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(Reprinted, incorporating
Amendments No. 1 and No. 2)

Code of practice for
Sanitary pipework

(Formerly CP 304)

Code de bonne pratique pour tuyauterie sanitaire

Richtlinie für Gebäude – Entwässerungsanlagen

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(See also index.)

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Foreword

This code of practice was first published in 1953 as CP 304 and revised under the same number in 1968. This second revision now supersedes the latter publication.

This edition considerably enlarges the code. The recommendations on design and workmanship are based on improved technology in plumbing and research undertaken by the Building Research Establishment, manufacturers and others, 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.

Recommendations in this edition of the code relating to discharges from WCs are based on the standard 9 litres (2 gallons) flushing cistern. If larger cisterns are installed, stacks and branch discharge pipes can be sized using the discharge unit method.

Systems designed to the recommendations of this code will be generally within the requirements of the Building Regulations 1976 and the Building Standards (Scotland) Regulations 1971 to 1975.

A new clause (clause 7) 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 code to enable performance to be included in more detail than is possible at present.

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

In accordance with BSI's programme of metrication, values in this code are expressed in metric terms. For further information reference should be made to BS 3763 and PD 5686.

British Standard Code of practice for

Sanitary pipework

1. Scope

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

This code does not purport to cover any special requirements of buildings such as may be found in hospitals, research and similar laboratories, or trade waste discharges. Neither does it cover the pumping/ejection of effluent from appliances incapable of being drained by gravity nor constraints imposed due to the consideration of fire hazards.

2. References

The titles of the standards publications referred to in this code are listed on the inside back cover.

3. Definitions

For the purposes of this code the following definitions, together with those in BS 4118, apply.

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.

3.3 branch ventilating pipe. A ventilating pipe connected to a branch discharge pipe.

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. A pipe which conveys the discharges from sanitary appliances.

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. 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 size. The term used in this code to indicate the nominal internal diameter of pipes regardless of specific materials and their classification or description in individual standards.

NOTE. The relationship between size (as used in this code) and individual pipe standards is shown in table 1.

3.10 stack. A main vertical discharge or ventilating pipe.

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

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

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, e.g. information on the possibility of surcharging and details of Statutory Regulations should be obtained from the local authority. Specific requirements of the water authorities 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 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 12.3).

4.2 Statutory requirements. Attention is directed to Acts, Byelaws, Regulations and any other Statutory requirements relating to matters dealt with in this code and related codes. Amongst others these include the following:

- (a) Public Health Act 1936 and 1961 and London Government Act 1963;
- (b) the Building Regulations, 1976;
- (c) the Building Standards (Scotland) Regulations, 1971 to 1975;
- (d) the Building Regulations (Northern Ireland) 1973;

Table 1. Equivalence between size (as defined in this code) and individual pipe standards

Size	Iron	Lead	Copper	Steel		Pitch fibre	Plastics						
	BS 416	BS 437	BS 602/1085	BS 2871	BS 1387	BS 3868	BS 2760	BS 1973	BS 3506	BS 3796	BS 4514	BS 5254	BS 5255
	Nominal bore	Nominal bore	Size of tube	Nominal bore	Nominal bore	Nominal bore	Nominal bore	Nominal size	Nominal size	Nominal size	Nominal size	Nominal size	Nominal size
mm	mm	mm	mm	mm	mm	mm	mm						
25	—	25	28	25	—	—	—	1	1	1	—	—	—
32	—	32	35	32	32	32	—	1¼	1¼	1¼	—	1¼/32	1¼/32
40	—	40	42	40	40	40	—	1½	1½	1½	—	1½/40	1½/40
50	50	50	54	50	50	50	50	2	2	2	—	2/50	2/50
65	65	65	67	65	65	65	—	—	2½	—	—	—	—
75	75	75	76.1	80	80	80	75	3	3	3	3	—	—
90	90	90	—	—	—	—	—	—	—	—	—	—	—
100	100	100	108	100	100	100	100	4	4	4	4	—	—
125	125	—	133	125	125	125	125	—	5	—	—	—	—
150	150	150	159	150	150	150	150	—	6	6	6	—	—

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

- (e) Sewerage (Scotland) Act 1968;
- (f) the Sanitary Accommodation Regulations, SR and O 1938 no. 611;
- (g) the Factories Act, 1961;
- (h) Food Hygiene (General) Regulations, Food and Drugs Act, 1970;
- (i) Offices, Shops and Railway Premises Act, 1963;
- (j) the Washing Facilities Regulations, 1964, SI no. 965;
- (k) the Sanitary Conveniences Regulations, 1964, SI no. 966;
- (l) Health and Safety at Work, etc. Act. 1974;
- (m) Standards for School Premises Regulations, 1972, SI no. 2051;
- (n) Technical Regulations for Places of Public Entertainment in Greater London, 1965;
- (o) some local authorities may have special powers or requirements in local Acts.

Users of this code should ensure that they are referring to the latest editions of the statutory regulations mentioned above and elsewhere in this code.

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

- (1) information on the number, position and types of appliances to be installed (see CP 3: Chapter VII and CP 305) and details of the proposed user of the premises;
- (2) notification on the appropriate forms and particulars of the proposed work;
- (3) drawings and specification.

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.

5. British standard codes and glossary

Further information on certain subjects referred to in this code is contained in the following:

CP 3	Code of basic data for the design of buildings Chapter III Sound insulation and noise reduction Chapter VII Engineering and utility services
CP 99	Frost precautions for water services
CP 231	Painting of buildings
CP 301	Building drainage
CP 305	Sanitary appliances Part 1 Selection, installation and special requirements
CP 308	Drainage of roofs and paved areas
CP 312	Plastics pipework (thermoplastics materials)
CP 413	Ducts for building services
BS 4118	Glossary of sanitation terms
BS 5619	Code of practice for the design of housing for the convenience of disabled people
BS 5810	Code of practice for access for the disabled to buildings

6. British standard specifications

All materials, appliances and components used in the discharge system described in this code should satisfy the requirements of relevant British Standards in so far as these are applicable. The standards include the following.

6.1 Pipes and fittings

BS 416	Cast iron spigot and socket soil, waste and ventilating pipes (sand cast and spun) and fittings
BS 437	Specification for cast iron spigot and socket drain pipes and fittings
BS 602 and 1085	Lead and alloy pipes for other than chemical purposes
BS 864	Capillary and compression tube fittings of copper and copper alloy Part 2 Metric units
BS 1211	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage
BS 1387	Steel tubes and tubulars suitable for screwing to BS 21 pipe threads
BS 1973	Polythene pipe (Type 32) for general purposes including chemical and food industry uses
BS 2760	Pitch-impregnated fibre pipes and fittings for below and above ground drainage
BS 2871	Copper and copper alloys. Tubes Part 1 Copper tubes for water, gas and sanitation
BS 3506	Unplasticized PVC pipe for industrial purposes
BS 3796	Polythene pipe (Type 50) for general purposes including chemical and food industry uses
BS 3868	Prefabricated drainage stack units: galvanized steel
BS 4127	Light gauge stainless steel tubes
BS 4514	Unplasticized PVC soil and ventilating pipe, fittings and accessories
BS 5254	Polypropylene waste pipes and fittings (external diameter 34.6 mm, 41.0 mm and 54.1 mm)
BS 5255	Plastics waste pipe and fittings
BS 6087	Specification for flexible joints for cast iron drainpipes and fittings (BS 437) and for cast iron soil, waste and ventilating pipes and fittings (BS 416)

6.2 Traps

BS 1184	Copper and copper alloy traps
BS 3943	Plastics waste traps

6.3 Appliances

BS 1125	WC flushing cisterns (including dual flush cisterns and flush pipes)
BS 1188	Ceramic wash basins and pedestals
BS 1189	Cast iron baths for domestic purposes
BS 1206	Fireclay sinks. Dimensions and workmanship
BS 1244	Metal sinks for domestic purposes Part 2 Metric units
BS 1329	Metal hand rinse basins
BS 1390	Sheet steel baths for domestic purposes
BS 1876	Automatic flushing cisterns for urinals
BS 3380	Wastes for sanitary appliances and overflows for baths
BS 3402	Quality of vitreous china sanitary appliances

- BS 4305 Baths for domestic purposes made from cast acrylic sheet
- BS 4880 Urinals
Part 1 Stainless steel slab urinals
- BS 5503 Specification for vitreous china washdown WC pans with horizontal outlet
Part 1 Connecting dimensions
Part 2 Materials, quality, performance and dimensions other than connecting dimensions
- BS 5504 Specification for wall hung WC pans
Part 1 Wall hung WC pan with close coupled cistern. Connecting dimensions
Part 2 Wall hung WC pan with independent water supply. Connecting dimensions
Part 3 Materials, quality and functional dimensions other than connecting dimensions
- BS 5505 Specification for bidets
Part 1 Pedestal bidets, over rim supply only. Connecting dimensions
Part 2 Wall hung bidets, over rim supply only. Connecting dimensions
Part 3 Vitreous china bidets, over rim supply only. Quality, workmanship and functional dimensions other than connecting dimensions
- BS 5506 Specification for wash basins
Part 1 Pedestal wash basins. Connecting dimensions
Part 2 Wall hung wash basins. Connecting dimensions
Part 3 Wash basins (one or three tap holes). Materials, quality, design and construction
- BS 5520 Vitreous china bowl urinals (rimless type)
- BS 5627 Specification for plastics connectors for use with horizontal outlet vitreous china WC pans

6.4 General

- BS 21 Pipe threads for tubes and fittings where pressure-tight joints are made on the threads

- BS 219 Soft solders
- BS 1494 Fixing accessories for building purposes
- BS 1710 Identification of pipelines
- BS 1845 Filler metals for brazing
- BS 2494 Materials for elastomeric joint rings for pipework and pipelines

7. Performance

7.1 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.

7.2 Performance criteria. In the design of any system the following performance criteria should be followed.

NOTE. In clauses 8 to 13 inclusive of this code, numbers in medium type in parentheses refer to the performance requirements given in 7.2.1 to 7.2.9.

7.2.1 Discharge. Requirements for the 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.

7.2.2 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

Table 2. Flow and usage data of sanitary appliances

Appliance	Capacity, l	Discharge data		Frequency of use (T), s	Individual probability (p) of discharge $p = \frac{t}{T}$
		Maximum flow rate, l/s	Duration (t), s		
Washdown WC	9	2.3	5	1200 600 300	0.0041 0.0083 0.0167
Urinal (per person unit)	4.5	0.15	30	1200 900	0.025 0.0333
Wash basin (32 mm branch)	6	0.6	10	1200 600 300	0.0083 0.0167 0.0333
Sink (40 mm branch)	23	0.9	25	1200 600 300	0.0208 0.0417 0.0834
Bath (40 mm branch)	80	1.1	75	4500 1800	0.0167 0.0417
Automatic washing machine	180	0.7	300	15000	0.0200
Shower	—	0.1	—	—	—
Spray tap basin	—	0.06	—	—	—

the building. For WCs there should be sufficient trap water for the containment of excreta. In this code, trap seal depths of 75 mm are assumed for traps with diameters of up to and including 50 mm and for traps with diameters larger than 50 mm, a 50 mm depth is also assumed. The only exception to this is given in 8.2.2(c). Additional information on trap performance 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 in this code are designed so that positive and negative pressures do not exceed 38 mm water gauge and that at least 25 mm of water seal is retained in the traps. These limitations are based on the worst likely discharge conditions.

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

7.2.3 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 pipework designed to limit pressure fluctuations, as in 7.2.2, will tend to be quiet. Another source of noise is the flow of water in discharge branches and stacks but this may be reduced by sound insulation of the pipework from the structure and of the containing ductwork.

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

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

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

7.2.7 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.

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

7.2.9 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.

7.3 Hydraulics and pneumatics of discharge systems.

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

7.3.1 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.

7.3.2 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 performance data

Typical seal loss (due to negative pressure (suction) of 375 N/m ² (38 mm water gauge) in discharge systems)		Typical evaporation loss	
Trap details	Approximate seal loss	Trap detail	Accepted average figure per week
Typical washdown WC, 50 mm seal depth	25 mm	small and large bore traps	2.5 mm
Small diameter tubular trap, 75 mm seal depth	19 mm		

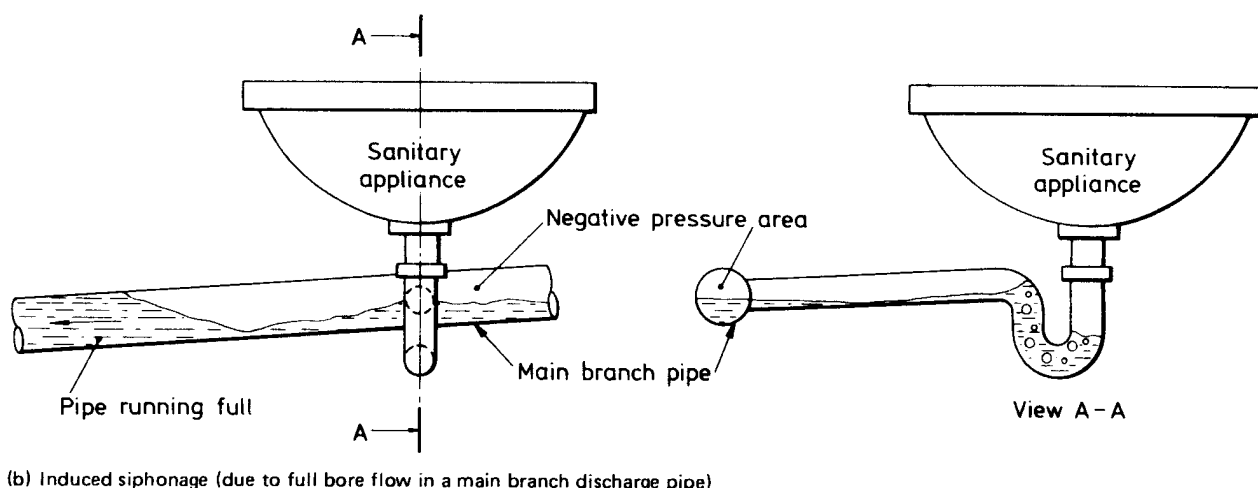
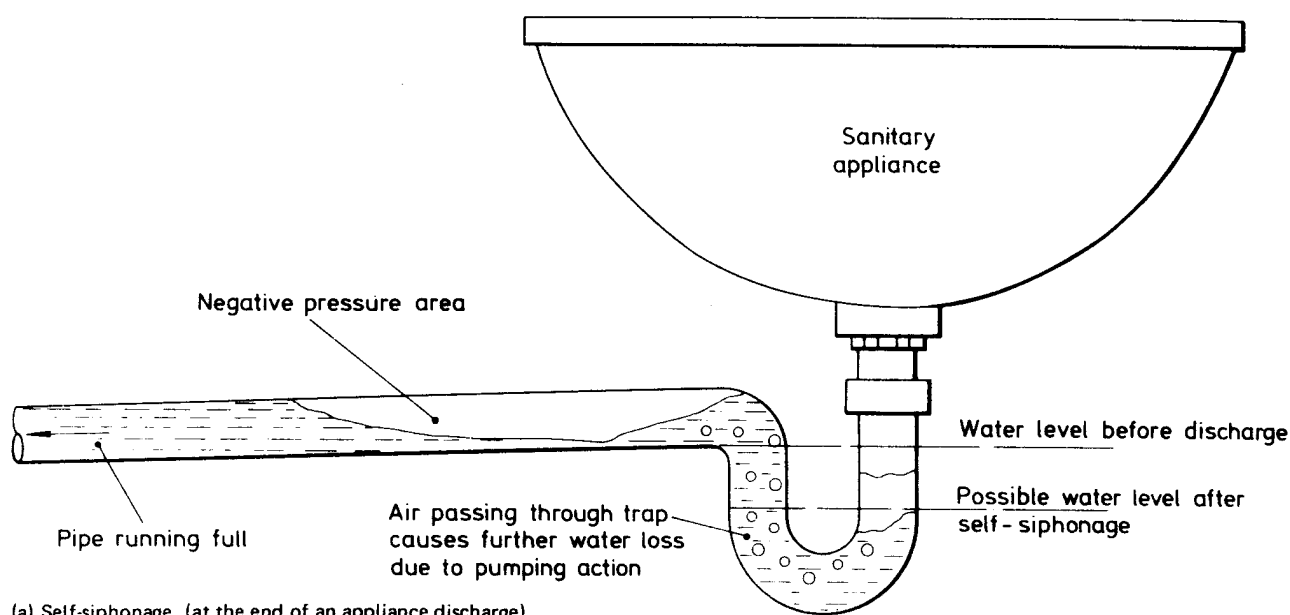


Figure 1. Seal loss due to flow in branch pipes

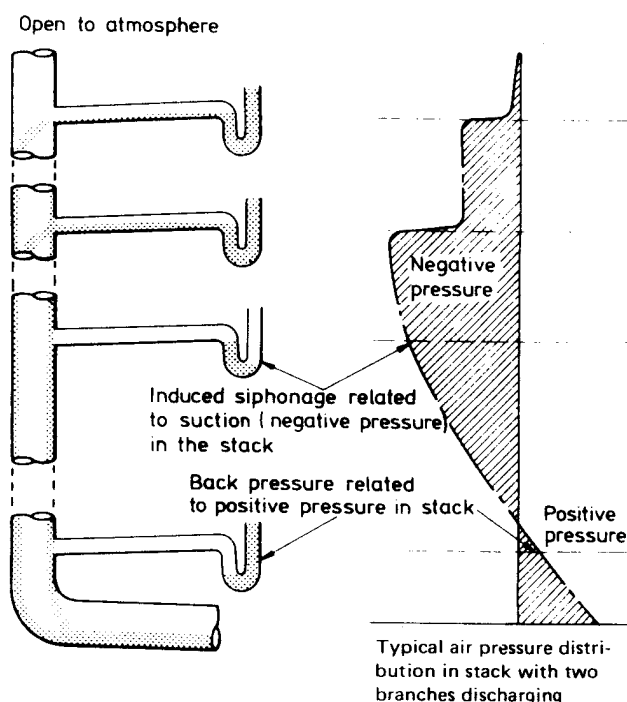
7.3.3 Additional information on discharge stacks

7.3.3.1 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 8.3.2.5).

7.3.3.2 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 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 8.3.3.2 and 9.3.2).

7.3.3.3 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 9.3.3).

7.3.3.4 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 will then be necessary (see 9.3.3).



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.

7.3.3.5 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 8.3.3.6).

7.3.3.6 Admission of rainwater into discharge stacks.

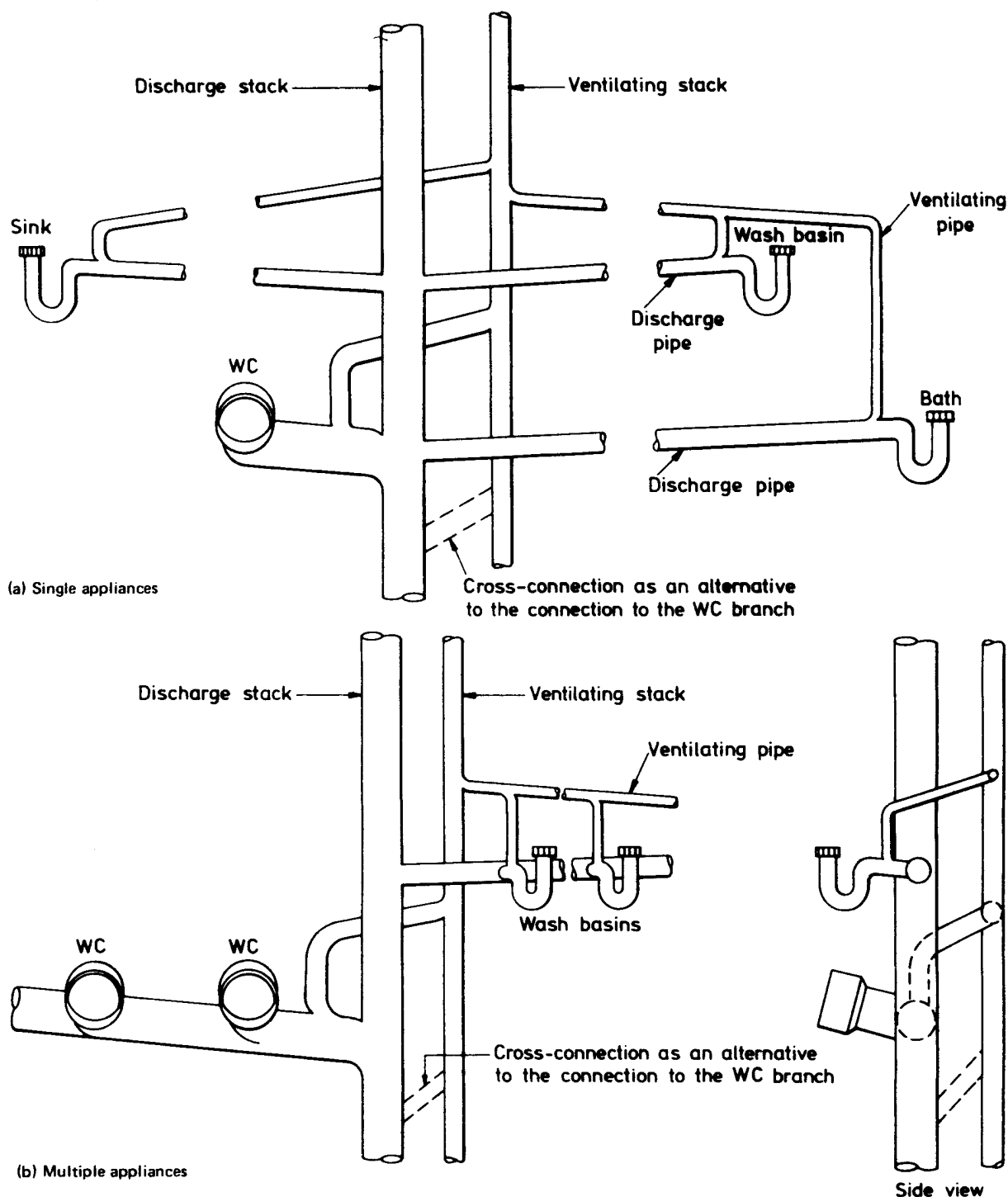
In some areas with combined drainage systems, discharge stacks are permitted to receive rainwater from roof areas. However, in very long stacks, i.e. say a 30 storey building, quite small continuous flows of rainwater can cause excessive pressure fluctuations. There is also the danger of flooding if a blockage occurs in the discharge stack or

underground drain during a heavy rainstorm especially if the roof area served is large.

Limited design data based on the above considerations are given in 9.3.4 and 8.4.3.

7.3.3.7 Effects of pumped or ejector discharge. Where it is necessary to pump/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.



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 (diagrammatic)

7.3.4 Description of discharge systems. The discharge systems in this code can conveniently be classified as follows.

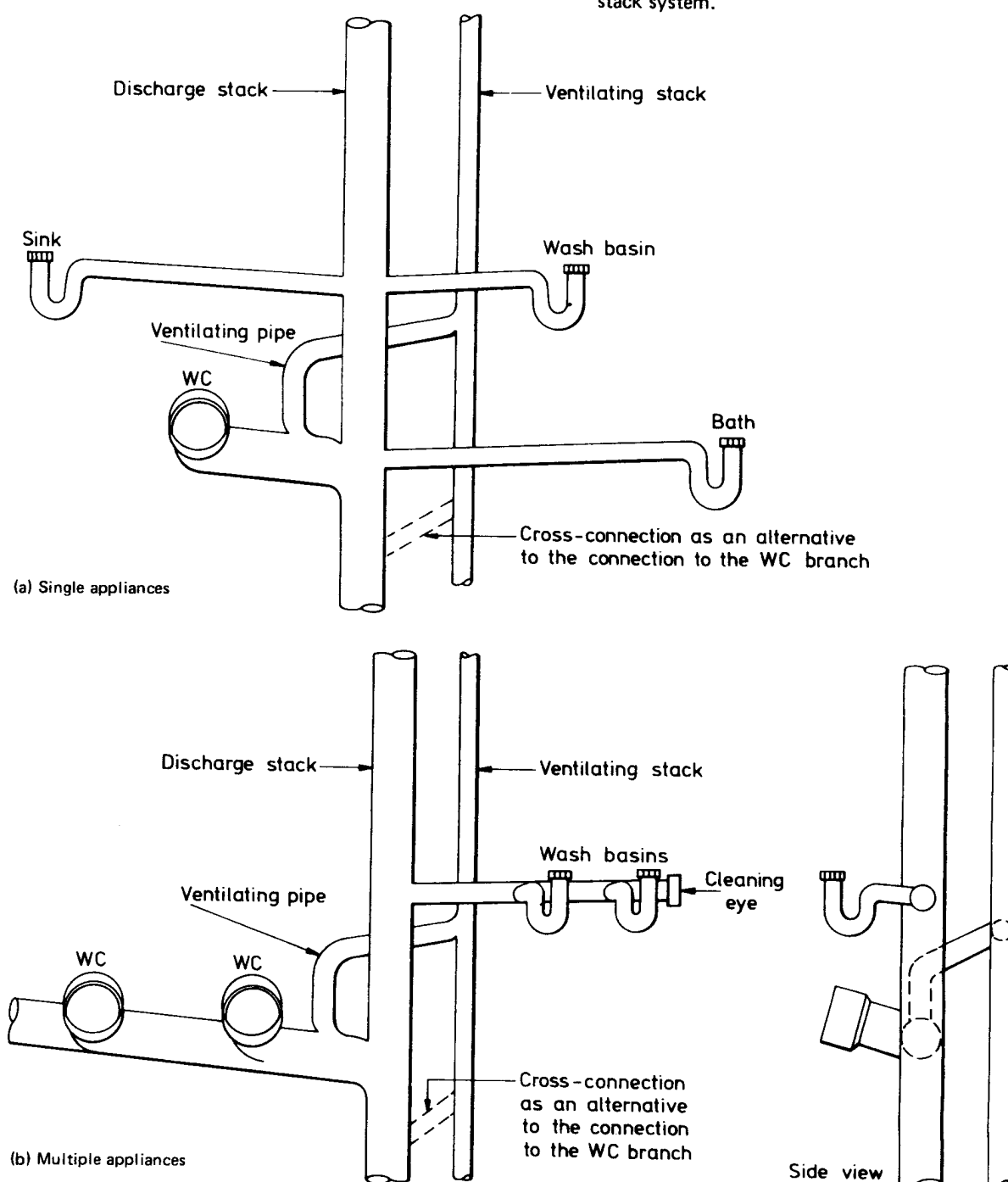
(a) *Ventilated system.* (See figure 3.) A ventilated system is used in situations where there are large numbers of sanitary appliances in ranges or where they have to be widely dispersed and it is impracticable to provide discharge stack(s) in close proximity to the appliances. Trap seals are safeguarded 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 figures 5 and 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.



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 (diagrammatic)

8. Design

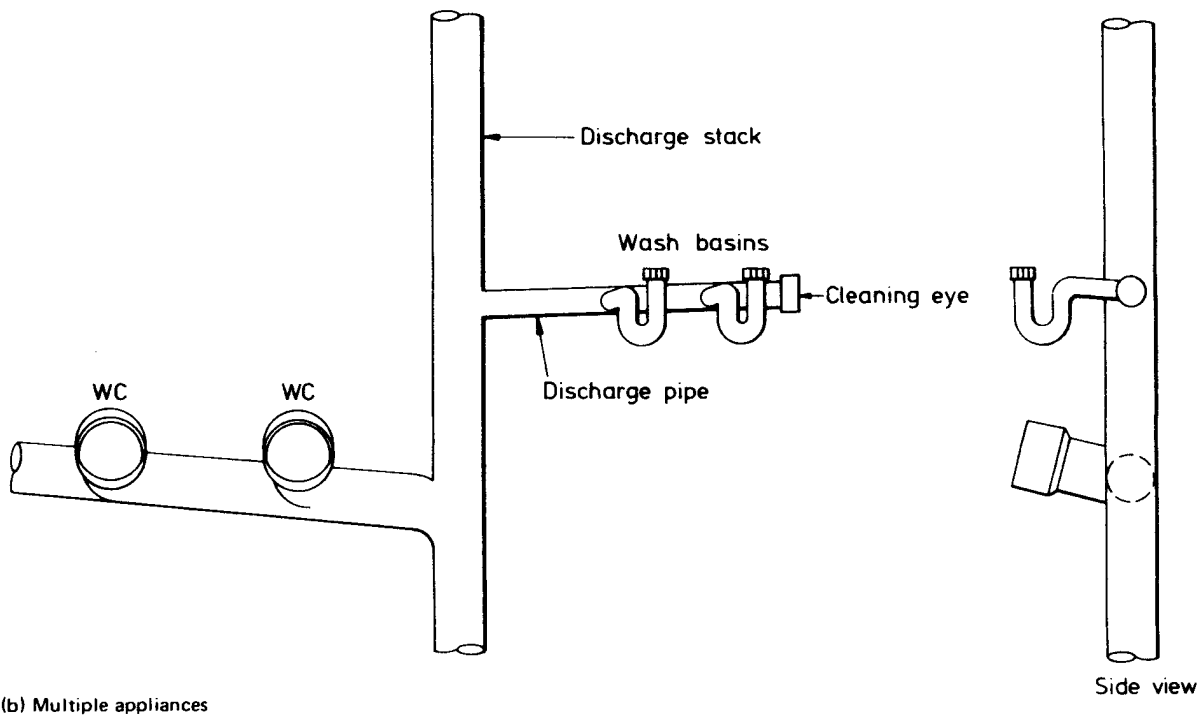
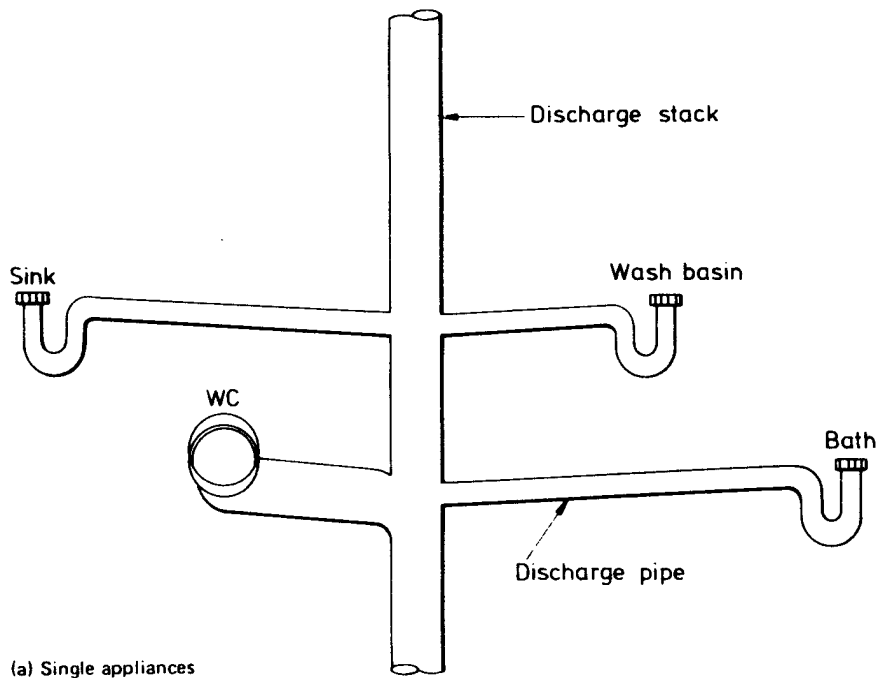
8.1 General. Recommendations in this code are based, wherever possible, on appliances, pipes and fittings that comply with British Standards.

This clause and clauses 9 and 10 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

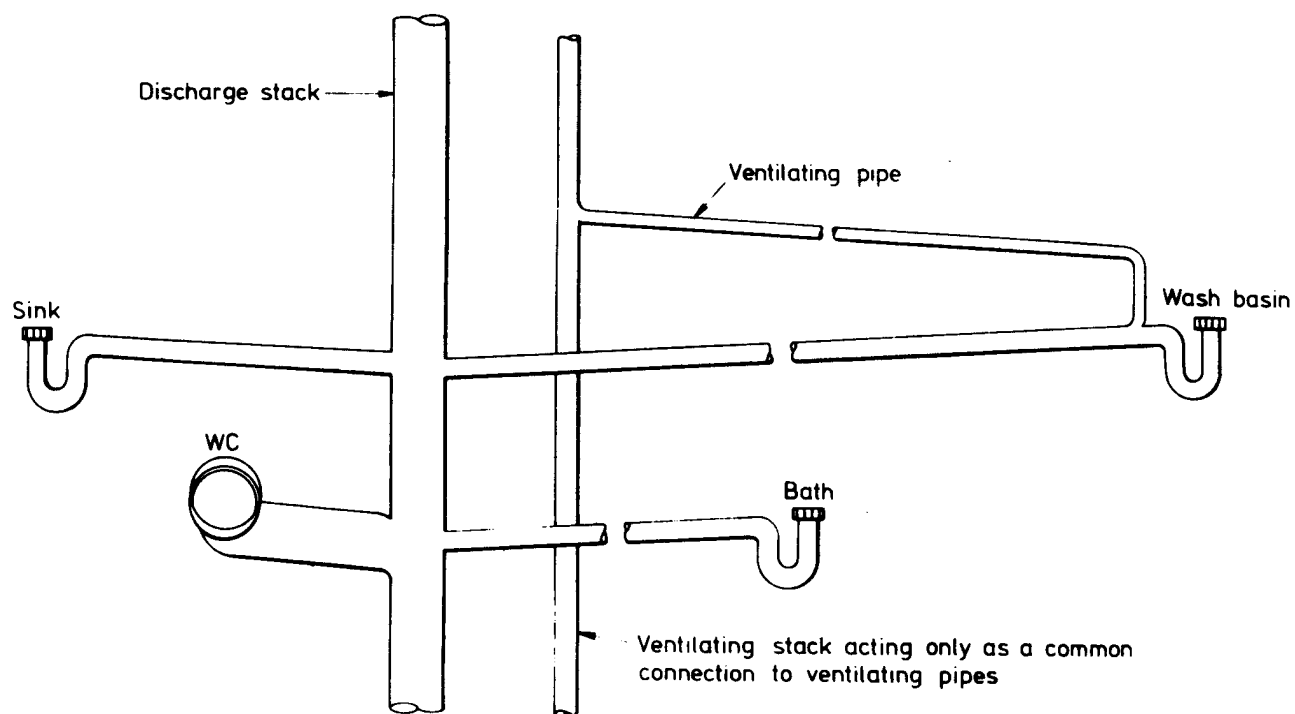
connected to, and often closely grouped round, a discharge stack;

(b) non-domestic building 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.

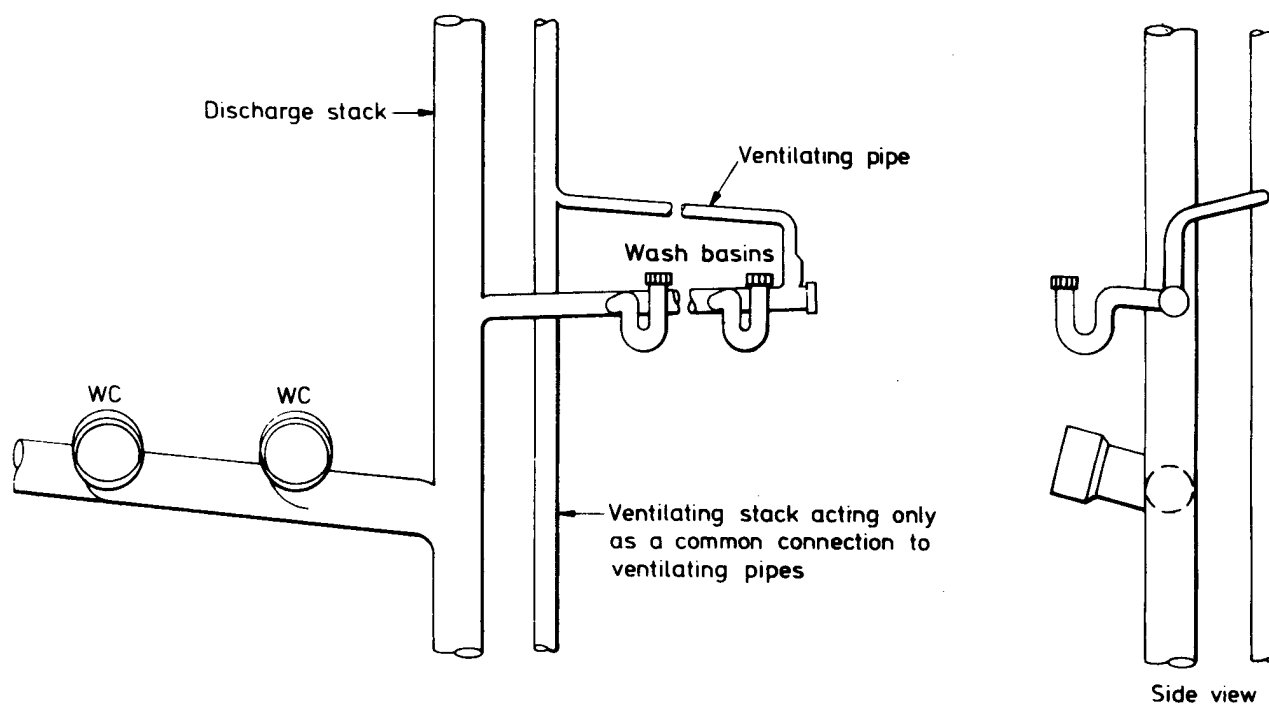


NOTE. For use in situations described in the note to figure 4, but where the discharge stack is large enough to limit pressure fluctuations without the need for a ventilating stack.

Figure 5. Single stack system (diagrammatic)



(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 (diagrammatic)

8.2 Traps (see figure 7)

8.2.1 General. Designs in this code are based on the use of traps with the basic dimensions as given in 8.2.2 and 8.2.3.

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 (7.2.5).

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 (7.2.7).

8.2.2 Depth of seals

- (a) Traps with outlets for pipes up to and including 50 mm size should have a minimum water seal of 75 mm (7.2.2).
- (b) Traps with outlets for pipes over 50 mm size should have a minimum water seal of 50 mm (7.2.2).
- (c) 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 8.3.2.7) (7.2.2).

8.2.3 Diameters of tubular traps. The size of tubular traps should be not less than those given in table 4 (7.2.1).

Table 4. Minimum sizes of tubular traps

Type of appliance	Size of trap, mm	Type of appliance	Size of trap, mm
Wash basin	32	Drinking fountain	32
Bidet	32	Bar well	32
Sink	40	Hotel or restaurant kitchen sink	40
Bath	40	Urinal (bowl)	40
Shower bath tray	40	Urinal (stall, 1 to 6)*	65
Wash tub	50	Food-waste disposal unit (industrial type)	50
Food-waste disposal unit (domestic)	40	Sanitary towel macerator	40

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

8.2.4 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 meet the requirements of 8.2.1 and 8.2.2. The size of inlet and outlet should be as given in 8.2.3 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.

8.2.5 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 do not protect the water seal from back pressure and they will

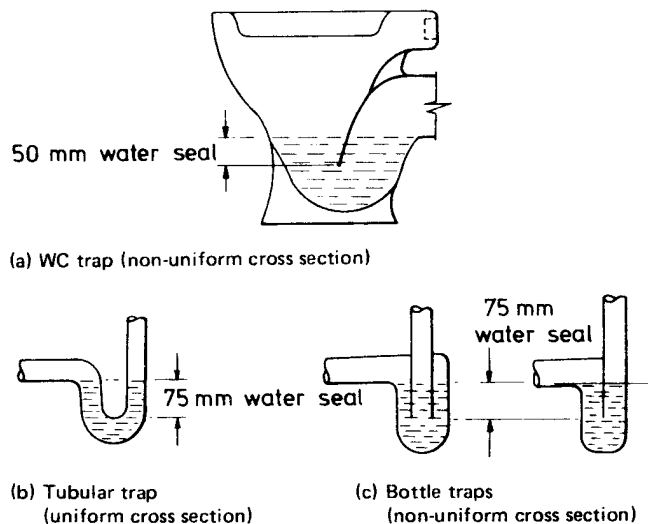


Figure 7. Trap types (diagrammatic)

become less efficient in resealing if the recommendations of 8.2.1 are not met. Resealing traps should be regularly inspected and maintained. Some types can be noisy in operation (7.2.3).

The depth of seals should be as given in 8.2.2 and also the sizes at inlet and outlet should be as given in 8.2.3 and there should be no reduction in flow area through the trap.

8.2.6 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 (7.2.2).

8.3 Discharge pipes and stacks

8.3.1 General. Because of their different performance characteristics it is convenient to deal with branch discharge pipes and discharge stacks separately.

8.3.2 Branch discharge pipes

8.3.2.1 Diameter. Branch pipes should not be reduced in diameter in the direction of flow. Sizes are given in clauses 9 and 10. Oversizing branch pipes to avoid self-siphonage problems can be uneconomic and can lead to an increased rate of deposit accumulation (7.2.1 and 7.2.5).

8.3.2.2 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 $1\frac{1}{4}^\circ$ (18 mm/m or 22 mm/m), but flatter gradients down to $\frac{1}{2}^\circ$ (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 rates (e.g. of not less than 2.5 l/s) and workmanship of a high standard (7.2.5).

Pipe sizes, gradients and pipe capacities are inter-related as shown in clause 9 and this relationship is vital for the 32 mm branches normally connected to wash basins. Vertical 32 mm branch pipe to wash basins with 's' traps often run full bore and ventilating pipework may be needed to prevent self-siphonage and noisy discharge (7.2.2 and 7.2.3).

8.3.2.3 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 (7.2.2 and 7.2.5).

8.3.2.4 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 (7.2.2 and 7.2.5).

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 (7.2.5).

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 9.2.2.7) (7.2.2).

8.3.2.5 Branch pipe connections to discharge stacks. (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

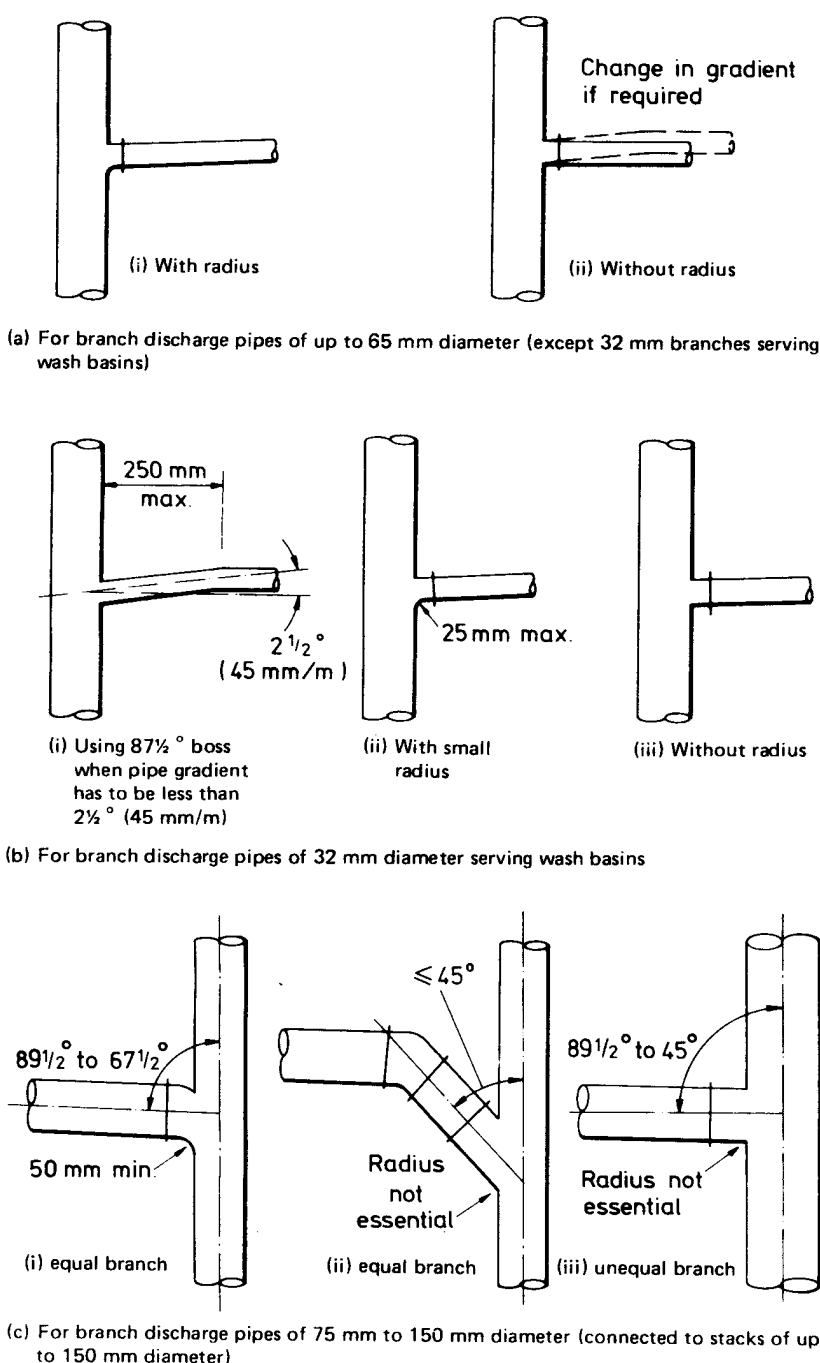


Figure 8. Branch discharge pipe connections to discharge stacks

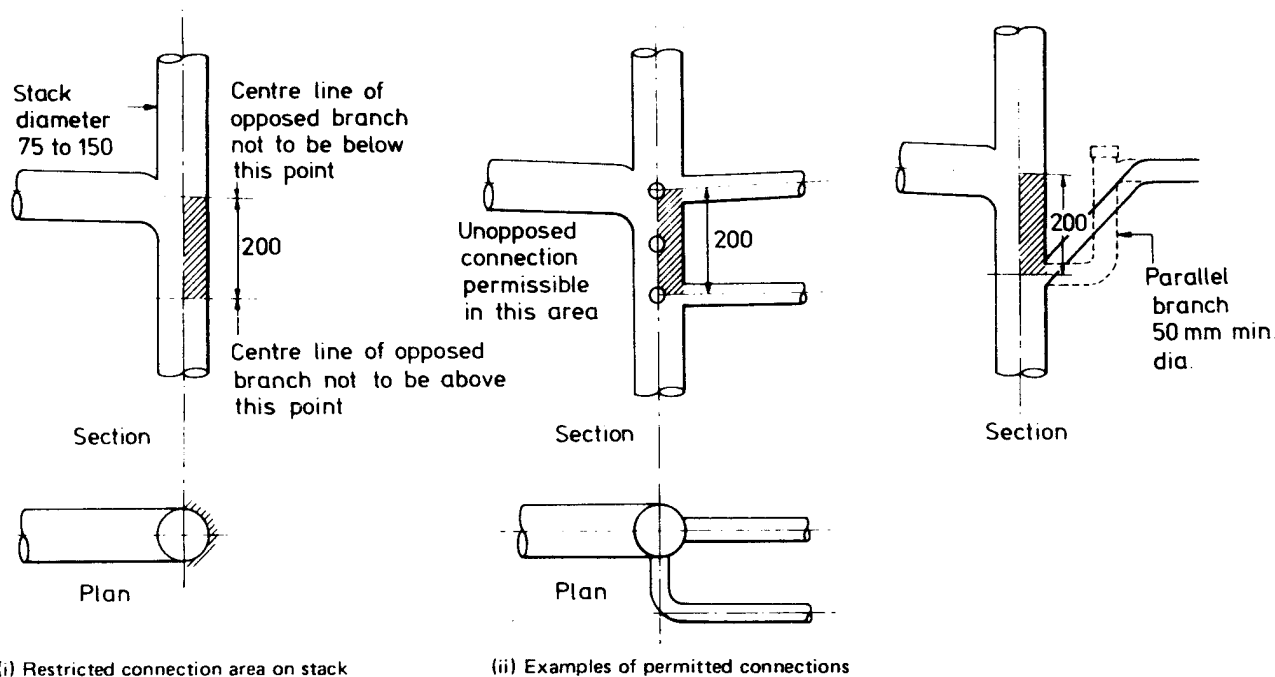
and some change in gradient close to the stack is permissible to allow the use of a standard $87\frac{1}{2}^\circ$ branch boss. However, for 32 mm pipes serving wash basins the sweep radius should be not greater than 25 mm (see figure 8(b)) and the change in gradient should be within 250 mm from the stack (7.2.2).

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 $89\frac{1}{2}^\circ$ to $67\frac{1}{2}^\circ$ (see figure 8(c) (i)) (7.2.2).

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

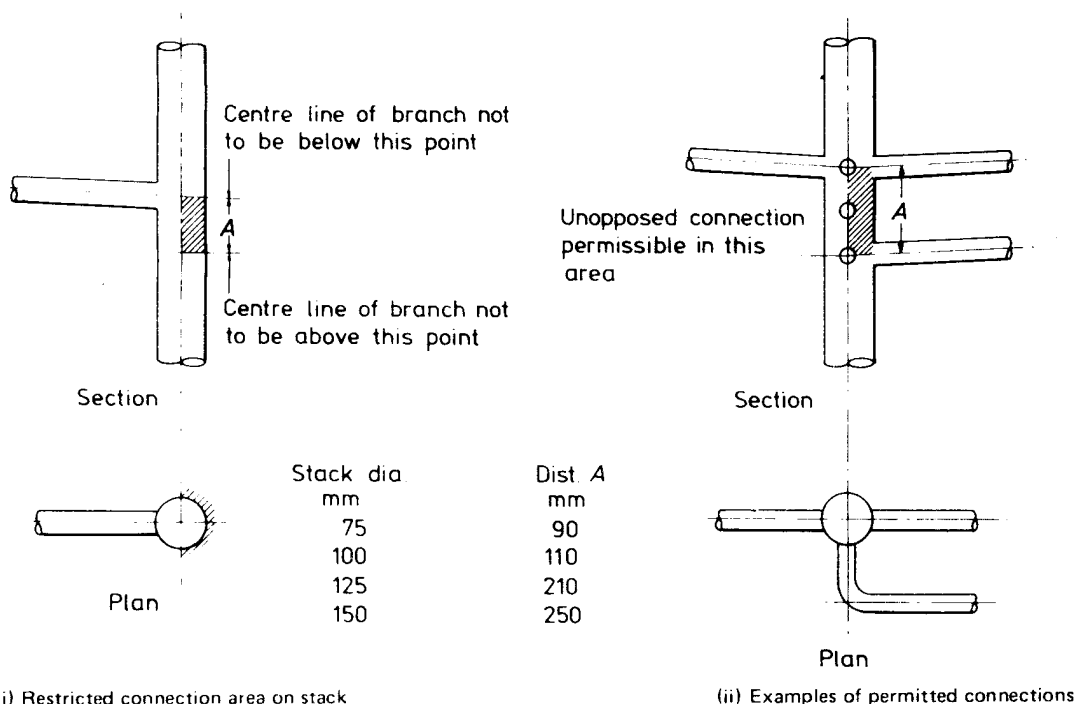
Branch inlets of 75 mm size joining 100 mm or 150 mm discharge stacks and branch inlets of 100 mm joining 150 mm stacks may be swept or unswept (see figure 8(c) (iii)).

8.3.2.6 Prevention of cross flow. (See figure 9.) Opposed small diameter branch discharge pipes without swept entries should be arranged so that the risk of the discharge from one branch into the other is avoided (7.2.5).



All dimensions are in millimetres.

(a) Opposed connections of large and small branch discharge pipes



(i) Restricted connection area on stack

(ii) Examples of permitted connections

(b) Opposed connections of small diameter branch discharge pipes

Figure 9. Opposed branch connections to stack; prevention of cross flow (see 8.3.2.6)

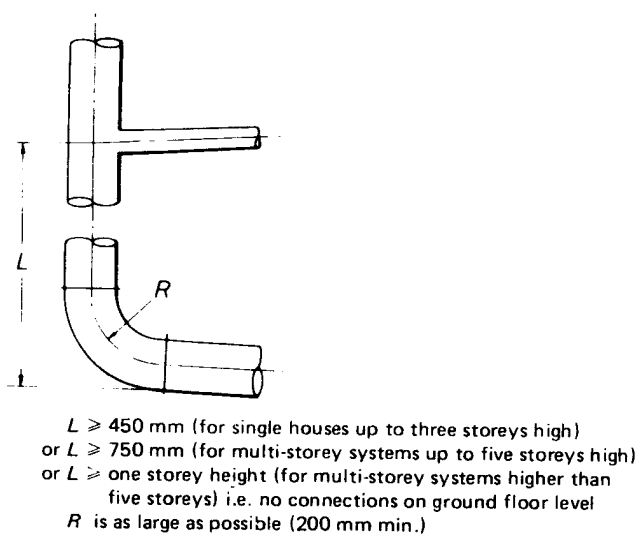
To prevent the discharge from a large diameter branch (e.g. a WC branch) backing up a smaller diameter branch (e.g. a bath branch) the latter should be connected to the stack so that its centre line meets the centre line of the stack at or above the level at which the centre line of the large branch 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) (7.2.5).

8.3.2.7 Direct connections to an underground drain

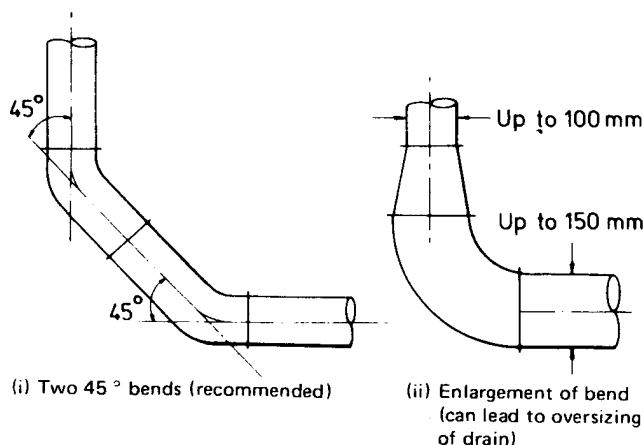
8.3.2.7.1 Gullies. It is often convenient in low rise houses, bungalows and ground floor flats or maisonettes, to discharge the waste water from some appliances, e.g. baths, wash basins and sinks, into an external gully. The appliances should be fitted with suitable traps and the discharge pipes should terminate below the grating but above the water level in the gully.

This arrangement usually requires a certain 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 (7.2.2 and 7.2.3).

8.3.2.7.2 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 (7.2.2).



(a) Bend and branch connection



(b) Alternative bend arrangements

Figure 10. Bend and branch connections at base of discharge stack

8.3.2.7.3 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 for single storey buildings to connect one each of bath, wash basin, sink, washing machine and WC, directly to the drain provided that the crown of the WC trap is not more than 1.5 m from the invert of the branch drain and that the distance between the topmost connection to the stub stack and the invert of the branch drain is not more than 2 m. The method can also be used for ground floor appliances of other buildings where it may be considered undesirable to connect them to the main discharge stack because of the effects of positive pressure at the base of the stack (7.2.2).

NOTE. Direct connections to a drain for individual appliances or for stub stacks should only be made when the drain is adequately ventilated to safeguard trap seals (7.2.2).

8.3.3 Discharge stacks

8.3.3.1 Diameter. The internal diameter of a discharge stack should be not less than that of the largest trap or branch discharge pipe connected to it. The discharge stack above the topmost appliance connection should be continued without any reduction of diameter to the point of termination (see 8.3.3.6), except for one and two storey housing where, in certain cases, economies can be made by using a 75 mm vent pipe without detriment to the performance of the system. Sizes of discharge stacks are given in clause 9 (7.2.1 and 7.2.5).

8.3.3.2 Bends and branches at the base of stacks.

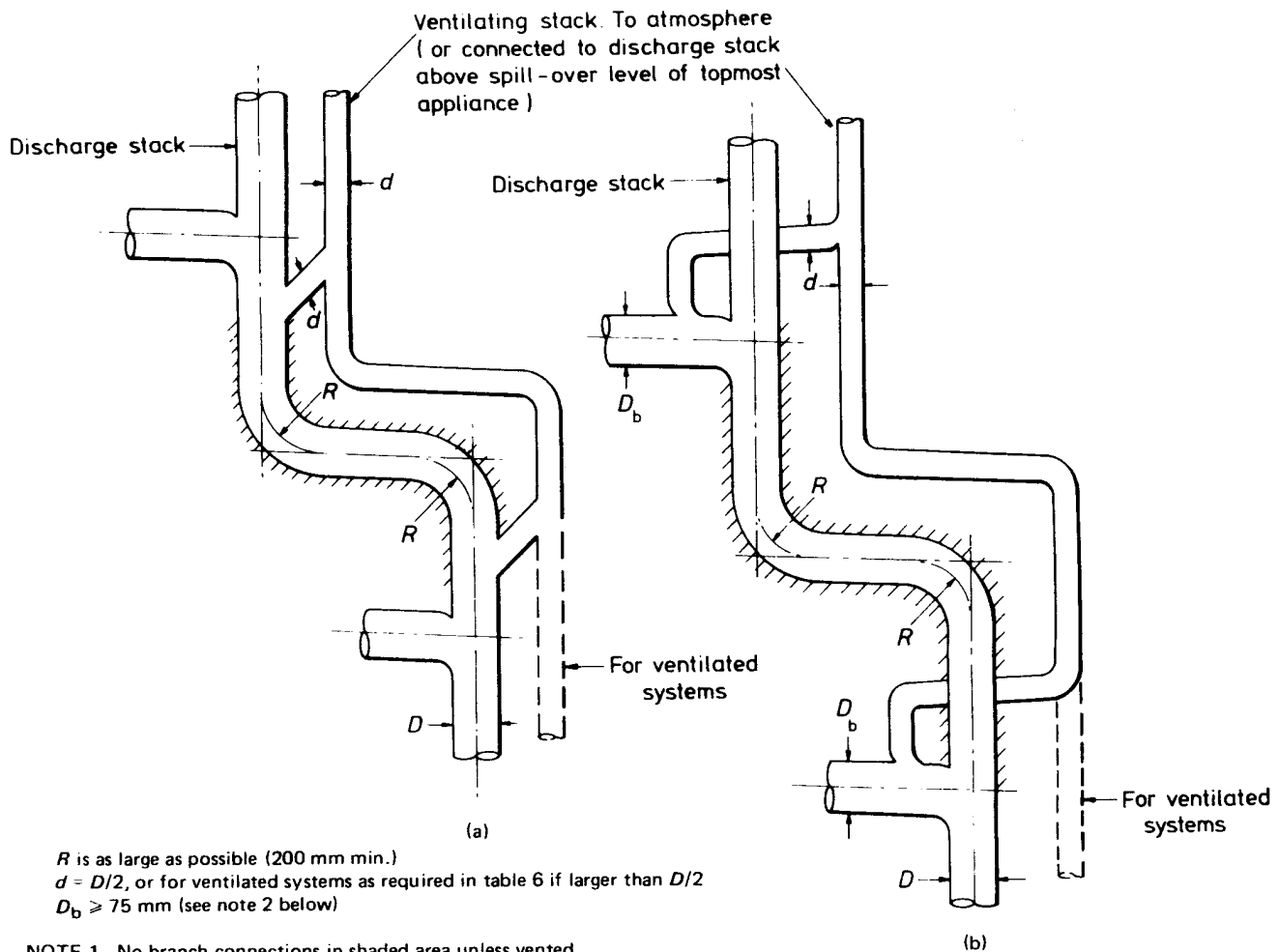
(See figure 10.) Bends at the base of a discharge stack should be of large radius, at least a 200 mm radius to the centre line, but preferably two 45° large radius bends should be used. Increasing the size at the base of a 100 mm stack and bend to 150 mm is an alternative but this may oversize the drain and be uneconomic (7.2.2 and 7.2.5).

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 the horizontal drain and not directly to the stack. For buildings over 20 storeys high it may be necessary for both the ground and first floor appliances to be so connected (7.2.2 and 7.2.5).

8.3.3.3 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 8.3.3.2 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 9.3.2 and figure 11. Offsets above the topmost appliance or branch connection do not require venting (7.2.2 and 7.2.5).

8.3.3.4 Surcharging of the drain. If the drain, to which the discharge stack is connected, is likely to be surcharged, a ventilating pipe or stack should be connected to the base of the stack above the likely flood level. Ventilated systems may require larger ventilating stacks. Sizes are given in clause 9 (7.2.2).

8.3.3.5 Intercepting traps. Intercepting traps are generally no longer used but if a stack is to be connected to an existing drain in which an intercepting trap is fitted, the size of ventilating stack should be as for a surcharged drainage system (see 8.3.3.4) (7.2.2).



NOTE 1. No branch connections in shaded area unless vented.

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

NOTE 3. No offset venting is required in 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

8.3.3.6 Termination of discharge stacks. (See figure 12.) The outlet of every discharge stack to the open air should be at such a height and position that foul air does not cause a nuisance or health hazard. In general this is achieved if the stack 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. Outlets should also be positioned away from parapets and corners of buildings (7.2.2).

The outlet of every discharge stack should be protected at its topmost end with a durable domical cage or other cover which does not unduly restrict the flow of air.

8.3.3.7 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 (7.2.5 and 7.2.7).

8.3.3.8 Discharge stacks serving only sinks. In some multi-storey flat layouts it may be convenient to connect the kitchen sinks 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. If such an arrangement

cannot be avoided, ready access to the stack should be provided and regular maintenance arranged (7.2.5 and 7.2.7).

8.4 Ventilating pipes and stacks

8.4.1 Branch ventilating pipes. (See figure 13.)

8.4.1.1 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 (7.2.2 and 7.2.5).

8.4.1.2 Connections to stacks. For branch discharge pipes requiring relief venting the ventilating pipes can be connected to the ventilation stack in a ventilated system. 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 also shown in figure 13(c) (7.2.2 and 7.2.5).