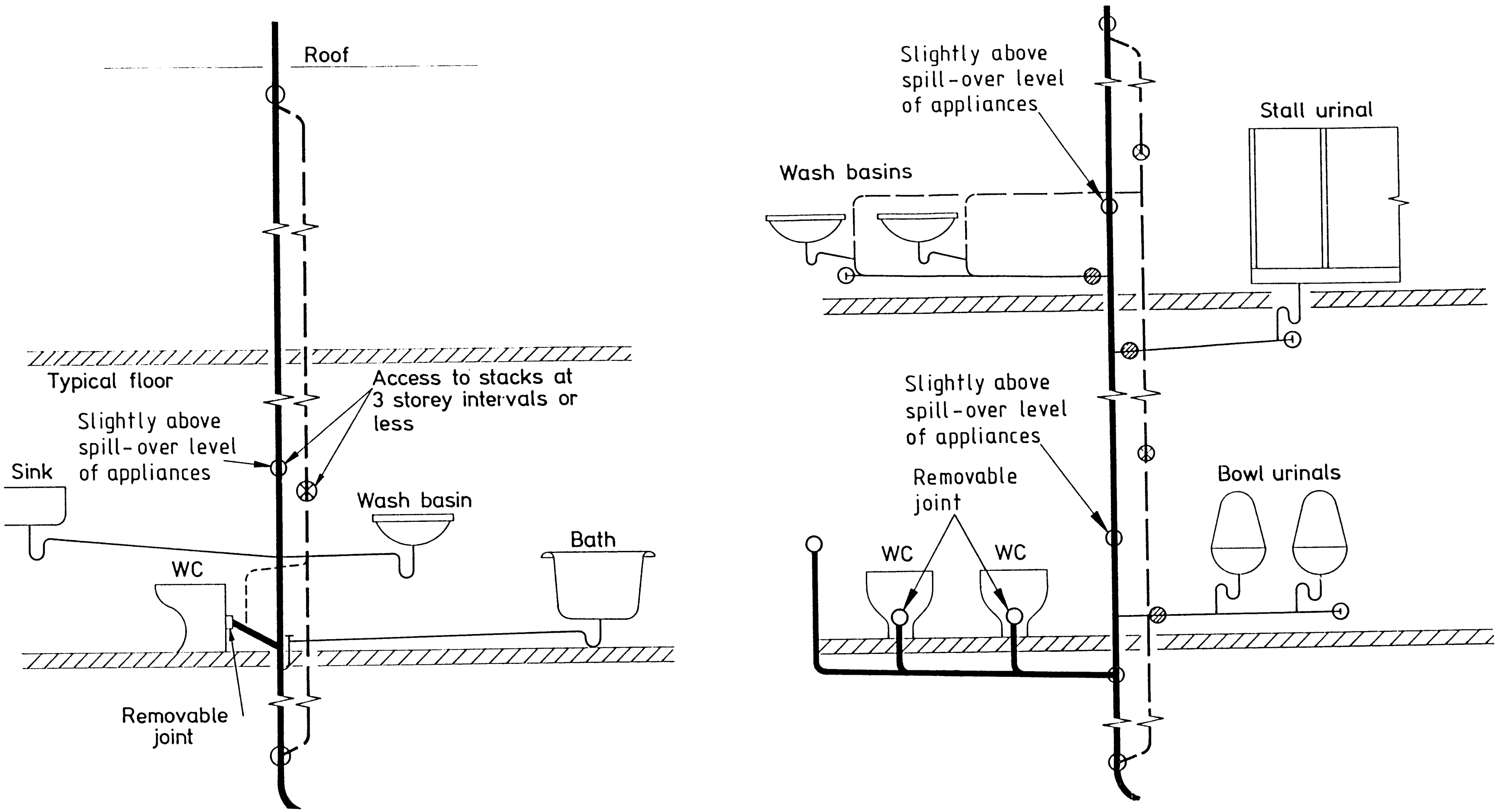
d_1	is same as ventilating stack
D_b	≥ 75 mm (if d is smaller than 50 mm, the method shown in the right-hand figure is preferable)
L	is as small as practicable

a) Cross-connections for discharge stack ventilation



b) Bottom of stacks

Figure 14 — Ventilating stacks



a) An example of access positions on stacks in a multi-storey application with single appliances

b) Example of commercial system

○ Access

◍ Access required if waste not detachable

⊗ Test access

Figure 15 — Access for cleaning and testing purposes

6.4.2.4 *Connections on modified single stack systems*

For modified single stack systems (see Figure 6) the ventilating stack is only acting as a common connection for the branch ventilating pipes, and connections to the discharge stack are normally unnecessary. A stack size of 32 mm is usually sufficient. However, if required, the two stacks can be connected at the stack vent (see Figure 12), otherwise the ventilating stack can pass through the roof to the atmosphere. Also, if there is a possibility of a condensation waterlock, e.g. with branch ventilating pipes as shown in Figure 13 c), then the lowest end of the ventilating stack should be connected to the discharge stack via a large size (75 mm min.) branch. (See Figure 14 and **5.2.2**.)

6.4.3 ***Termination of ventilating pipes*** (see Figure 12)

Ventilating pipes should be positioned as described for stack vents (see **6.3.3.7**) and should be fitted with a guard or domical cage of durable material or other cover which does not unduly restrict the flow of air (see **5.2.2**).

6.5 Access (see Figure 15)

6.5.1 ***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. The use of apparatus or equipment 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 (see **5.2.7** and **5.2.9**).

6.5.2 ***Pipe ducts***

Pipework enclosures, e.g. ducts and casings, should be suitable in size and provide ready access for maintenance, testing and cleaning. They should be constructed appropriately for fire resistance, sound insulation and to limit the spread of vermin (see **5.2.3**, **5.2.7**, **5.2.9**).

6.5.3 ***Water closets***

WCs are particularly prone to obstruction in or near the trap through misuse. There are advantages in using a joint or jointing material to a WC pan which will allow the easy removal and replacement of the pan (see **5.2.7**).

6.5.4 ***Urinals***

The discharge from urinals can give rise to heavy deposits especially with hard water. Special attention is therefore necessary to the provision of access so that all parts of the stack, branch and trap can be readily cleaned (see **5.2.7**, **6.3.3.9**, **7.2.3.2**).

6.5.5 ***Wash basins, sinks and baths***

Where access is required this may be conveniently provided by the use of traps and joints that are easily disconnected. Additional access is needed only under exceptional circumstances, such as where the discharge pipe is longer than normal or where several bends occur in the pipework (see **5.2.7**).

With soft water, branches from spray tap wash basins are likely to become blocked and particular attention should be paid to access. Stacks serving sinks only, especially where the water is soft, may require access on each floor (see **5.2.7**).

6.5.6 ***Discharge and ventilating stacks***

Where the discharge stack has a long drain connection to a manhole, access for rodding and testing should be provided at or near the foot of the stack (see **5.2.7** and **5.2.9**).

For multi-storey domestic buildings, access to the ventilating and discharge stacks should be provided at about three 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 (see **5.2.7** and **5.2.9**).

6.5.7 ***Restaurant and canteen kitchens***

In restaurant and canteen 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 (see **5.2.5**, **5.2.7** and **5.2.9**).

It is also necessary to ensure that access points are located in positions which will be accessible after the appliances have been installed (see **5.2.7**).

6.6 Materials

6.6.1 ***General***

Pipes and fittings should be suitable for their purpose and should conform to the requirements of the relevant British Standards listed in Annex A.

The choice of material depends on the size and function of the pipework, 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. (See **5.2.5** and **5.2.6**.)

6.6.2 ***Types of materials***

6.6.2.1 *Metals*

The following metals are generally suitable for discharge and ventilating pipes covered by this standard:

a) cast iron;

b) copper;

c) galvanized steel;

d) lead;

e) stainless steel;

Electrolytic corrosion may occur where dissimilar metals are in contact in the presence of moisture. In the following scale, where any two metals are combined, the upper one may be attacked and the closer the metals are in the scale, the lower the risk of attack (see **5.2.6**):

1) zinc;

2) iron;

3) lead;

4) brass;

5) copper and stainless steel.

6.6.2.2 *Plastics*

The following plastics are generally suitable for discharge pipes covered by this standard:

a) acrylonitrile butadiene styrene (ABS);

b) high density polyethylene (HDPE);

c) modified unplasticized polyvinyl chloride (MUPVC);

d) unplasticized polyvinyl chloride (PVC-U);

e) polypropylene (PP).

Some of these materials may not be suitable if large quantities of very hot water have to be discharged; also some solvents and organic compounds can damage plastics materials. The relevant British Standards should be consulted or expert advice sought if these conditions are likely (see **5.2.6**).

Plastics material exposed to direct sunlight may require protection to resist ultraviolet degradation. It is advisable to seek guidance from manufacturers of any materials other than PVC-U or MUPVC (see **5.2.6**).

6.6.2.3 *Borosilicate glass*

This material is generally used for laboratory waste discharge but it may be applied to other drainage systems.

6.7 Special design considerations

6.7.1 ***Restaurant and canteen kitchens***

6.7.1.1 *General*

For the purpose of considering the waste discharge from restaurant and canteen kitchens the work process can be divided into two main operations:

a) food preparation and cooking, involving the use of vegetable preparation sinks, general purpose sinks, vegetable paring machines and waste disposal units;

b) washing up, involving the use of waste disposal units, dish washing machines, pot wash sinks, sterilizing sinks and general purpose sinks.

The time scale during which the operations may be carried out will not conform to a set pattern, but will vary from kitchen to kitchen according to its size, the number of meals served and the period over which the meal service is provided.

The peak rate of waste discharge will probably occur during washing up periods when dish washing machines are in use. Dish washing machines vary in size and according to the capacity of the machine may use water from 125 l/h with a peak flow rate in the order of 80 l/min to in excess of 600 l/h with a peak of 180 l/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.

Kitchens are of necessity designed to ensure a natural flow of work and seldom permit the grouping of the appliances to give the best conditions for drainage. It is of primary importance that there should be no loss of water seal in the traps on kitchen appliances, therefore an adequate ventilated system of drainage is necessary (see **5.2.1**, **5.2.2** and **6.5.7**).

6.7.1.2 *Specific requirements*

Drain-off valves on food containers should be of the full way plug-cock type with quick release bodies for easy cleaning. These valves should not be connected to a discharge pipe or drain without an intervening air break.

Floor channels and gratings to open gullies found in kitchens, food preparation rooms and wash-up rooms harbour dirt and grease and if the gratings are not properly fitted they can be hazardous to pedestrian traffic. This form of drainage is unhygienic and should be avoided.

Sinks and dish washing machines should be individually trapped and connected directly to the discharge stack.

Vegetable paring machines should be fitted with a waste dilution unit and the discharge pipe should be trapped and connected directly to the discharge stack.

The pipes from appliances which discharge waste water containing heavy concentrations of solid matter, e.g. vegetable paring machines and food waste disposal units, should not be connected to the head of long runs of horizontal discharge pipes or discharge to grease traps. They should be connected as close as is practicable to the main vertical discharge stack or drain to gain the maximum flushing advantage from appliances with high waste water discharge rates (see **7.2.2.6.1**).

Where practicable, items of kitchen equipment such as steaming ovens, bains-marie, boilers and cafe sets should discharge over a drip tray or a fixed tundish having a trapped outlet connected to the discharge system.

Boiling pans should be drained separately over removable tundishes into trapped gullies. The trapped gully should be fitted with a solid hinged flap flush with the floor, the flap kept closed when not in use (see **5.2.5** and **5.2.7**).

6.7.1.3 *Grease traps*

The use of grease traps should be avoided if practicable. Where used, they should be designed and located to promote cooling, coagulation and retention of the grease within the trap. Grease traps that have enzyme dosing facilities should be installed and used in accordance with the manufacturer's instructions.

They should be sized to achieve maximum efficiency. The temperature and velocity of flow of the waste water should allow the grease to separate and collect on the surface of the water in the trap reservoir. In the standard type of grease trap the process of separation will be impaired or even prevented by the use of detergents which emulsify the grease.

Consideration should also be given to the general nature of the waste matter discharged, since the reduced flow velocity through the trap will allow solid waste matter in suspension to settle and collect in the trap reservoir.

Provision should be made to facilitate the hygienic removal and disposal of the grease. Provision should also be made for the trap to be completely emptied and cleaned periodically to prevent the development of septic conditions in the trap reservoir.

To avoid the risk of food contamination, grease traps should not be located in food rooms (see **5.2.5** and **5.2.7**).

6.7.2 ***Hairdressing salons***

Special fittings should be provided at the outlet of basins to prevent the ingress of hair into the discharge system (see **5.2.5** and **5.2.7**).

7 Commonly used pipework arrangements; layout and sizing data

7.1 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.

In small discharge pipes up to 50 mm diameter, changes of direction greater than 45° should be made by swept fittings of 25 mm minimum throat radius. Alternatively two or more unswept fittings of not more than 45°, separated by short lengths of pipe, may be used. Bends may be formed on metal pipes, but a relatively large radius may then be required to ensure that the throat of the bend is smooth.

Typical examples of pipe sizing procedures are given in Annex B.

7.2 Commonly used arrangements of branch discharge pipes

7.2.1 ***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 **6**.

7.2.2 ***Branch discharge pipes to single appliances***

7.2.2.1 *Water closets* (see Figure 16)

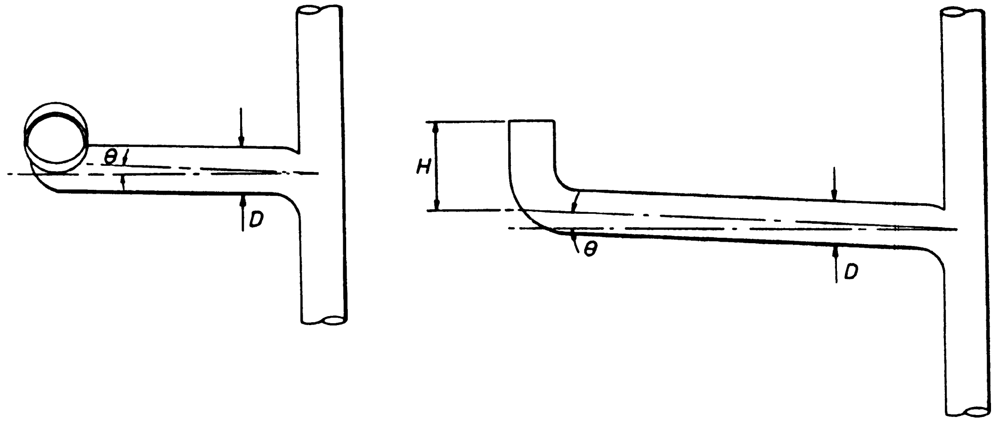
WC branches of 75 mm or 100 mm size do not normally require venting whatever the length or the number of bends included in the run. Bends, however should have as large a radius as possible to prevent blockage (see **5.2.2** and **5.2.5**).

7.2.2.2 *Urinals* (see Figure 17)

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 (see **5.2.2**).

The likelihood of a build-up of deposits means that all urinal branches should be as short as possible and should not exceed 3 m (see **5.2.5** and **6.5.4**).



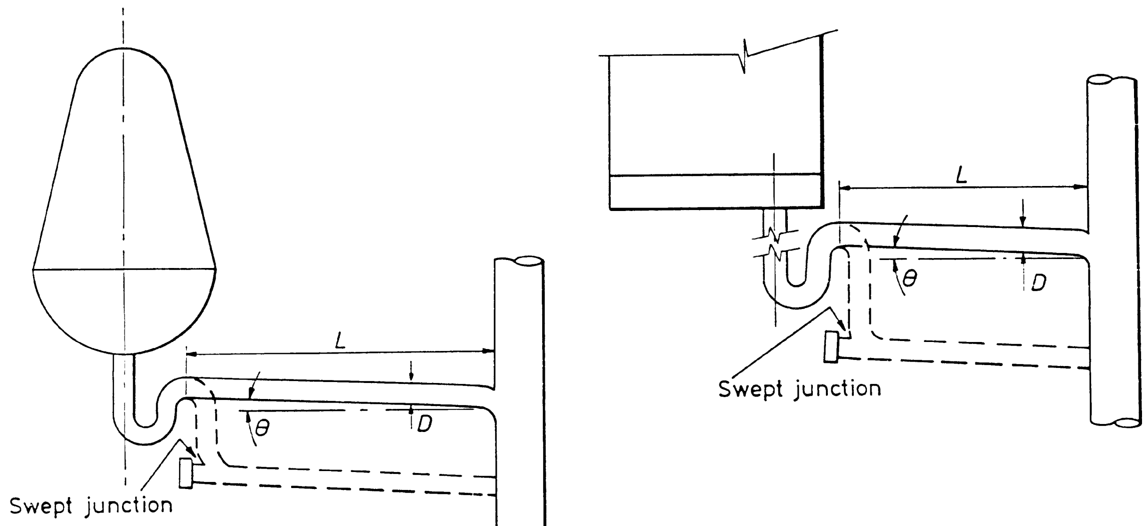
a) 'P' trap configuration

b) 'S' trap configuration

D	is usually 100 mm (75 mm can be used for some WCs)
O	≥ 1° (18 mm/m)
H	< 1.5 mm (longer connections must be extended upwards as a discharge stack and a 'P' type configuration used)

NOTE Any additional bends should be of large radius and the WC trap should have a 50 mm seal depth (see also Figure 8 for branch connection to stack).

Figure 16 — Branch discharge pipes for single WCs



D is 40 mm
θ between 1° and 5°
(18 to 90 mm/m)
L is as short as possible (3 m max.)
Trap of 75 mm seal depth:
40 mm diameter (bowl/trough)
50 mm diameter (trough)

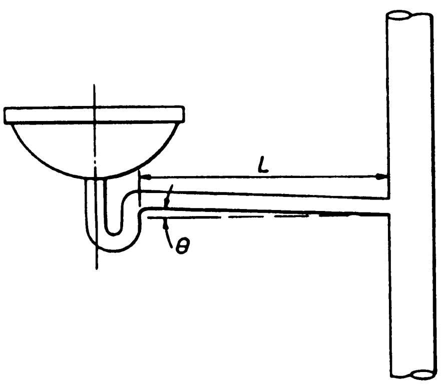
a) Bowl/trough urinal

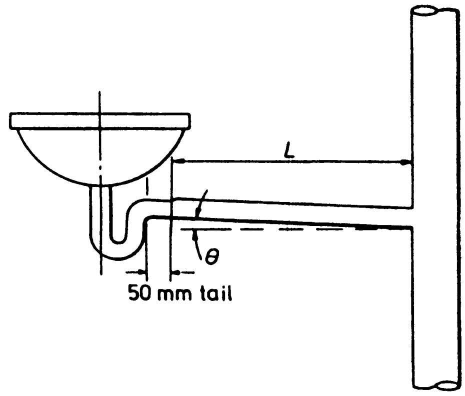
D is 65 mm
θ is between 1° and 5° (18 to 90 mm/m)
L is as short as possible (3 m max.)
Trap of 50 or 75 mm seal depth:
65 mm diameter

b) Slab/stall urinal

NOTE All additional bends in the horizontal plane should be of large radius. Acceptable alternative "S" trap arrangements are shown by a dotted line and design limits are as for "P" trap. (See also Figure 8 for branch connection to stack.)

Figure 17 — Branch discharge pipes for single urinals





L and θ see design curve in a) ii) *θ* is between 1 ° and 2½° (18 to 45 mm/m)

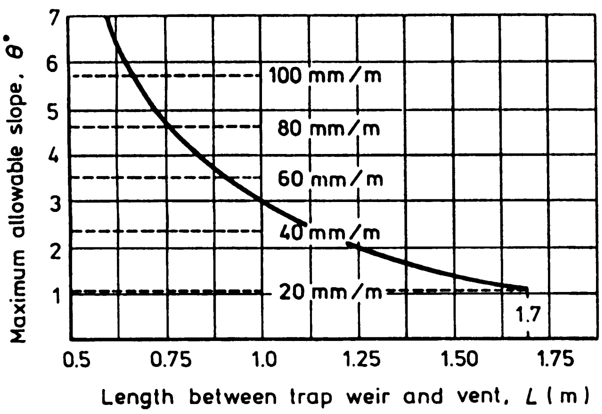
Trap of 75 mm seal depth and 32 mm diameter

i) 32 mm branch discharge pipe

L is between 1.7 m 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 may be included in the branch pipe.

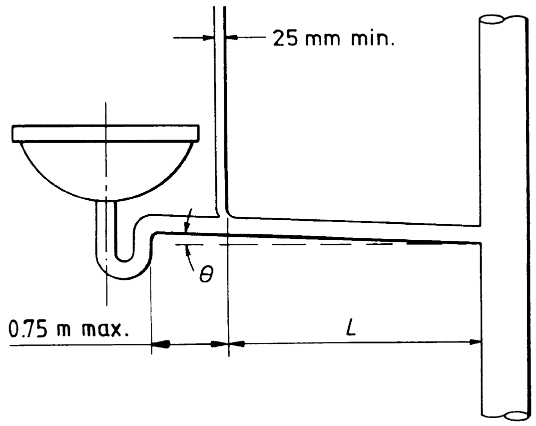
iii) 40 mm branch discharge pipe



ii) Design curve for 32 mm branch discharge pipe; maximum slopes allowed for pipe lengths of up to maximum of 1.7 m

a) Arrangements without ventilating pipes

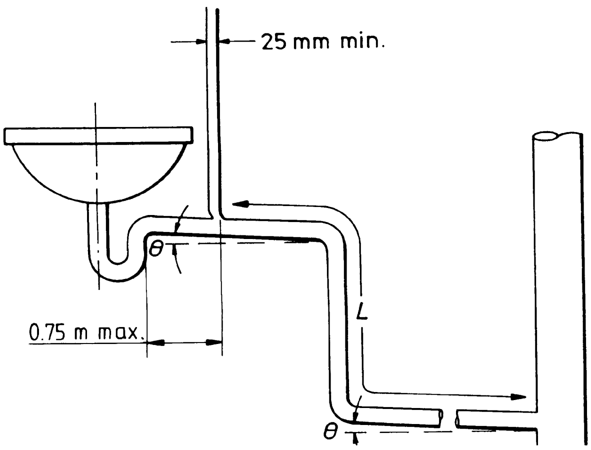
Figure 18 — Branch discharge pipes for single wash basins



$\theta \geq 1°$ (18 mm/m)

$L < 3$ mm

i) Long 32 mm branch discharge pipes

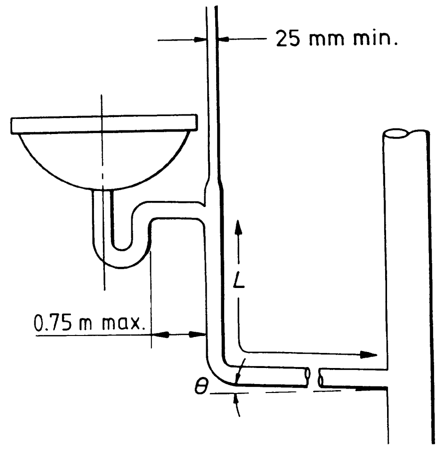


$\theta \geq 1°$ (18 mm/m)

$L < 3$ m

Trap 75 mm seal depth 32 mm diameter

ii) Vertical 32 mm or 40 mm branch discharge pipe



$\theta \geq 1°$ (18 mm/m)

$L < 3$ m

Trap of 75 mm seal depth and 32 mm diameter

iii) Alternative arrangement with vertical 32 mm or 40 mm branch discharge pipe

NOTE 1 Blockage is more likely to occur with long branch pipes.

NOTE 2 Venting is also required for more than two bends in the horizontal plan in the branch pipes shown in a).

NOTE 3 In all the arrangements shown in a) and b) above, any trap outlet not aligned perpendicularly to the centre line of the stack will require at least one additional bend.

NOTE 4 See also Figure 8 for branch connection to stack.

b) Arrangements requiring ventilating pipes

Figure 18 — Branch discharge pipes for single wash basins *(concluded)*

7.2.2.3 *Wash basins, with plug waste* (see Figure 18)

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 Figure 18 a) i) and Figure 18 a) ii). Arrangements outside these strict design limits should be vented or a larger diameter pipe used (see Figure 18 a) iii) and Figure 18 b). In situations where it is impracticable to comply with these conditions a suitable resealing trap or air admittance valve may be fitted (see **5.2.2**).

Basins fitted with spray traps and grated wastes i.e. without plugs, are dealt with in **7.2.3.4**.

7.2.2.4 *Bidets*

Branch discharge pipes to bidets should be designed to the recommendations given for wash basins with plug wastes in **7.2.2.3**.

7.2.2.5 *Sinks and baths* (see Figure 19)

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 (see **5.2.2** and **5.2.5**).

7.2.2.6 *Waste disposal units*

7.2.2.6.1 *Food waste disposal units*

Special precautions are necessary where food waste disposal units are connected to a discharge system and any recommendations as to installation given by the manufacturers should be considered.

A tubular (not bottle or resealing) type trap should always be fitted, which is easily accessible for cleaning. A discharge pipe from such a unit should be not less than 40 mm size for household types and not less than 50 mm for industrial types, and should be as short as practicable, connecting directly to a main discharge pipe or stack. The discharge pipe gradient should be at least 7½° (135 mm/m) to the horizontal, although steeper gradients are advisable, and any bends should be of large radius. It is an advantage, especially with industrial installations, if other appliances can be connected to the discharge pipe upstream of the waste disposal unit connection, to assist transport of the waste material. The discharge pipe or stack should connect directly to a drain without an intervening gully trap (see **5.2.5**).

To avoid hot grease being carried into discharge pipes and drains, where it might build-up and cause blockages, food waste disposal units should always be connected to the cold water supply to solidify grease before it enters the drainage system. Further information on these units is given in **6.7.1** (see **5.2.5**).

7.2.2.6.2 *Sanitary towel disposal units*

Special precautions are necessary where sanitary towel disposal units are connected to a discharge system and any recommendations as to installation given by the manufacturers should be considered.

A tubular (not bottle or resealing) type trap should always be fitted, which is easily accessible for cleaning. A discharge pipe from such a unit should be not less than 40 mm size and should be as short as practicable, connecting directly to a main discharge pipe or stack. The discharge pipe gradient should be at least 3° (54 mm/m) to the horizontal, although steeper gradients are advisable, and any bends should be of large radius. It is an advantage if other appliances can be connected to the discharge pipe upstream of the disposal unit connection, to assist with the discharge of the waste material. The discharge pipe or stack should connect directly to a drain without an intervening gully trap (see **5.2.5**).

7.2.2.7 *Combined branches for bath and wash basin* (see Figure 20)

A common branch serving a bath and wash basin can be used but self- and induced siphonage of the seals can occur and water from the basin may back-up into the bath if the arrangement is incorrectly designed. The gradient and length of the branch and the shape of the branch junction all have an effect on performance and it is not possible to set down general design limits. Therefore, tests are usually needed to assess the behaviour of a particular arrangement but the layout shown in Figure 20 has been proved in practice and should function satisfactorily (see **5.2.2**).

7.2.2.8 *Showers*

Flow rates from single head 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 (see **5.2.2**, **5.2.5** and **5.2.7**).

Multiple head showers may produce considerable flow rates. (See Table 2.)

7.2.2.9 *Domestic automatic washing machines and dish washing machines* (see Figure 21)

Requirements may vary slightly but the arrangements shown in Figure 21 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 (see **5.2.2**).

NOTE Some of the arrangements in Figure 21 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.

7.2.2.10 *Floor drainage gullies*

Branch pipes from 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 (see **5.2.2**).

7.2.3 *Branch discharge pipes for ranges of appliances*

NOTE The pipe sizes given in **7.2.3.1** to **7.2.3.4** are based on congested usage and a criterion of satisfactory service of 99 %.

7.2.3.1 *Ranges of WCs* (see Figure 22)

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 (see **5.2.2**).

7.2.3.2 *Ranges of urinals* (see Figure 23)

No venting is needed with the large size main branch pipes (50 mm to 75 mm) normally used with ranges of stall and bowl urinals. 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 (see **5.2.2** and **5.2.5**).

7.2.3.3 *Ranges of wash basins*

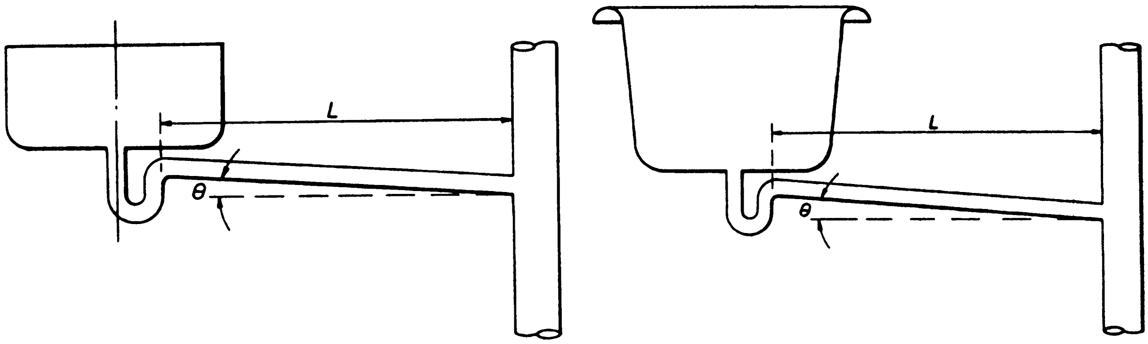
Venting is often needed with ranges of wash basins but some arrangements requiring no venting are also shown in Figure 24 (see **5.2.2**).

7.2.3.4 *Spray tap basins (without plugs)*

The discharge rate from spray tap basins is low (about 0.06 l/s). With the pipe size that has to be used, self cleansing velocities cannot be satisfactorily achieved in practice and, consequently, an accumulation of grease and soap residue in the pipe will occur. These deposits can build up rapidly especially with soft water.

For most situations the main branch discharge pipe serving spray tap basins need not exceed 32 mm. There is, however, a tendency for trap siphonage to occur as deposits build up in the discharge pipe and if the number of basins exceeds five or if the total length of the discharge pipe exceeds 4.5 m, a 25 mm ventilating pipe should be provided (see Figure 25) (see **5.2.2**).

The rate of grease and soap residue build-up can be reduced by installing, at the head of the range of spray tap basins, an appliance which will provide an occasional cleansing flush to the discharge pipe (e.g. a sink). In these circumstances venting and/or an enlargement of the discharge pipe may be required (see **5.2.2** and **5.2.5**).

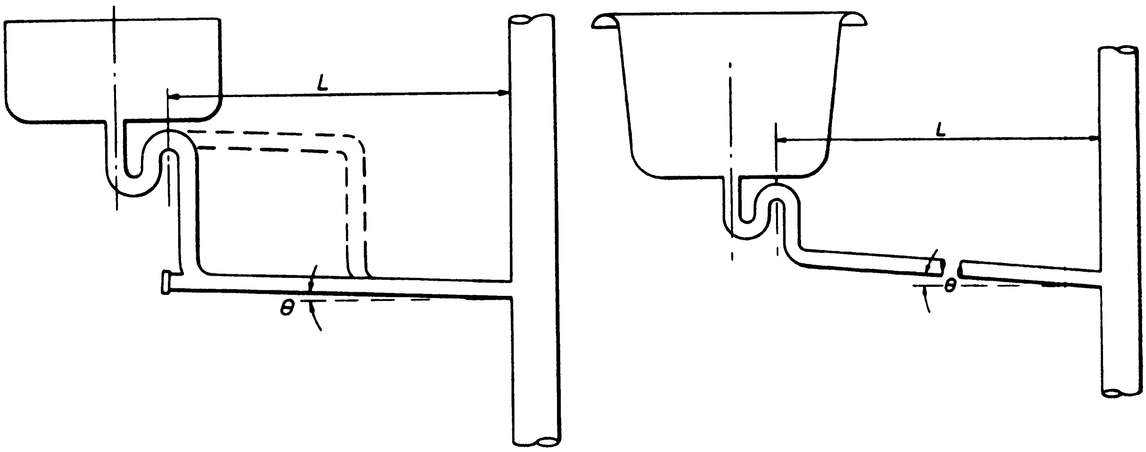


i) Sink   ii) Bath

θ is between 1° and 5° (18 to 90 mm/m)

L < 3 m (if L > 3 m then blockage and noisy discharge will be more likely to occur)
Trap of 75 mm seal depth for sink or 50 mm seal depth for bath, and 40 mm diameter

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



i) Sink   ii) Bath

θ is between 1° and 5° (18 to 90 mm/m)

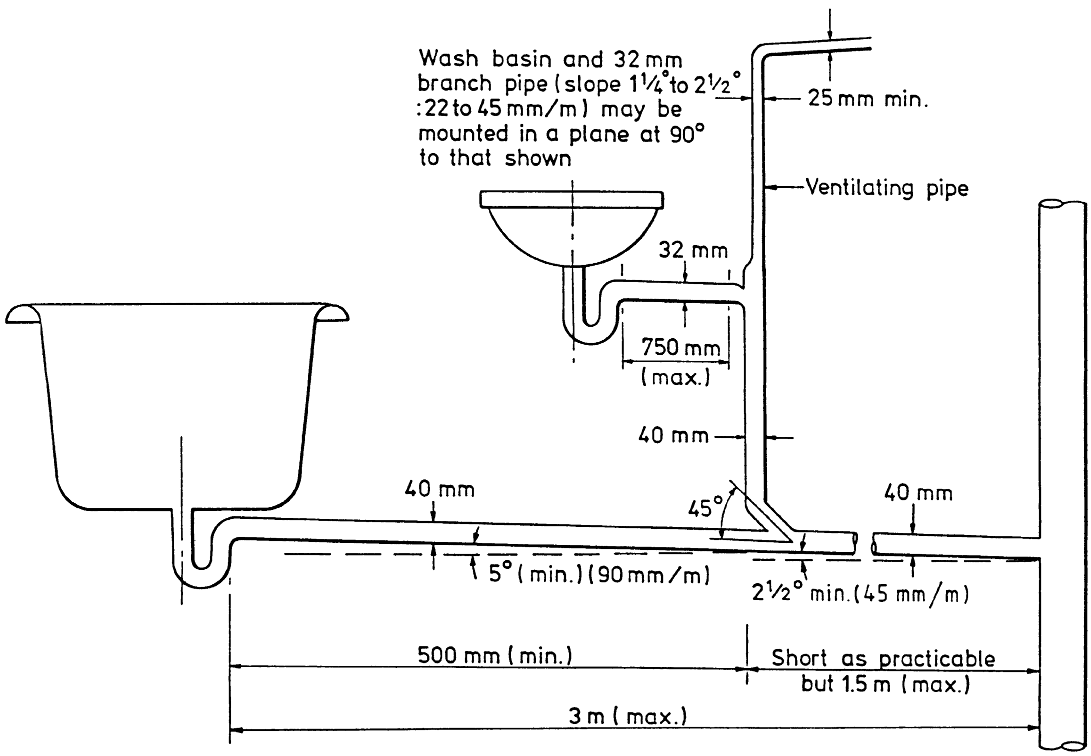
L < 3 m (if L > 3 m blockage will be more likely) also noisy discharges are likely with these arrangements and can only be prevented by trap venting as shown, for example, in figure 18b)ii and iii)

Trap of 75 mm seal depth for sink or 50 mm seal depth for bath, and 40 mm diameter

NOTE Any trap outlet not aligned prependicularly to the centre line of the stack will require at least one additional bend. See also Figure 8 for branch connection to stack.

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

Figure 19 — Branch discharge pipes for single baths and sinks



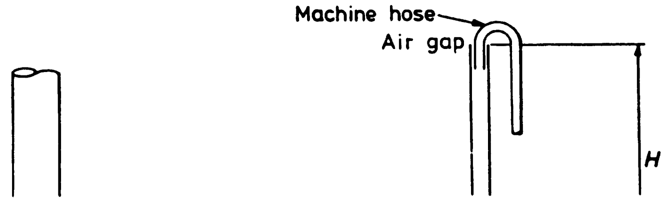
NOTE 1 A bend in the horizontal plane can be included in the 40 mm pipe. (Minimum radius 150 mm to centre line.)

NOTE 2 Any deviation from the dimensions (and limits) shown may cause self-siphonage or back flow into the bath.

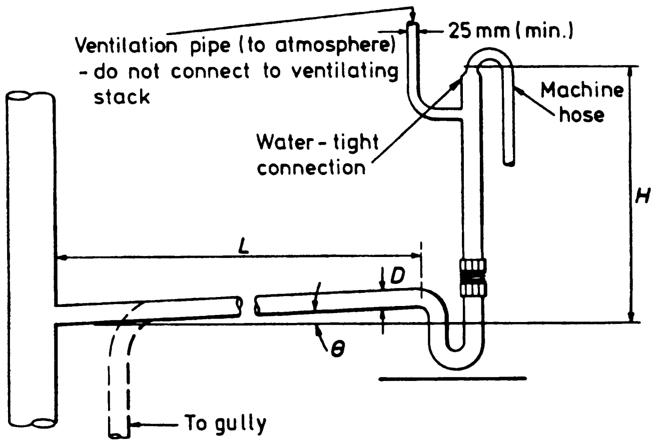
NOTE 3 Resealing traps can be used instead of venting but noisy bath and wash basin discharge may result.

NOTE 4 See also Figure 8 for branch connection to stack.

Figure 20 — Combined branch discharge pipe arrangement for a bath and wash basin



a) Without venting



D is 40 mm

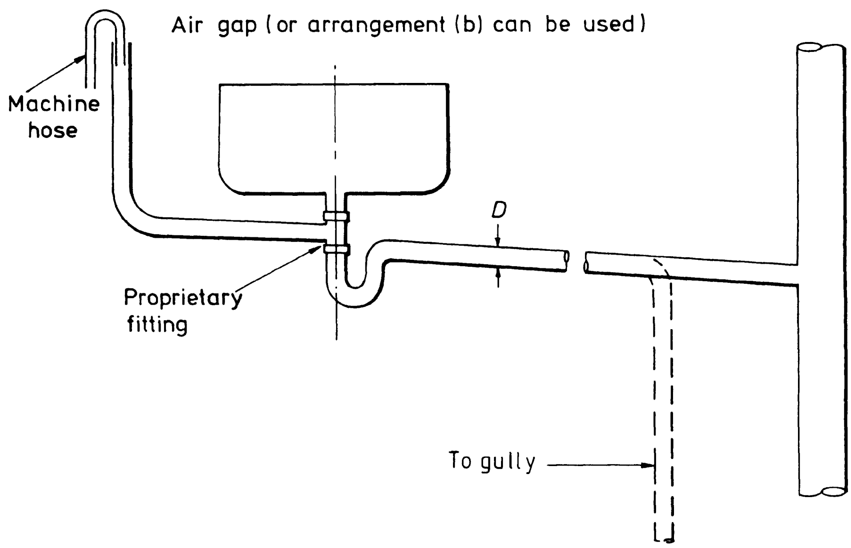
θ is 1° to 2½° (18 to 45 mm/m)

L < 3 m

H is 600 mm to 900 mm (depends on washing or dish washing machine design)
Trap of 75 mm seal depth and 40 mm diameter

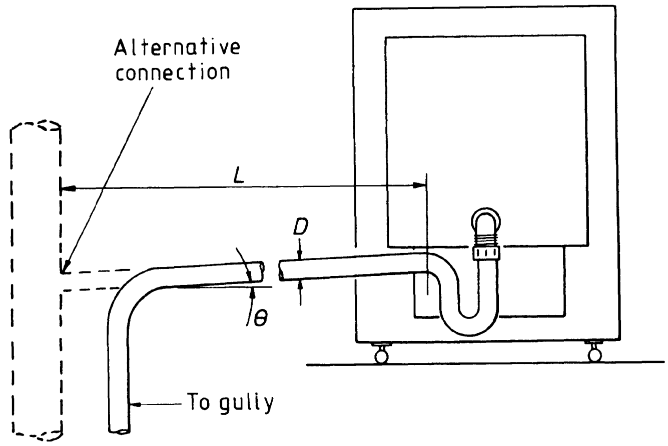
b) With venting

Figure 21 — Branch discharge pipes for washing and dish washing machines



D is 40 mm (see also figure 19 for details of sink discharge pipe design)

c) Connection to sink discharge pipe



D is 40 mm

θ is 1° to 2½° (18 to 45 mm/m)

$L < 3$ m

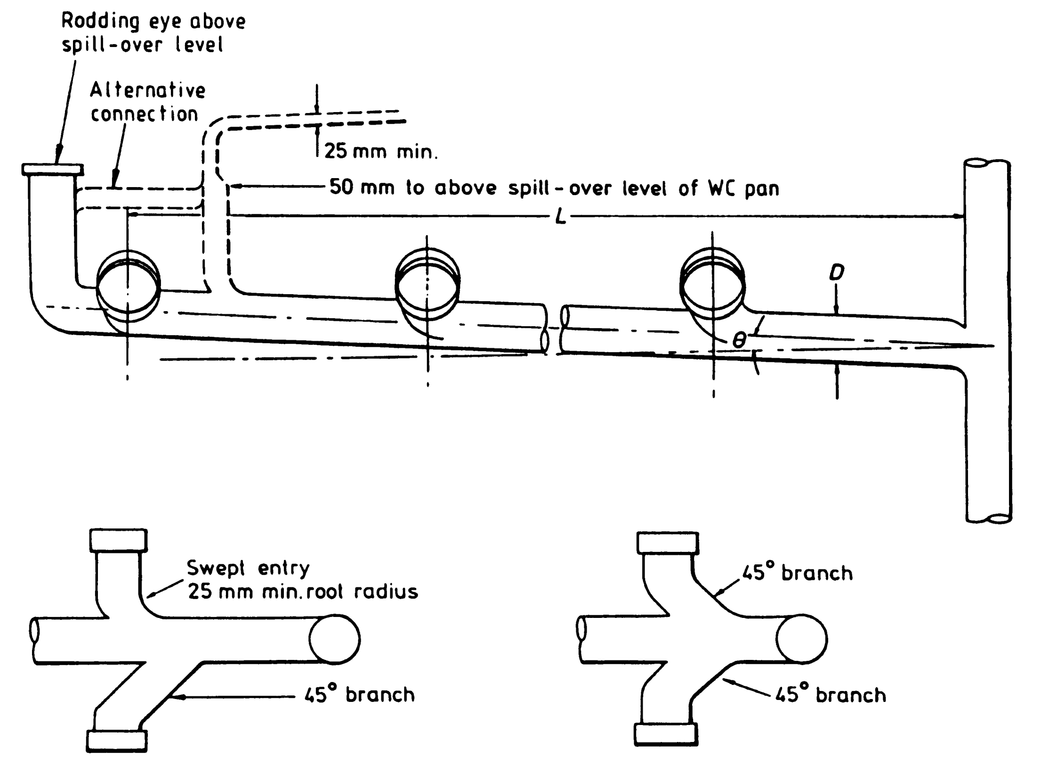
Trap

d) Machines with low level outlets

NOTE 1 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 sink discharge pipe or trap will cause machine water to back up into the sink.

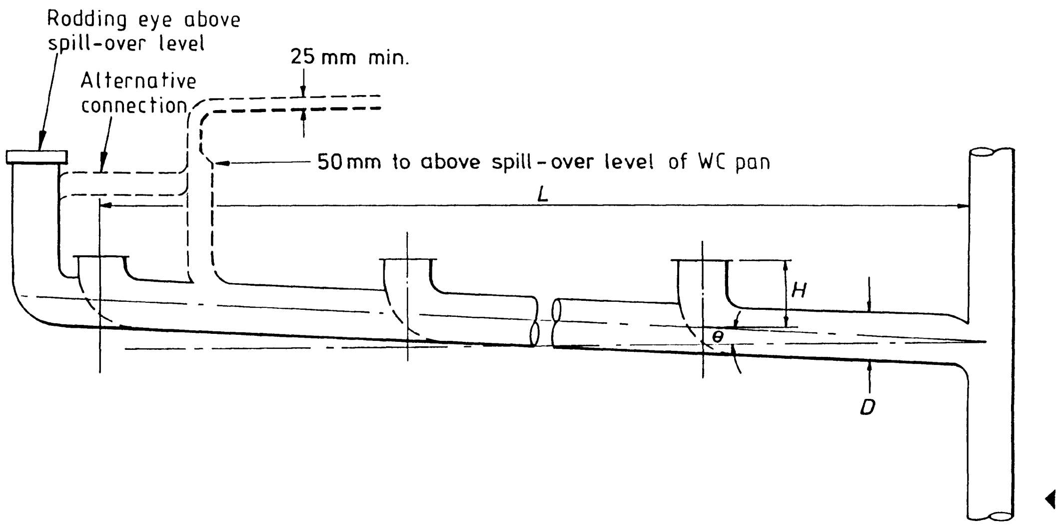
NOTE 2 Large dish washing machines (as used in restaurant kitchens) may have waste outlets which may limit the trap seal depths. Traps beneath machines should be located in an accessible position and where less than 75 mm seal depths are used, care should be taken to ensure at least 25 mm water seal is retained in the trap after every discharge (see **5.2.2**).

Figure 21 — Branch discharge pipes for washing and dish washing machines *(concluded)*



a) 'P' trap configuration

Figure 22 — Branch discharge pipes for ranges of WCs



b) 'S' trap configuration

D is 75, 100 or 150 mm depending on loading (see tables 6 and 8)

θ is ½° to 5° (9 to 90 mm/m)

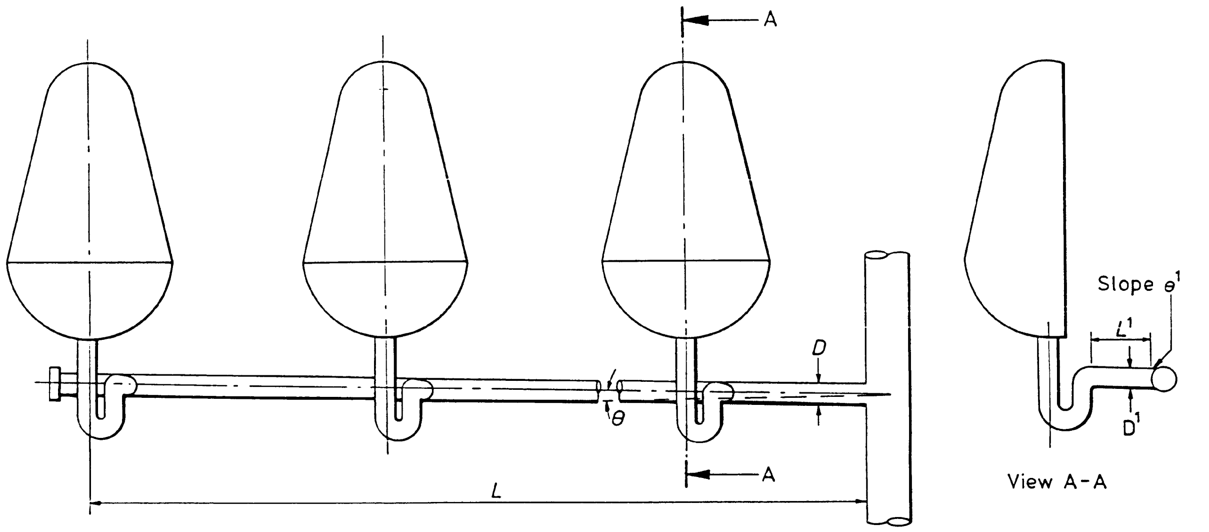
L < 15 m

H < 1.5 m

WC trap of 50 mm seal depth

NOTE Any additional bends should be of large radius. For more than eight WCs in a range, or with more than two bends in the main branch pipe, a 25 mm ventilating pipe should be used as shown. See also Figure 8 for branch connections to stack.

Figure 22 — Branch discharge pipes for ranges of WCs *(concluded)*



D is 50 mm

D^1 is 40 mm

θ is 1° to 5° (18 to 90 mm/m)

θ^1 is 1° to 2½° (18 to 45 mm/m)

L is as short as practicable commensurate with activity space requirements

L^1 is as short as practicable

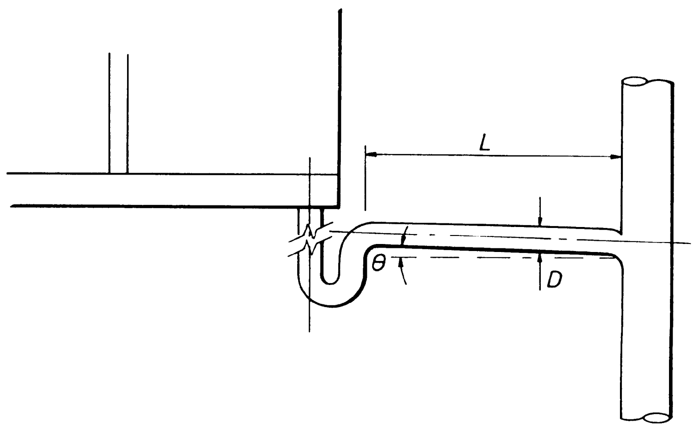
Trap of 75 mm seal depth and 40 mm diameter

Any bends should be of large radius

a) Bowl urinal

NOTE See also Figure 8 for branch connections to stack.

Figure 23 — Branch discharge pipes for ranges of urinals



D is 65 mm (for up to 6 stalls) or 75 mm

θ is 1° to 5° (18 to 90 mm/m)

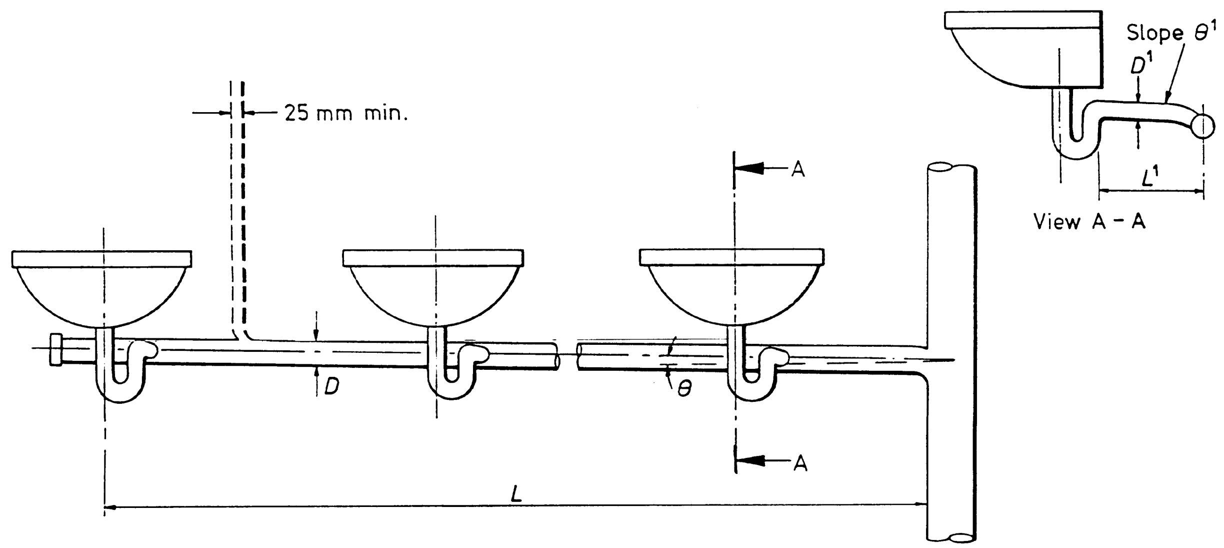
L is as short as practicable

Trap of 50 or 75 mm seal depth and 65 mm diameter.

NOTE For more than seven stalls or slab equivalent length, more than one outlet should be provided. Any trap outlet not aligned prependicularly to the center line of the stack will require at least one additional bend. Any additional bends at the outlet of the trap or in the horizontal plane should be of large radius. See also Figure 8 for branch connection to stack.

b) Stall urinal

Figure 23 — Branch discharge pipes for ranges of urinals *(concluded)*



D is 50 mm

D^1 is 32 mm

θ is 1° to 2½° (18 to 45 mm/m)

θ^1 is 1° to 2½° (18 to 45 mm/m)

L^1 is 0.75 m (max.)

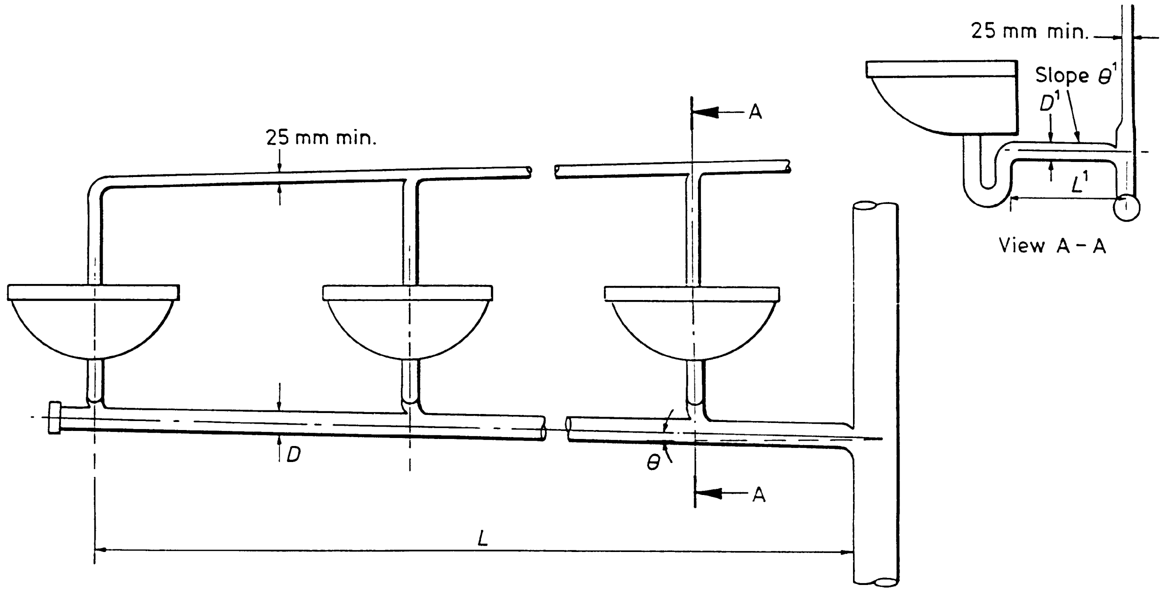
Trap of 75 mm seal depth and 32 mm diameter

No bends in main branch pipes
No ventilating pipe required where:
L is 4 m (max.)
i) Up to 4 wash basins (straight branch pipe)

25 mm ventilating pipe required as shown where *L* is 7 m (max.)
Up to 2 bends may be used in main branch pipe
ii) Up to 5 wash basins

a) Arrangements requiring minimum venting

Figure 24 — Branch discharge pipes for ranges of wash basins



D is 50 mm (65 mm for more than 10 basins)

D^1 is 32 mm

θ is 1° to 2½° (18 to 45 mm/m)

*θ*8¹ is 1° to 2½° (18 to 45 mm/m)

L is 10 m (max.)

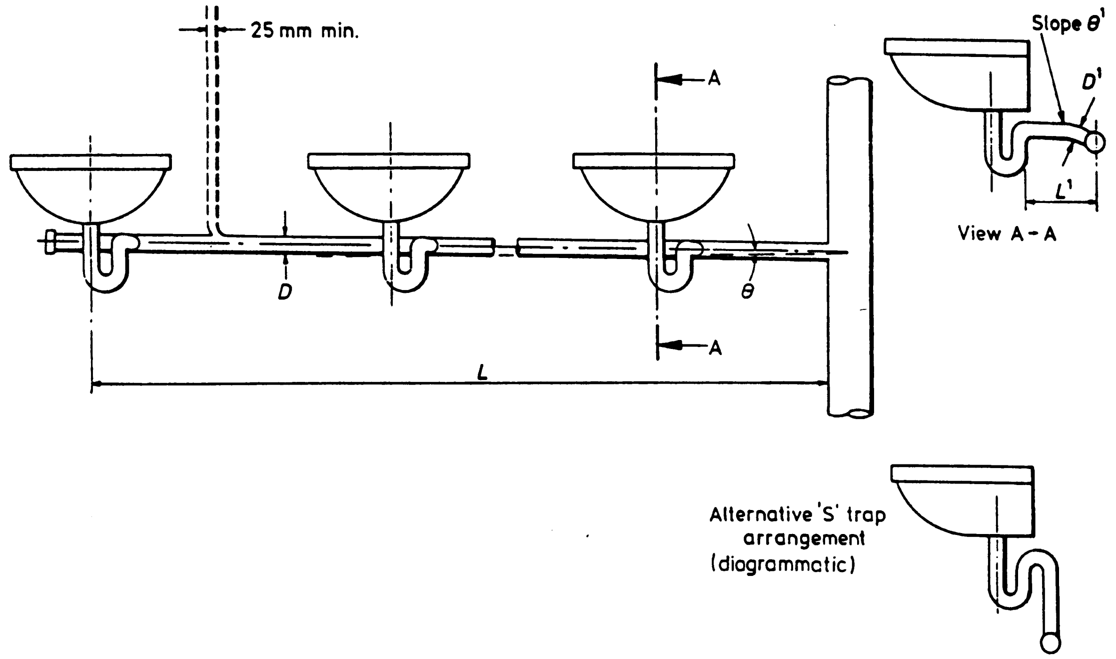
L^1 is 0.75 m (max.)

Trap of 75 mm seal depth and 32 mm diameter, 25 mm ventilating pipes required as shown

Any additional bends in the horizontal plane should be of large radius: swept junctions to be used

NOTE See also Figure 8 for branch connection to stack.

Figure 24 — Branch discharge pipes for ranges of wash basins *(concluded)*



***D*, *D*[1] is 32 mm**

θ, θ^1 is 1° to 2½° (18 to 45 mm/m)

***L* is as short as practicable (4.5 m max.)**

***L*[1] is as short as practicable**

Trap of 50 mm minimum seal depth and 32 mm diameter with flush grated waste and swept junction should be used (see 6.2.2).

Any additional bends in the horizontal plane should be of large radius.

NOTE For more than five basins or with *L* greater than 4.5 m use 25 mm ventilating pipe as shown. See also Figure 8 for branch connection to stack.

Figure 25 — Branch discharge pipes for ranges of spray tap basins (without plugs)

7.3 Discharge stack, branch and ventilating pipe relationships for common arrangements of appliances

7.3.1 *Stack sizing*

7.3.1.1 *General*

Arrangements of appliances in bungalows and two and three storey houses are assumed to be as in Figure 26, arrangements Aa, Ab, Ac, Ba and Bb, and appropriate discharge stack sizes are inset in each case. Any of the branch entry shapes shown in Figure 8 c) may be used for these arrangements.

Arrangements of appliances Ca, Cb, Da, Db, Eb and Ec are of a kind often repeated on several floors of a building. Table 5 gives sizes of discharge and ventilating pipes and stacks for these (see Figure 26).

7.3.1.2 *Assumptions*

The following assumptions apply together with those given in **7.1** and **7.2.1**:

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 **7.3.2**;

c) WCs have cistern capacities up to 9 l;

d) the drain serving the base of the stack is not likely to be surcharged and an intercepting trap is not fitted. Additional venting is needed if these conditions apply (see **7.3.3**);

e) the branch discharge pipe sizes are as given in **7.2**.

An "appliance group" 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 Table 6 for urinals).

7.3.1.3 Conversion table for stacks serving WCs, basins and urinals

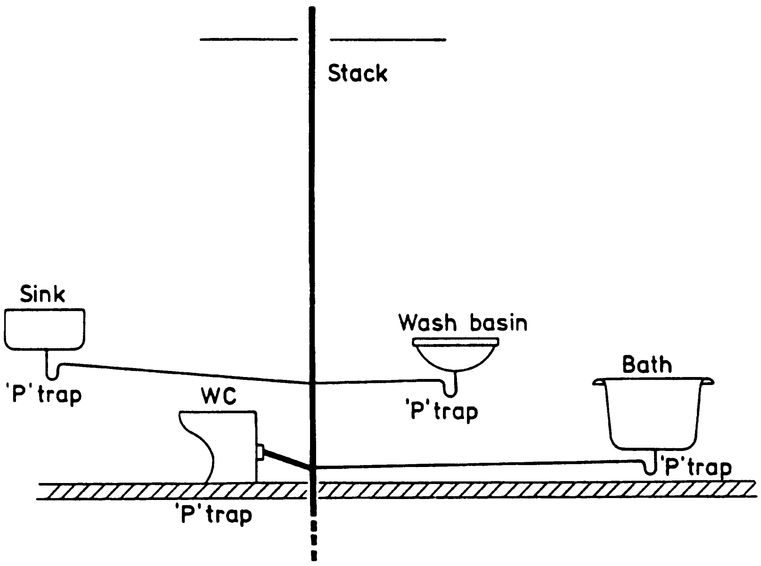
Table 5 includes a conversion table to enable systems serving wash basins, WCs and urinals to be sized for commercial or congested usage. It gives four examples of WC/urinal/wash basin combinations that may be taken as hydraulically equivalent to WC/wash basin combinations in Table 5.

7.3.2 *Ventilating stack sizes for offsets in discharge stacks* (see **6.3.3.4**)

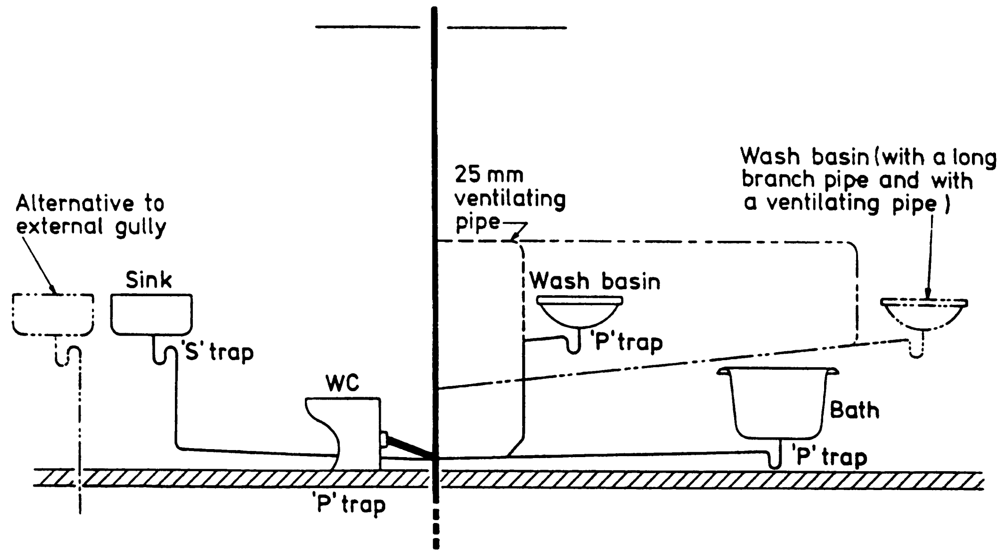
Offsets in the wet portion of a discharge stack generally require the connection of a ventilating stack, the diameter of which should be half the diameter of the discharge stack. For systems requiring a larger ventilating stack, see **7.3.3**. However, when offsets are fitted to systems with only a few appliances connected, up to three storeys in height, no additional venting is needed but large radius bends as described in **6.3.3.4** are then essential and the distance between the centre lines of the nearest branch connections and the offset should be at least 750 mm (see **5.2.2**).

7.3.3 *Ventilating pipe sizes for drainage systems affected by surcharging or by inclusion of intercepting traps* (see **6.3.3.5** and **6.3.3.6**)

Discharge stacks connected to drains which are likely to surcharge, or connect close to an intercepting trap, may 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 (see **5.2.2**).

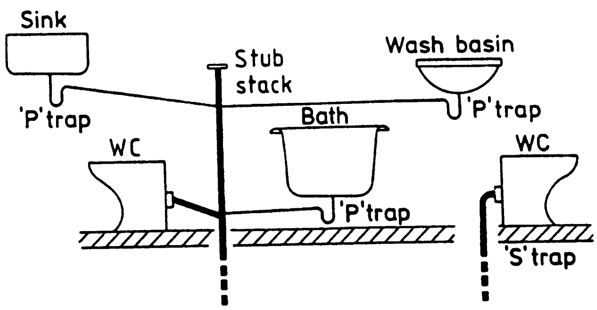


Arrangement Aa. Discharge stack not less than 75 mm

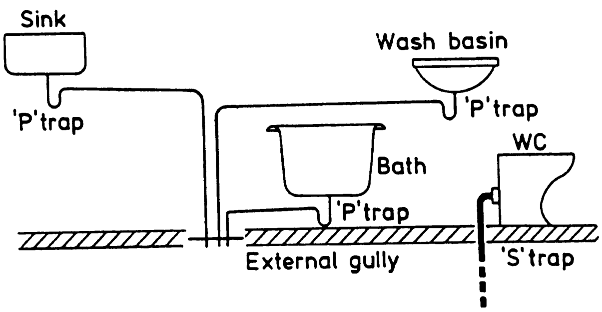


Arrangement Ab. Discharge stack not less than 75 mm

Figure 26 — Common arrangements of discharge stacks and branches

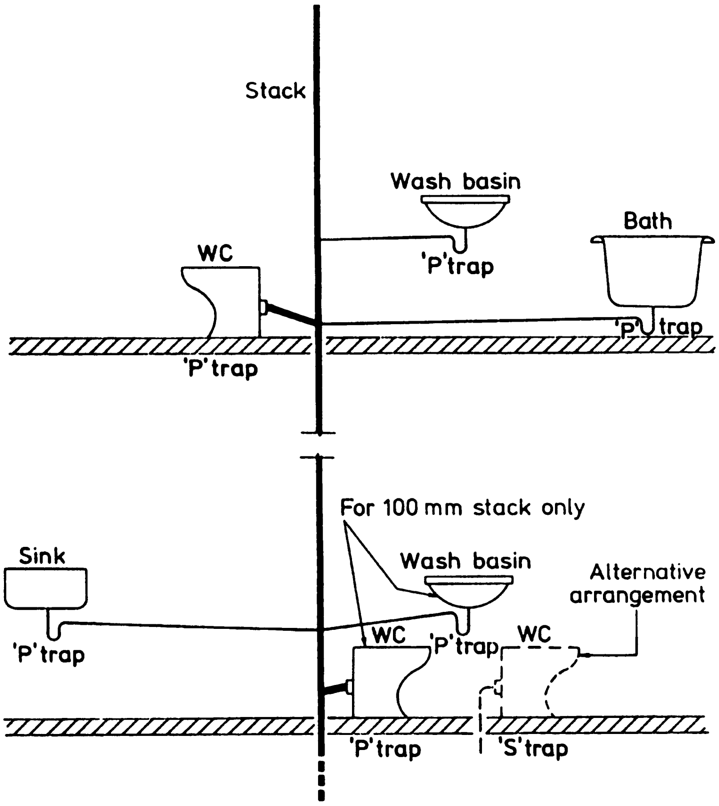


Arrangement Ac i). Ground floor appliances



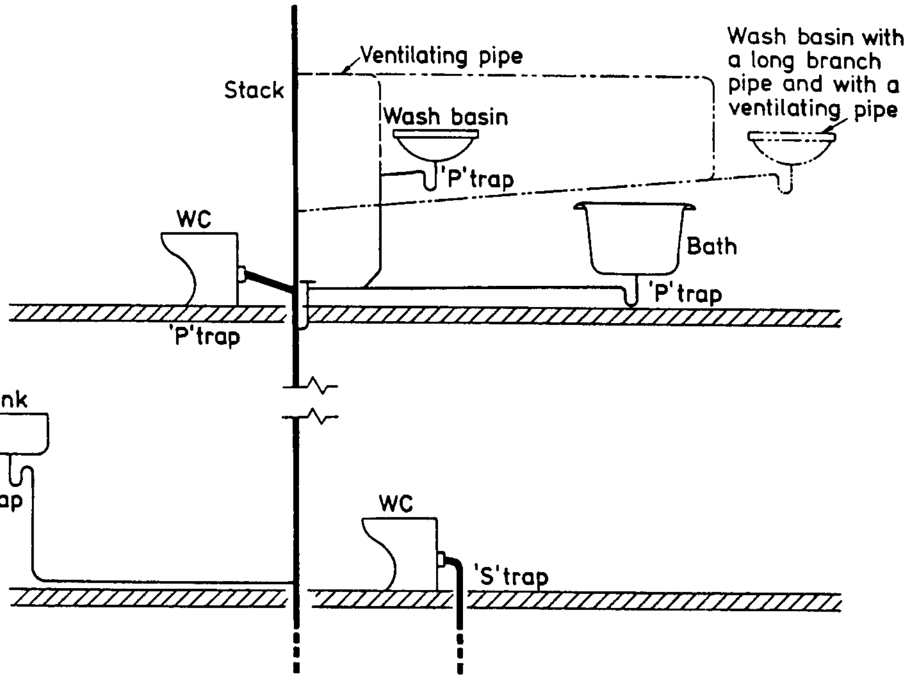
Arrangement Ac ii). Ground floor appliances

Figure 26 — Common arrangements of discharge stacks and branches *(continued)*



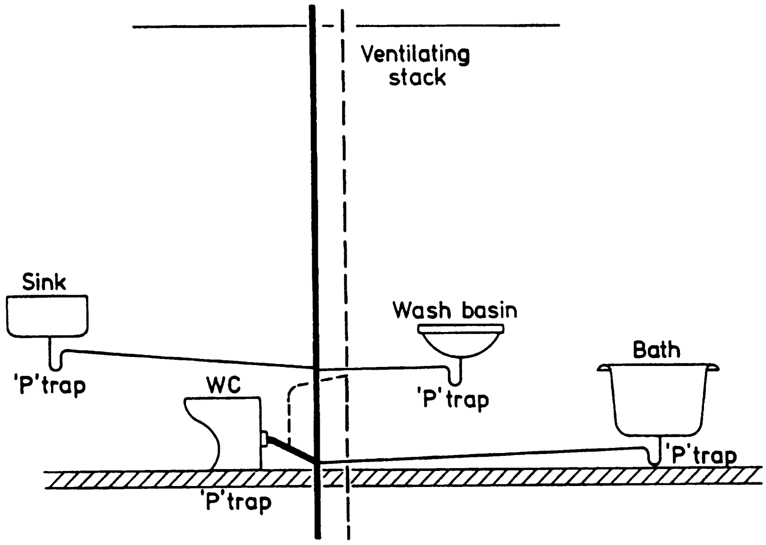
Arrangement Ba. Two storeys: discharge stack not less than 75 mm
Three storeys: discharge stack not less than 100 mm

Figure 26 — Common arrangement of discharge stacks and branches *(continued)*

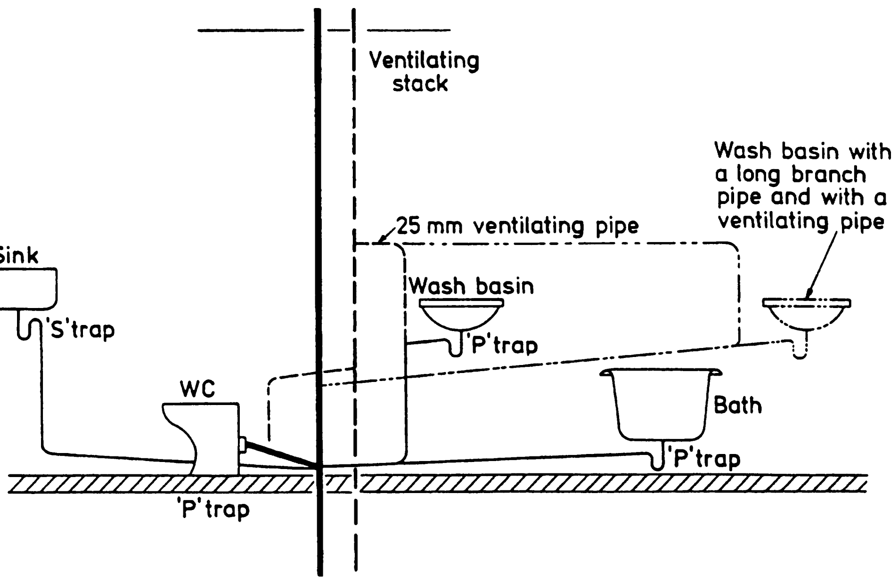


Arrangement Bb. Two storeys: discharge stack not less than 75 mm
Three storeys: discharge stack not less than 100 mm

Figure 26 — Common arrangement of discharge stacks and branches *(continued)*



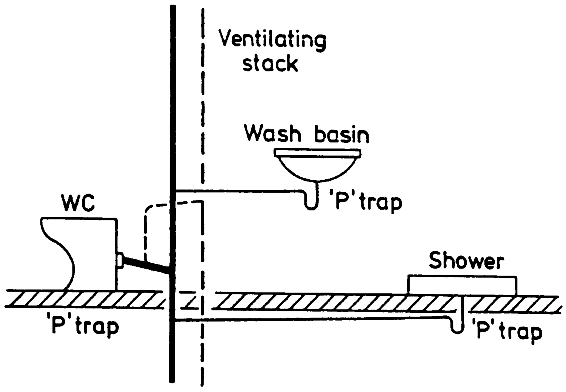
Arrangement Ca



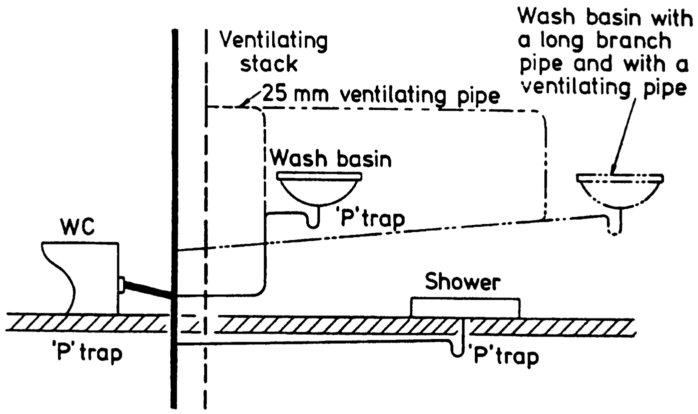
Arrangement Cb

Arrangement C. Multi-storey flats

Figure 26 — Common arrangements of discharge stacks and branches (*continued*)



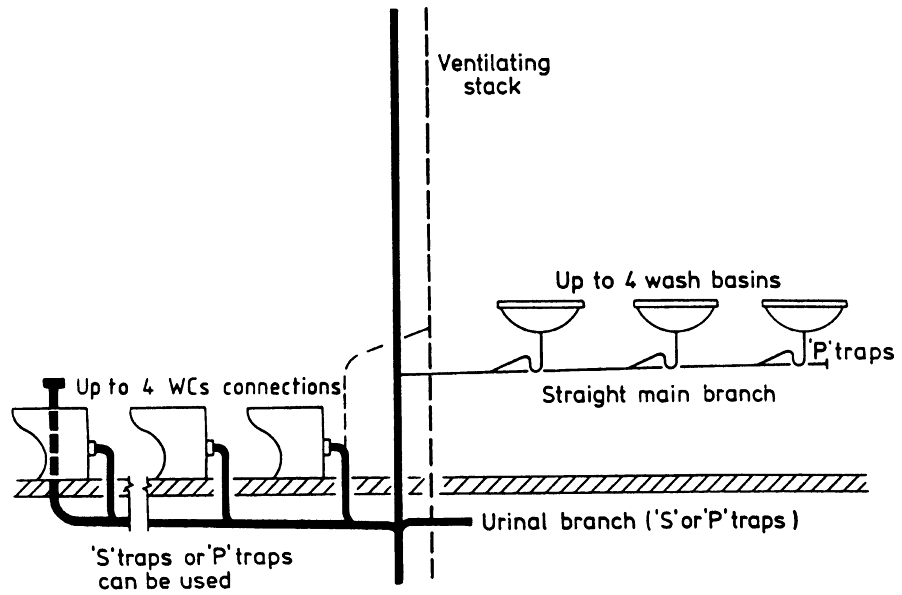
Arrangement Da



Arrangement Db

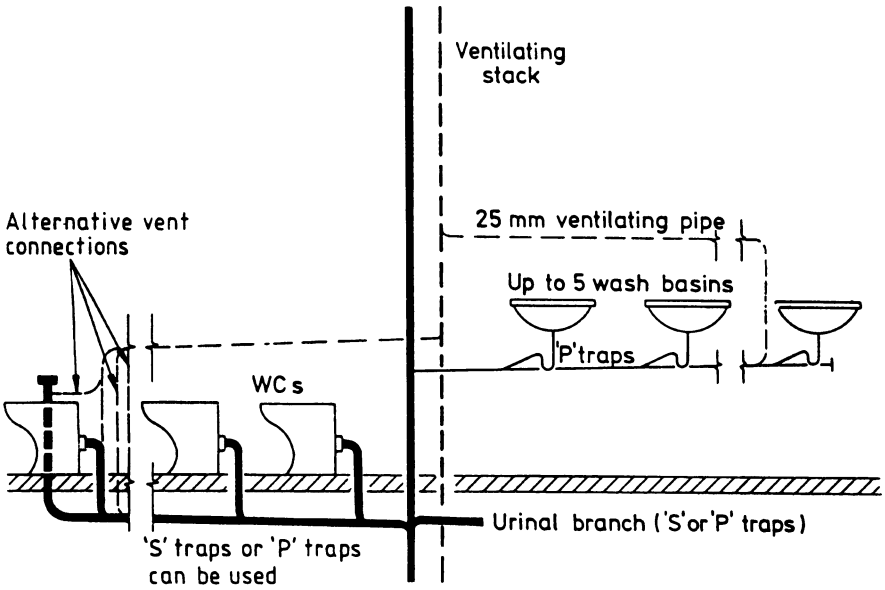
Arrangement D. Multi-storey halls of residence

Figure 26 — Common arrangements of discharge stacks and branches *(continued)*



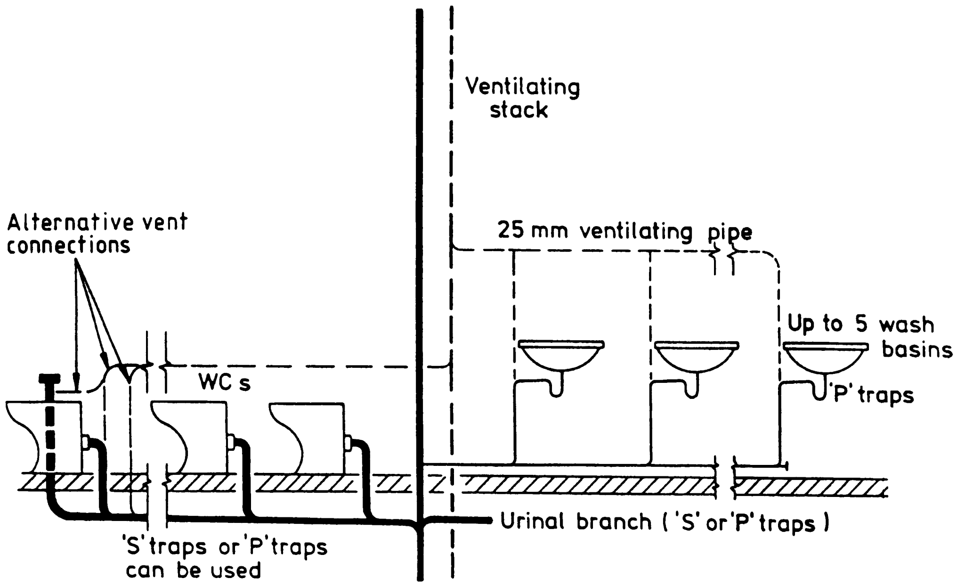
Arrangement Ea

Figure 26 — Common arrangements of discharge stacks and branches *(continued)*



Arrangement Eb

NOTE Only 5 WCs and 5 wash basins per floor are referred to in table 5 on ventilating stack sizes.



Arrangement Ec

NOTE Only 5 WCs and 5 wash basins per floor are referred to in Table 5 on ventilating stack sizes.
Arrangement E. Commercial and public buildings

Figure 26 — Common arrangements of discharge stacks and branches (*concluded)*

Table 5 — Ventilating stack sizes (in millimetres) for commonly used arrangements of discharge stacks and swept entry branches

Discharge stack size		100 mm																				150 mm													
Frequency of use		20 min				10 min										5 min						20 min		10 min						5 min					
Usage description		Domestic				Hall of residence				Commercial						Congested						Domestic		Hall of residence		Commercial				Congested					
Number of floors		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)		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	32[a]	50	50	0	32[a]	32	32	0	32[a]	0	32[a]	32	32	0	32[a]	0	32[a]	32	32	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]
	2	0	32[a]	50	50	0	32[a]	32	32	0	32[a]	0	32[a]	32	32	0	32[a]	50	50	50	50	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]	0	32[a]
	3									0	32[a]	32	32	40	40	0	32[a]	50	50							0	32[a]	0	32[a]	0	32[a]	0	32[a]	65	65
	4									0	32[a]	40	40	40	40	32	32[a]									0	32[a]	75	75	0	32	75	75	75	75
	5									0	32[a]	40	40				32[a]									0	32[a]	75	75	0	32	75	75	75	75

NOTE 1 See **7.3.1.2** for design assumptions and composition 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[a].

NOTE 3 The following are conversions to be used with the above table (see **7.3.1.3**).

WC	**Urinal**	**Wash basin**		**WC**	**Wash basin**
2 +	1	2	Hydraulically	2 +	2
2 +	2	3	equivalent to	3 +	3
3 +	3	4		4 +	4
4 +	4	5		5 +	5

[a] Modified single stack arrangement (see **6.4.2.4**).

8 Pipe sizing using discharge unit method

NOTE For background see Burberry and Griffiths [12].

8.1 General

This method can be used for special installations, e.g. systems for very tall or large buildings, not covered by the data in **7.3**. A criterion of satisfactory service of 99.5 % is assumed. In this method, numerical values are assigned to sanitary appliances to express their load producing properties. By fixing a flow limit of one-quarter capacity for the discharge stacks (larger flows will cause plug flow giving rise to uncontrollable pressure fluctuations) and one-half capacity for branch discharge pipes, the maximum number of discharge units permissible for a given pipe or stack diameter can be stated. However, this discharge unit method cannot give guidance on the venting requirements as it is based entirely on hydraulic loadings and not on the pressures developed within the stack. Consequently, one of the Table 6, Table 7 or Table 8, as appropriate, giving approximate ventilating pipe and stack sizes, should be used with this data. Table 9 shows vent pipe sizes increasing with size of discharge stack. This is usually a safe assumption but it can lead to oversized ventilating systems in some cases (see **5.2.1** and **5.2.2**).

NOTE The flow and usage data and design limits specified in clause **5** are assumed in all parts of clause **8**.

Table 6 — Discharge unit values and flow rates for common appliances

Type of appliance	Minimum interval of discharge min	Discharge units
Washdown WC with 9 l high or low level cistern[a]	20 10 5	7 14 27
Washdown WC with 7.5 l high or low level cistern[a]	20 10 5	6 12 24
Washdown WC with 6 l high or low level cistern	20 10 5	6 11 23
Washdown WC with 9 l close coupled cistern[a]	20 10 5	4 8 16
Washdown WC with 7.5 l close coupled cistern[a]	20 10 5	4 7 14
Washdown WC with 6 l close coupled cistern	20 10 5	3 6 11
Washdown WC fitted with a macerator	Add 0.4 ls^{-1} per unit	< 1 See note
Urinal (per person unit)	Add 0.15 ls^{-1} per unit	< 1 See note
Wash basin (32 mm branch)	20 10 5	1 3 5
Sink (40 mm branch)	20 10 5	7 13 26
Bath (40 mm branch)	75 (domestic) 30 (congested)	7 17
Spray tap basin	Add 0.06 ls^{-1} per tap	< 1 See note
Electric shower	Add 0.07 ls^{-1} per unit	< 1 See note
Low pressure shower (per Spray head)	Add 0.15 ls^{-1} per spray head	< 1 See note
High pressure shower (per Spray head)	Add 0.15 – 0.35 ls^{-1} per Spray head	< 1 See note
Automatic washing machine	250 (domestic) 4 (commercial/congested)	3 18
Dishwashing machine	Add 0.25 ls^{-1} per unit	< 1 See note
One group consisting of: one WC (7.5 l), one bath, one or two basins, one sink and a washing machine		14

NOTE Where such appliances are used the total flow, from those that are likely to discharge at the same time (as determined by suitable probability calculations), should be calculated and added to the flow equivalent to the total discharge units of the other appliances (obtained from Figure 27) producing the design flow rate, or design loading, that can be used in Table 7 and Table 8.

[a] British Standard WC cistern capacities have the following tolerances:
9 ± 0.5 l (BS 1125), 7.5 + 0 – 0.5 l (BS 7357).

8.2 Procedure

8.2.1 *General*

Discharge unit values for sanitary appliances in common use are given in Table 6. For other appliances the discharge unit value should be taken as that given in Table 6 for an appliance with the same diameter trap. See also Table 7 and Table 8 for capacity and number of discharge units permissible.

Table 7 — Maximum capacity and number of discharge units for vertical stacks

Size mm	Approximate capacity of stack l/s	Approximate number of discharge units
50	1.2	10[a]
65	2.1	60[a]
75	3.4	200
90	5.3	350
100	7.2	750
125	13.3	2 500
150	21.7	5 500

NOTE Ventilating stacks may be required and sizes are shown in Table 9.
[a] No WCs.

Table 8 — Maximum number of discharge units allowed on branch discharge pipes

Size	Discharge units		
	Gradient ½°	Gradient 1¼°	Gradient 2½°
mm	(9 mm/m)	(22 mm/m)	(45 mm/m)
32	—	1	1
40	—	2	8
50	—	10	26
65	—	35	95
75	—	100	230
90	120	230	460
100	230	430	1 050
125	780	1 500	3 000
150	2 000	3 500	7 500

NOTE 1 Maximum number of discharge units permitted for a 150 mm vertical stack is 5 500.
NOTE 2 Discharge pipes sized in this way give the minimum size necessary to carry the expected flow load.
NOTE 3 Ventilating pipes may be required and sizes are shown in Table 9.

8.2.2 *Guide to ventilating pipe and stack sizes*

The sizes of ventilating pipes or stacks should be as given in Table 9 but they are only a general guide. The sizes from this table will in most cases be larger than the specific recommendations given in this standard (see **5.2.2**).

Table 9 — General guide for the sizes of ventilating pipes and stacks

Size of branch discharge pipe or discharge stack, *D*	Size of branch ventilating pipe or stack
Less than 75 mm	⅔ *D* (25 mm min.)
75 mm and above	½ *D*

8.2.3 *Admission of rainwater into discharge stacks*

The discharge unit method and associated ventilating pipe and stack sizing data can be used for discharge stacks which also collect rainwater from roof areas, but attention is drawn to the possible dangers (see **5.3.4.6**). Consequently, it is generally recommended that such arrangements are limited to roof areas not more than 40 m^2 per stack and to buildings of not more than 10 storeys in height.

9 Work on site

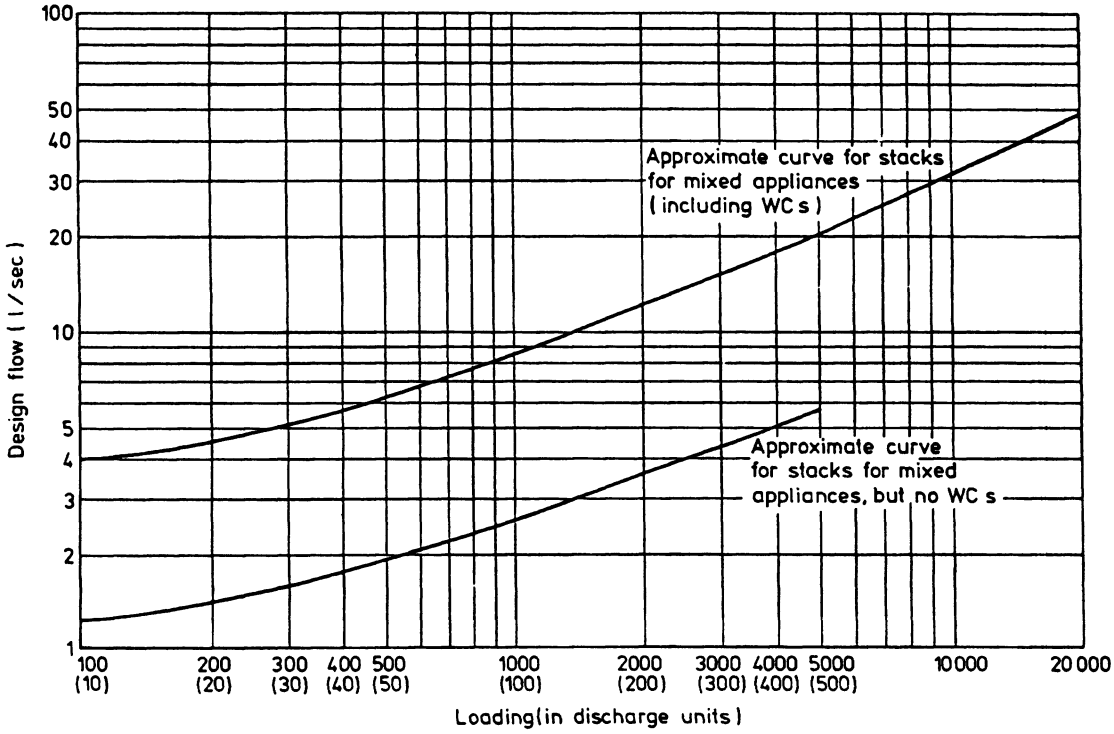
9.1 Jointing of pipes

9.1.1 *General*

All joints made in pipework and joints of pipework to appliances should be air-tight and water-tight and should remain so during use. Care should be taken to ensure that no jointing material projects inside the bore of the pipe. Some flexibility is desirable where there is a possibility of movement in a pipeline or between the pipe and the appliance and provision should be made in the assembly of sanitary pipework to accommodate and control thermal movement. To conform to electrical wiring regulations (BS 7671), pipework may require continuity of electrical bonding at each joint (see **5.2.4**, **5.2.5** and **5.2.6**.)

9.1.2 *Joints between pipes of different materials*

The range of materials employed for sanitary pipework produces different jointing conditions when they are connected to one another. Manufacturer's recommendations should be followed.



NOTE The upper units in the horizontal scale relate to the curve for appliances including WCs and the lower units in parentheses relate to the curve for appliances without WCs.

Figure 27 — Design flows for stacks serving mixed types of appliances with and without WCs

9.2 Support and fixing of pipes

9.2.1 *General*

Any external pipework or materials which require protection against atmospheric corrosion should be so fixed as to give free access, all round the pipe, for the application of paint or other protective coating. The minimum clearance for this purpose between the pipe and structure should be 30 mm and, generally, such pipes should not be fixed in chases or internal angles. All fixings should be carefully aligned and either accurately plugged to the wall or built in and secured (see **5.2.6** and **5.2.7**).

The fixing and provision for thermal movement of pipework in ducts requires special consideration. Ducts should be large enough to allow for the pipe to be fixed at the gradients given in **6.3** without adversely affecting access as recommended in **6.5**.

Discharge pipes, if located in ducts with high ambient temperatures, are liable to dry out between discharges if the flow in the pipe is small and intermittent. This might cause a build-up of deposit in the pipe and bring about pipe blockage. The ambient temperature in the ducts should be controlled to prevent this happening. In situations where the discharge pipe is receiving hot water, high ambient temperatures will inhibit heat loss through the pipe wall. Consideration should be given to insulating discharge pipes. (See **5.2.5**.)

Hot water pipes in the vicinity of discharge pipes should be insulated against heat transfer.

Where pipes pass through walls or solid floors, they should be protected by a layer of inert material. Suitable fire stops should be fitted where appropriate.

Alternatively, the pipes may be accommodated in sleeves of inert material which should extend through the full finished thickness of the floor or wall and be secured against movement (see **5.2.6**).

The recommended spacings for pipe fixings are set out in Table 10.

Table 10 — Maximum distance between pipe supports

Pipe material	Pipe size mm	Vertical pipes m	Low gradient pipes m
Acrylonitrile butadiene sytrene ABS	32 40 50	1.2 1.2 1.2	0.5 0.5 0.6
Cast iron	All sizes	3.0	3.0
Copper	25 32 to 40 50 65 to 100	2.4 3.0 3.0 3.7	1.8 2.4 2.7 3.0
Galvanized steel	25 32 40 to 50 65 to 75 100	3.0 3.0 3.7 4.6 4.6	2.4 2.7 3.0 3.7 4.0
Polyethylene PE	32 to 40 50	1.2 1.2	0.5 0.6
Modified unplasticized polyvinyl chloride MUPVC	32 to 40 50	1.2 1.2	0.5 0.6
Polypropylene PP	32 to 40 50	1.2 1.2	0.5 0.6
Unplasticized polyvinyl chloride PVC-U	32 to 40 50 75 to 100 150	1.2 1.2 1.8 1.8	0.5 0.6 0.9 1.2
Borosilicate glass (see note 1)	25 40 to 75 100 150	1.0 1.2 1.5 1.8	1.0 1.2 1.4 1.8
Stainless steel (see note 2)	All sizes	2.0	2.0

NOTE 1 Where two or more fittings are adjacent on low gradient pipes, additional fixing should be provided.
NOTE 2 Supports should be located close to and downstream of sockets. Additional supports are recommended at junctions and changes of direction.

9.2.2 ***Thermal movement***

The movement caused by temperature changes in pipework requires special consideration and, therefore, adequate provision for expansion should be made, especially with pipes made of plastics and copper. Where pipes of these materials pass through walls or solid floors, sleeves should be provided as described in **9.2.1**.

9.2.3 ***Types of fixing***

9.2.3.1 *Cast iron pipes*

The following fixing methods may be used:

a) ears on the pipe sockets;

b) cast iron, malleable iron or steel holderbats for building in, or nailing or screwing to the structure;

c) purpose-made straps or hangers.

9.2.3.2 *Copper tubes*

The following fixing methods may be used:

a) copper alloy holderbats for building in, or screwing to the structure;

b) pipe clips of copper, copper alloy, plastics or other suitable material;

c) purpose-made straps or hangers.

9.2.3.3 *Galvanized steel tubes*

The following fixing methods may be used:

a) malleable iron schoolboard pattern brackets for building in, or screwing to the structure;

b) malleable iron pipe rings, with either back plates or girder clips;

c) purpose-made straps or hangers.

9.2.3.4 *Plastics pipes*

Holderbats of metal, plastics coated metal or suitable plastics material may be used for fixing plastics pipes, but care should be taken to ensure that the pipe clip does not bite into the external surface of the pipe when tightened. Where anchor points are required to control thermal movement, the holderbats are usually fitted on the pipe sockets between special ribs. Intermediate guide brackets fitted to the pipe barrel should allow thermal movement to take place.

In multi-storey dwellings, vertical pipes should be supported by metal brackets because of their greater fire resistance.

9.2.4 ***Distance between pipe supports***

The distance between pipe supports should not exceed those shown in Table 10. In vertical pipe runs there should be at least one pipe support bracket at each storey height, fixed behind a collar to support the vertical load and avoid downward movement of the pipes and loss of expansion gaps. Supports should be adjacent to joints and of adequate strength to carry the weight of the pipe plus contents.

For low gradient pipework where the layout occasionally requires shorter lengths than the maximum, support distances should be adjusted to suit these shorter lengths and provision of lateral bracing should be considered when pipes are flexibly jointed.

9.3 Protection during building construction

Every care should be taken to protect the work and to prevent the entry of foreign matter into any part of the system during construction. Openings should, therefore, be kept sealed with purpose-made fittings (see **5.2.5**).

Special care should be taken with pipe systems having ring seal joints to prevent deflection of the joint after the pipework is assembled. Pipework should not be allowed to carry any external load either during or after construction.

All access covers and cleaning eyes should be fitted at the time of installation and be finally fixed and sealed after testing (see **5.2.4**).

10 Inspection and testing of completed installations

10.1 General

Inspections and tests should be made during the installation of the discharge system as the work proceeds, to ensure that the pipework is properly secured and clear of obstructing debris and superfluous matter and that all work which is to be concealed is free from defects before it is finally enclosed (see **5.2.2**, **5.2.4**, **5.2.5** and **5.2.9**).

Prefabricated units should be tested at the works or place of fabrication, and inspected on delivery at the site.

10.2 Final inspection

On completion, the discharge system should be meticulously inspected to ensure that the recommendations of this British Standard have been observed and that no cement droppings, rubble or other objects are left in or on the pipes and that no jointing material projects into the pipe bore. When this has been done, tests for soundness of the pipework and for performance should be made (see **5.2.5**).

10.3 Testing

10.3.1 ***Air test***

NOTE Normally the test for soundness is carried out to detect if all pipes and fittings are air-tight. It should be completed in one operation but for large multi-storey systems testing in sections may be necessary (see **5.2.4**).

10.3.1.1 *Preparation*

The water seals of all sanitary appliances should be fully charged and test plugs or bags inserted into the open ends of the pipework to be tested. To ensure that there is a satisfactory air seal at the base of the stack, or at the lowest plug or bag in the stack if only a section of the pipework is to be tested, a small quantity of water sufficient to cover the plug or bag can be allowed to enter the system.

One of the remaining test plugs should be fitted with a tee piece, with a cock on each branch, one branch being connected by means of a flexible tube to a manometer. Alternatively, a flexible tube from a tee piece fitted with cocks on its other two branches can be passed through the water seal of a sanitary appliance. Any water trapped in this tube should be removed and then a manometer can be connected to one of the branches as described above.

10.3.1.2 *Application*

Air is pumped into the system through the other branch of the tee piece until a pressure equal to 38 mm water gauge is obtained. The air inlet cock is then closed and pressure in the system should remain constant for a period of not less than 3 min.

10.3.2 ***Leak location***

NOTE Defects revealed by an air test may be located by the methods given in **10.3.2.1** to **10.3.2.3**.

10.3.2.1 *Smoke*

A smoke producing machine may be used which will introduce smoke under pressure into the defective pipework. Leakage may be observed as the smoke escapes. Smoke cartridges containing special chemicals should be used with caution, taking care that the ignited cartridge is not in direct contact with the pipework and that the products of combustion do not have a harmful effect upon the materials used for the discharge pipe system.

Smoke testing of plastics pipework should be avoided due to naptha having a detrimental effect, particularly on ABS, PVC-U and MUPVC. Rubber jointing components can also be adversely affected.

10.3.2.2 *Soap solution*

With the pipework subjected to an internal pressure using the smoke machine or the method described in **10.3.1**, a soap solution can be applied to the pipes and joints. Leakage can be detected by the formation of bubbles.

10.3.2.3 *Water test*

There is no justification for a water test to be applied to the whole of the plumbing system. The part of the system mainly at risk is that below the lowest sanitary appliance and this may be tested by inserting a test plug in the lower end of the pipe and filling the pipe with water up to the flood level of the lowest sanitary appliance, provided that the static head does not exceed 6 m.

10.3.3 ***Performance tests***

10.3.3.1 *General*

All appliances, whether discharged singly or in groups, should drain speedily, quietly and completely (see **5.2.1**, **5.2.2**, and **5.2.3**).

To ensure that adequate water seals are retained during peak working conditions the tests described below should be carried out. After each test a minimum of 25 mm of water seal should be retained in every trap. Each test should be repeated at least three times, the trap or traps being recharged before each test. The maximum loss of seal in any one test, measured by a dip stick or small diameter transparent tube, should be taken as the significant result.

10.3.3.2 *Tests for self-siphonage and induced siphonage in branch discharge pipes*

To test for the effect of self-siphonage the appliance should be filled to overflowing level and discharged by removing the plug; WC pans should be flushed. The seal remaining in the trap should be measured when the discharge has finished. Ranges of appliances, connected to a common discharge pipe, should also be tested for induced siphonage in a similar way. The number of appliances which should be discharged together is given in Table 11. The seal remaining in all the traps should be measured at the end of the discharge. The worst conditions usually occur when the appliances at the upstream end of the discharge pipe are discharged (see **5.2.2** and **5.2.3**).

10.3.3.3 *Test for induced siphonage and back pressure in discharge stacks*

A selection of appliances connected to the stack should be discharged simultaneously and the trap and seal losses due to positive or negative pressures in the stack should be noted. These selected appliances should normally be close to the top of the stack and on adjacent floors, as this gives the worst pressure conditions. Table 11 shows the number of appliances which should be discharged simultaneously (see **5.2.2** and **5.2.3**).

As an example, for a block of flats nine storeys high with the stack serving one WC, one wash basin, one sink and one bath on each floor, the test would consist of one WC, one wash basin and one sink being discharged simultaneously on the top floor. Where the stack served two WCs, two wash basins, two baths and two sinks on each floor, the discharge test would consist of one WC, one wash basin and two sinks. The WC, wash basin and one sink would be discharged on the top floor and the remaining sink on the floor immediately below.

For the purpose of this test, baths are ignored as their use is spread over a relatively long period and consequently they do not add materially to the normal peak flow on which Table 11 is based. Where a stack serves baths only, the number to be discharged simultaneously in a test should be taken to be the same as for sinks. Flows from showers are small and these can usually be ignored for stacks serving mixed appliances. Similarly for non-domestic buildings spray tap basins and urinals need not be included in the test when the stack also serves other appliances.

Table 11 — Number of sanitary appliances to be discharged for performance testing

Type of use	Number of appliances of each kind on the stack	Number of appliances to be discharged simultaneously		
		WC	Wash basin	Kitchen sink
Domestic	1 to 9 10 to 24 25 to 35 36 to 50 51 to 65	1 1 1 2 2	1 1 2 2 2	1 2 3 3 4
Commercial or public	1 to 9 10 to 18 19 to 26 27 to 52 53 to 78 79 to 100	1 1 2 2 3 3	1 2 2 3 4 5	
Congested	1 to 4 5 to 9 10 to 13 14 to 26 27 to 39 40 to 50 51 to 55 56 to 70 71 to 78 79 to 90 90 to 100	1 1 2 2 3 3 4 4 4 5 5	1 2 2 3 4 5 5 6 7 7 8	

NOTE These figures are based on a criterion of satisfactory service of 99 %. In practice, for systems serving mixed appliances, this slightly overestimates the probable hydraulic loading. The flow load from urinals, spray tap basins and showers is usually small in most mixed systems, hence these appliances need not normally be discharged.

11 Maintenance

11.1 General

Discharge pipe systems should be kept in a clean and sound condition in order to maintain maximum efficiency. This is facilitated by designing in accordance with the recommendations in this British Standard (see **5.2.5**, **5.2.6** and **5.2.8**).

The following points should be noted:

a) vertical ventilating pipes of cast iron or steel are liable to accumulate rust at bends and offsets;

b) when access covers, caps and cleaning eyes are removed, damaged packings, ring seals, washers and missing fixings should be renewed before replacement;

c) care should be taken in the use of chemical descaling agents, which are often of a corrosive nature and materials employed in the pipe system should be clearly identified before treatment to ensure that the internal surfaces are not subject to damaging chemical attack;

d) caution is necessary when employing methods of clearing obstructions which involve the use of air or water at high pressures;

e) hand operated rods for removing blockages in discharge pipes should be capable of passing through the system without damaging the internal surfaces of pipes and fittings;

f) mechanized rodding equipment should only be used by properly trained operators and the pipework to be cleared should be thoroughly examined in advance to enable selection of the appropriate cleaning attachments;

g) in renewing paintwork care should be taken to preserve any distinguishing colours which may have been used for identification purposes. Reference should be made to BS 1710.

11.2 Cleaning and descaling

11.2.1 *Types of blockage or deposit and method of removal*

11.2.1.1 *Deposits due to misuse of the discharge system*

Complete or partial blockages due to large objects or compacted masses, such as toilet paper and sanitary towels, can usually be loosened by rodding. All such material should be removed from the system at the nearest access point.

11.2.1.2 *Lime scale*

In hard water districts where heavy lime scale accumulations are observed on the surface of the sanitary appliances, similar lime scale deposits may form in the discharge stacks and pipes. The worst condition will be found in the stacks and pipes from urinals where precipitation of lime generated by the reaction of urine in contact with hard water accelerates the process of scale formation. In these situations, conditions can be further aggravated by the residue from abrasive cleaning powders used in the cleaning of sanitary appliances which may combine with the lime precipitate culminating in complete blockage of the pipe.

Recurring scale formations of this type are best dealt with by periodic de-scaling of the system using suitably inhibited acid-based cleaners (see **11.2.2.5**). The discharge stacks and pipes should be inspected periodically and the rate of scale formation noted. The required frequency of treatment and the strength of acid required to soften the scale can then be established and included on a planned maintenance schedule. It should not be necessary to repeat the treatment more than three or four times a year.

Where lime scale encrustation in a urinal discharge pipe is very heavy, to the point of almost total blockage, the obstruction can sometimes be softened and removed by the application of an acid drip feed method (see **11.2.2.5**). In severe cases it may be necessary to repeat the process to ensure that all deposits are removed.

NOTE Reference should be made to COSHH Regulations [8].

11.2.1.3 *Accumulation of grease and soap residues*

Obstructions in discharge pipes and traps caused by accumulations of grease and soap residues can often be partially removed by use of a plunger, but a more effective treatment is by flushing the system with a strong solution of soda crystals dissolved in hot water (see **11.2.2.5**). The process is easy to carry out and once the required frequency of treatment has been established it can be applied as a routine periodic service. Blockages of this type are mostly found in long discharge pipes from sinks or wash basins, especially in soft water areas and where the rate of flow in the pipe falls below that required to sustain a self-cleansing velocity. Where mirrors are fixed over the basins, hair combings washed into the waste pipes will combine with the grease and soap residues and considerably increase the risk of blockage.

11.2.2 *Cleaning and descaling techniques*

11.2.2.1 *Plunger*

This is a simple means of clearing a slight blockage in a sink or basin branch pipe and trap or even a WC.

11.2.2.2 *Rods*

This is the traditional method of clearing blockages. A number of devices are available for the end of the rod, for example, scrapers, plungers and brushes. These are suitable for cleaning pipes of 75 mm size and larger where only moderate flexibility is required to introduce the rods into the pipework. Mechanically rotated versions are also available.

11.2.2.3 *Kinetic ram*

The kinetic ram gun can be usefully employed for the removal of obstructions in branch pipes provided its function and its limitations are properly understood. The function of the gun is based on the principle that the impact of compressed air against a column of water behind a blockage will create a shock wave which is transmitted to the obstruction to dislodge and remove it. A stubborn blockage can, however, produce a blow-back of the gun and injure the operator, or damage pipework and appliances not designed to withstand the pressure applied. AAVs should be removed before a kinetic ram gun is used as undue pressures and blow-back may cause malfunction. On completion, the AAV should be correctly replaced. When AAVs are permanently fixed, ram guns should not be used. Where there are open branches on the system, waste matter may be forced out of the openings and damage wall and ceiling decorations. The use of the gun on plumbing installations should be generally restricted to the removal of blockages consisting of compacted soft material, e.g. grease, soap residue and saturated paper.

11.2.2.4 *Coring and scraping*

Coring of the pipe can be considered in pipes of 100 mm size and over, where the pipe bore is severely restricted or even completely blocked with hard lime scale or similar material. However, the pipe material should first be ascertained to ensure that damage will not result.

The process involves the use of a purpose-made rotating steel cutter on a flexible drive which can be pushed into the pipe to cut through the obstructions. Peripheral accumulations of grease and other gelatinous formations in pipes of these sizes can generally be removed satisfactorily by the periodic use of profile scrapers attached to ropes and pulled through the pipe.

11.2.2.5 *Chemical cleaning*

Details of these methods are given in Table 12. Attention to safety precautions is vital if injury to the operator or damage to pipework and appliances is to be avoided (see **11.2.3** and Table 12).

NOTE 1 Refer to COSHH Regulations [8].

NOTE 2 Chemical de-sealing agents may damage some plastics fittings and mechanisms. Manufacturer's advice should be sought.

11.2.3 ***Safety precautions***

The work involved in the removal of scale and grease from sanitary appliances and plumbing drainage installations requires understanding of the problem and skill in the handling and application of chemicals and tools. Great care should be taken to ensure that all the necessary precautions are taken to minimize the risk of personal injury to the cleaning operatives or damage to the appliances and the system. Protective clothing including gloves and eye-shields should be provided for operatives handling and using chemicals and on completion of the work all exposed surfaces of sanitary appliances should be thoroughly washed, using a detergent cleanser to remove any acid or other chemical which might otherwise come into contact with a person using the appliance. Adjoining finishes and decorations may need protecting while the work is in progress.

11.3 Periodic inspection

In addition to general maintenance work, periodic inspections and tests may be advisable to ascertain if there are any defects due to normal wear and tear, or to misuse or negligence. All defects should be made good.

Table 12 — The chemical cleaning of discharge stacks and branches

Application	Method	Notes
The removal of lime scale accumulations in discharge stacks and branch pipes.	Apply diluted, in hibited, acid-based descaling fluid directly to scale. This can be done either by pouring small measured quantities of fluid into the pipes at predetermined points on the pipe line, or by using a drip feed method (acid strength approximately 15 % inhibited hydrochloric acid, 20 % ortho phosphoric acid). For heavy lime scale encrustations undiluted descaling fluid can be used (30 % inhibited hydrochloric acid, 40 % ortho phosphoric acid). The softening scale can be removed by thorough flushing and where practicable by the use of drain rods and scrapers. On completion of the work the system should be thoroughly flushed with clean water. Particular care should be given to the traps of appliances to ensure that all traces of acid are removed from the trap water seals when the work is finished.	Acid-based descaling fluid will attack linseed oil bound putty. Care should be taken to avoid unnecessary and/or prolonged contact of descaling fluid with the jointing material used in the jointing of the outlet fittings on wash basins and urinals. *Drip feed method.* The acid-based descaling fluid is allowed to drip slowly into the discharge pipe, at a rate of about 4 l over a period of 20 min. Repeat, after flushing with clean water, if necessary for very heavy deposits.
The removal of grease and soap residues from the discharge pipes from wash basins and sinks.	Fill the wash basin or sink with very hot water and add soda crystals at the rate of 1 kg soda crystals to 9 l of hot water. When the crystals have dissolved, release basin or sink plug to flush trap and discharge pipe. For basins in ranges fill all of the basins with soda solution, and release plugs simultaneously. Clean overflows using a solution of soda crystals in hot water and a wire core bottle brush.	For cases where grease and soap residue formation in the discharge pipes is frequent, this process can be applied periodically with very satisfactory results. In severe cases it may be necessary to repeat the operation monthly. Soda crystals are not to be confused with caustic soda which should not be used for this purpose.
NOTE Acid-based cleaners in contact with chlorine bleach will produce chlorine gas. It is essential that discharge systems be thoroughly flushed before acid-based cleaners are used, to remove as far as possible all traces of chlorine bleach residues. All windows should be opened in the areas where acid-based cleaners are being used.		

Annex A (normative)
Publications specifying materials, components and appliances

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).*

BS 219, *Specification for soft solders.*

BS 416, *Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron.*

BS 437, *Specification for cast iron spigot and socket drain pipes and fittings.*

BS 864, *Capillary and compression tube fittings of copper and copper alloy.*

BS 864-2, *Specification for capillary and compression fittings for copper tubes.*

BS 1125, *Specification for WC flushing cisterns (including dual flush cisterns and flush pipes).*

BS 1188, *Specification for ceramic wash basins and pedestals.*

BS 1189, *Specification for baths made from porcelain enamelled cast iron.*

BS 1206, *Specification for fireclay sinks: dimensions and workmanship.*

BS 1244, *Metal sinks for domestic purposes.*

BS 1244-1, *Imperial units with metric equivalents.*

BS 1244-2, *Specification for sit-on and inset sinks.*

BS 1329, *Specification for metal hand rinse basins.*

BS 1387, *Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads.*

BS 1390, *Specification for baths made from vitreous enamelled sheet steel.*

BS 1710, *Specification for identification of pipelines and services.*

BS 1845, *Specification for filler metals for brazing.*

BS 1876, *Specification for automatic flushing cisterns for urinals.*

BS 2494, *Specification for elastomeric seals for joints in pipework and pipelines.*

BS 2779, *Specification for pipe threads for tubes and fittings where pressure-tight joints are not made on the threads (metric dimensions).*

BS 2871, *Specification for copper and copper alloys. Tubes.*

BS 2871-1, *Copper tubes for water, gas and sanitation.*

BS 3380, *Specification for wastes (excluding skeleton sink wastes) and bath overflows.*

BS 3402, *Specification for quality of vitreous china sanitary appliances.*

BS 3506, *Specification for unplasticized PVC pipe for industrial uses.*

BS 3868, *Specification for prefabricated drainage stack units: galvanized steel.*

BS 3943, *Specification for plastics waste traps.*

BS 4127, *Specification for light gauge stainless steel tubes, primarily for water applications.*

BS 4305, *Baths for domestic purposes made of acrylic material.*

BS 4346, *Joints and fittings for use with unplasticized PVC pressure.*

BS 4346-3, *Specification for solvent cement.*

BS 4514, *Specification for unplasticized PVC soil and ventilating pipes, fittings and accessories.*

BS 4772, *Specification for ductile iron pipes and fittings.*

BS 4880, *Specification for urinals.*

BS 4880-1, *Stainless steel slab urinals.*

BS 5254, *Specification for polypropylene waste pipe and fittings (external diameter 34.6 mm, 41.0 mm and 54.1 mm).*

BS 5255, *Specification for thermoplastics waste pipe and fittings.*

BS 5503, *Vitreous china washdown WC pans with horizontal outlet.*

BS 5503-1, *Connecting dimensions.*

BS 5503-2, *Materials, quality, performance and dimensions other than connecting dimensions.*
BS 5503-3, *Specification for WC pans with horizontal outlet for use with 7.5 L maximum flush capacity cisterns.*
BS 5504, *Wall hung WC pans.*
BS 5504-1, *Wall hung WC pan with close coupled cistern. Connecting dimensions.*
BS 5504-2, *Wall hung WC pan with independent water supply. Connecting dimensions.*
BS 5504-3, *Materials, quality and functional dimensions other than connecting dimensions.*
BS 5504-4, *Specification for wall hung WC pans for use with 7.5 L maximum flush capacity cisterns.*
BS 5505, *Specification for bidets.*
BS 5505-1, *Pedestal bidets over rim supply only. Connecting dimensions.*
BS 5505-2, *Wall hung bidets, over rim supply only. Connecting dimensions.*
BS 5505-3, *Vitreous china bidets over rim supply only. Quality, workmanship and functional dimensions other than connecting dimensions.*
BS 5506, *Specification for wash basins.*
BS 5506-1, *Pedestal wash basins. Connecting dimensions.*
BS 5506-2, *Wall hung wash basins. Connecting dimensions.*
BS 5506-3, *Wash basins (one or three tap holes). Materials, quality, design and construction.*
BS 5520, *Specification for vitreous china bowl urinals (rimless type).*
BS 5619, *Code of practice for design of housing for the convenience of disabled people.*
BS 5627, *Specification for plastics connectors for use with horizontal outlet vitreous china WC pans.*
BS 5810, *Code of practice for access for the disabled to buildings.*
BS 6087, *Specification for flexible joints for grey or ductile cast iron drainpipes and fittings (BS 437) and for discharge and ventilating pipes and fittings (BS 416).*
BS 6100, *Glossary of building and civil engineering terms.*
BS 6100-2, *Civil engineering.*
BS 6100-2.7, *Public health — Environmental engineering.*
BS 6100-2, *Services.*
BS 6100-3.3, *Sanitation.*
BS 6209, *Specification for solvent cement for non-pressure thermoplastics pipe systems.*
BS 6367, *Code of practice for drainage of roofs and paved areas.*
BS 6437, *Specification for polyethylene pipes (type 50) in metric diameters for general purposes.*
BS 6465, *Sanitary installations.*
BS 6465-1, *Code of practice for scale of provision, selection and installation of sanitary appliances.*
BS 6700, *Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.*
BS 6731, *Specification for wall hung hand rinse basins. Connecting dimensions.*
BS 7357, *Specification for 7.5 L WC flushing cisterns.*
BS 7358, *Specification for close coupled suites with flush capacity of 7.5 L maximum.*
BS 7671, *Requirements for electrical installations. IEE Wiring Regulations. Sixteenth edition.*
BS 8000, *Workmanship on building sites.*
BS 8000-13, *Code of practice for above ground drainage and sanitary appliances.*
BS 8301, *Code of practice for building drainage.*
BS 8313, *Code of practice for accommodation of building services in ducts.*
CP 312, *Code of practice for plastics pipework (thermoplastics material).*

Annex B (informative) Examples of pipe sizing procedures

B.1 Example 1

B.1.1 *Task*

Determine the size of the discharge and ventilating stacks and branches required for a block of flats, 12 storeys high, serving two appliance groups (WC, bath, wash basin and sink) per floor. The appliances are closely grouped around the stack.

B.1.2 *Procedure*

a) Branch pipe sizes are given in **7.2**. Suppose that, for this example, no ventilating pipes are required for the branch discharge pipes.

b) Refer to **7.3** and in particular to Figure 26. Arrangement Ca corresponds to the layout required, therefore Table 5 can be used for sizing the pipework.

c) In Table 5, for a 100 mm discharge stack, domestic usage, number of floors 11 to 15, the ventilating stack size for two appliance groups is 50 mm, i.e. a ventilated stack system can be used.

Similarly for a 150 mm discharge stack, the ventilating stack size required is 0, i.e. a single stack system can be used.

d) The designer has now to decide which system is likely to be the most convenient and economic. The size of drain has to be considered so that it is not oversized for the likely flow load. For connection to an existing drain, there should be no reduction in size in the direction of flow.

B.2 Example 2

B.2.1 *Task*

Determine the size of the discharge and ventilating stacks and branches required for an eight storey block of offices serving three WCs, three wash basins and three urinals per floor.

B.2.2 *Procedure*

a) Branch pipe sizes are given in **7.2**. Suppose that the number of bends used means that branch ventilating pipework connected to the end of the main branch discharge pipe is needed for the basin discharge pipes.

b) Refer to **7.3** and in particular to Figure 26. Arrangement Eb corresponds to the layout required, therefore Table 5 can be used for sizing the pipework.

c) In Table 5, refer to the conversion table. Three WCs, three basins and three urinals per floor can be assumed to be approximately equivalent to four WCs and four wash basins per floor.

NOTE Approximations such as this are safe as long as the nearest higher number of groups is used e.g. for Table 5 for, say, two WCs and three wash basins per floor, use the three WCs and three basins group.

d) Using Table 5, for a 100 mm discharge stack, commercial usage, number of floors 5 to 8, in arrangement Eb, the ventilating stack size for four groups of appliances per floor (i.e. four WCs and four wash basins per floor) is 40 mm; i.e. a ventilated system can be used.

Similarly for a 150 mm discharge stack, the size of the ventilating stack required is 32 mm. This is a modified single stack arrangement in which the ventilating stack is only used to connect the branch ventilating pipes to atmosphere.

NOTE If branch ventilating pipes to the wash basin discharge pipes had not been required, e.g. arrangement Ea, a 150 mm single stack system could have been used.

e) The designer has now to decide which system is likely to be the most convenient and economic. The size of drain has to be considered so that it is not oversized for the likely flow load. For connection to an existing drain, there should be no reduction in size in the direction of flow.

B.3 Example 3

B.3.1 *Task*

Determine the size of the discharge and ventilating stacks and branches required for a 10 storey block of offices, serving three WCs per floor and also receiving rainwater from a portion of the roof of 40 m^2.

B.3.2 *Procedure*

a) Branch pipe sizes are given in **7.2**. Assume for this example that no branch ventilating pipes are required.

b) Refer to **7.3** and in particular Figure 26. Arrangement Ea corresponds to the type of arrangement even though there are no basins in this case. Rainwater loading is within the requirement of **5.3.4.6** so Table 5 can be used.

c) In Table 5, for a 100 mm discharge stack, commercial usage, number of floors 9 to 12, arrangement Ea, the ventilating stack size required for three groups of appliances (the closest safe approximation to the actual number of appliances connected) per floor is 40 mm, i.e. a ventilated stack system.

Alternatively for a 150 mm discharge stack, the size of ventilating stack required is 0, i.e. a single stack system. The designer has then to decide which system is likely to be the most convenient and economic. The size of drain has also to be considered [see **B.1.2** c)].

B.3.3 ***Alternative procedure***

Alternatively, the discharge unit method can be used (see clause **8**) for sizing the stacks.

a) In Table 6, one WC with close coupled 6 l cistern is represented by 6 discharge units for a 10 min interval of discharge. For three WCs per floor on 10 floors the total number of discharge units is (3 × 10) × 6 = 180.

b) The rainwater flow (following the procedure in BS 6367) assuming a rainfall rate of 75 mm/h is 0.83 l/s.

c) Using Figure 27, the flow equivalent for 180 discharge units is approximately 4.5 l/s. The total design flow load is therefore 5.33 l/s.

d) In Table 7, a 90 mm discharge stack has a maximum capacity of 5.3 l/s and is therefore just large enough. However, the most likely commercial size available will be 100 mm.

e) In Table 9, the ventilating stack size has to be half the diameter of the discharge stack, i.e. 50 mm. Therefore a 90 mm or 100 mm discharge stack with a 50 mm ventilating pipe can be used.

NOTE This ventilating pipe size is larger than that given by the use of the data given in Table 5. This possibility is referred to in **8.2.2**.

B.4 Example 4

B.4.1 ***Task***

Determine the size of the discharge and ventilating stacks and branches for a four storey public building in which 10 WCs, 10 wash basins and five urinals are closely grouped in ranges on the third floor of the building and are to be connected to a discharge stack which also serves a WC and wash basin on the first floor. The discharge stack will be connected to an existing drain liable to surcharge.

B.4.2 ***Procedure***

a) Branch pipe sizes are given in **7.2**. The range of 10 WCs can be connected to a 100 mm branch discharge pipe but a 25 mm vent pipe will be needed as shown in Figure 22. The range of 10 wash basins will require a 50 mm discharge pipe and a 25 mm ventilating pipe as shown in Figure 24 b). Assume for this example that no venting will be required for the first floor appliances.

b) Referring to **7.3**, it will be seen that this arrangement is not within the scope of Table 5 and so the discharge unit method (clause **8**) has to be used for the sizing of the discharge and ventilating stacks.

c) In Table 6, for congested use:

one WC with 7.5 l low level cistern is represented by 24 discharge units

one wash basin is represented by 5 discharge units;

the flow rate from one urinal is 0.15 l/s.

For five urinals the flow will be:

(5 × 0.15) = 0.75 l/s

For 11 WCs and 11 wash basins, the number of discharge units is:

(11 × 24) + (11 × 5) = 319

d) Using Figure 27, the flow equivalent of 319 discharge units is approximately 5.2 l/s. The total design flow load is therefore:

(5.2 + 0.75) = 5.95 l/s.

e) In Table 7, a 100 mm discharge stack has a maximum capacity of 7.2 l/s and is therefore large enough.

f) In Table 9, the ventilating stack size has to be half the diameter of the discharge stack, i.e. 50 mm.

g) However, the drain is likely to be surcharged and **7.3.3** states that for this situation the ventilating size should be at least 75 mm for a 100 mm discharge stack.

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