BRITISH STANDARD

BS EN 12056-2:2000

Gravity drainage systems inside buildings —

Part 2: Sanitary pipework, layout and calculation

The European Standard EN 12056-2:2000 has the status of a British Standard

ICS 91.140.70; 91.140.80

National foreword

This British Standard is the official English language version of EN 12056-2:2000. It supersedes BS 5572:1994 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/505, Wastewater engineering, to Subcommittee B/505/21, Roof drainage and sanitary pipework, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

The national annexes are an informative element of this British Standard and contain information provided for easier implementation of EN 12056-2:2000 in the United Kingdom, within the framework envisaged by the scope of the European Standard. Users are reminded that only the normative elements of the adopted European Standard set out the provisions to which it is necessary to conform in order to form part of a trade description when citing this British Standard by number or when compliance with it is claimed.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 85 and a back cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12056-2

June 2000

ICS 91.140.80

English version

Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation

Réseaux d'évacuation gravitaire à l'intérieur des bâtiments - Partie 2: Systèmes pour les eaux usées, conception et calculs

Schwerkraftentwässerungsanlagen innerhalb von Gebäuden - Teil 2: Schmutzwasseranlagen, Planung und Berechnung

This European Standard was approved by CEN on 27 October 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 12056-2:2000 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165, Waste water engineering, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by June 2001.

This is the second part in a series of the following five parts:

Part 1: General and performance requirements;

Part 2: Sanitary pipework, layout and calculation;

Part 3: Roof drainage, layout and calculation;

Part 4: Waste water lifting plants, layout and calculation;

Part 5: Installation and testing of drainage systems, instructions for operation, maintenance and use.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard applies to waste water drainage systems which operate under gravity. It is applicable for drainage systems inside dwellings, commercial, institutional and industrial buildings.

Differences in plumbing within Europe have led to a variety of systems being developed. Some of the major systems in use are described but this standard has not attempted to detail the intricacies of each system. Detailed information additional to that contained in this standard may be obtained by referring to the technical documents listed in annex A.

This second part of the standard sets out principles which shall be followed for both layout and calculation. It makes limited provision for drainage systems conveying trade effluent and also makes limited provision for fluids removed by pumps.

All drawings in the standard are given as examples and are not intended to exclude any other system configuration.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of publication referred to applies.

EN 12056-1: Gravity drainage systems inside buildings - Part 1: General and performance requirements.

EN 12056-3: Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation.

EN 12056-4: Gravity drainage systems inside buildings - Part 4: Waste water lifting plants, layout and calculation.

EN 12056-5 Gravity drainage systems inside buildings - Part 5: Installation and testing, instructions for operation, maintenance and use.

EN 752 Drain and sewer systems outside buildings.

prEN 12380 Ventilating pipework - Air admittance valve systems (AVS).

3 Definitions

For the purpose of this European Standard, the following definitions apply.

3.1 General

3.1.1 waste water

water which is contaminated by use and all water discharging into the drainage system, e.g. domestic and trade effluent, condensate water and also rainwater when discharged in a waste water drainage system

3.1.2 domestic waste water
water which is contaminated by use and normally discharged from WC, shower, bath, bidet, wash basin, sink, floor gully

3.1.3 trade effluent
water after industrial use and processes contaminated/polluted water including cooling water

3.1.4 grey water
waste water not containing faecal matter or urine

3.1.5 black water
waste water containing faecal matter or urine

3.1.6 rainwater
water resulting from natural precipitation that has not been deliberately contaminated

3.1.7 flood level
the maximum level to which waste water can rise within a drainage system

3.1.8 drainage system
a system composed of drainage equipment, and other components collecting waste water and discharging by means of gravity; effluent lifting plant may be part of a gravity drainage system

3.1.9 combined system
a drainage system for both rain and waste water in a single pipe

3.1.10 separate system
a drainage system for draining rain and waste water separately by dedicated pipework

3.2 Pipes and fittings

3.2.1 sanitary pipework
arrangement of discharge pipework, with or without ventilating pipes, connected to a drainage system

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

3.2.2 nominal diameter (DN*)*
numerical designation of size which is a convenient round number approximately equal to the diameter in mm

3.2.3 internal diameter (d_i)
mean internal diameter of the pipe barrel at any cross-section

3.2.4 external diameter (d_a)
mean external diameter of the pipe barrel at any cross-section

3.2.5 minimum internal diameter ($d_{i\,min}$)
smallest internal diameter allowed with maximum tolerance

3.2.6 branch discharge pipe
pipe connecting sanitary appliances to a discharge stack or drain

3.2.7 square entry
equal branch junction that is more than 45°, or has a centre line radius less than the internal pipe diameter

3.2.8 swept entry
equal branch junction that is at 45° or less, or has a centre line radius not less than the internal pipe diameter

3.2.9 connection bend
first fitting in direction of flow after trap outlet

3.2.10 discharge stack
main (generally vertical) pipe, conveying discharges from sanitary appliances

3.2.11 stack offset
non-vertical part of a discharge stack

3.2.12 drain
near horizontal pipe suspended within a building or buried in the ground to which stacks or ground floor appliances are connected

3.2.13 filling degree
proportion of water depth (h) to the inside diameter (d_i)

3.3 Ventilating pipework

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

3.3.2 branch ventilating pipe
ventilating pipe connected to a branch discharge pipe

3.3.3 stack vent
extension of a vertical discharge pipe above the highest branch discharge pipe connection that terminates in an end, open to the atmosphere

3.3.4 ventilating stack
Main vertical ventilating pipe, connected to a discharge stack, to limit pressure fluctuations within the discharge stack

3.3.5 air admittance valve
valve that allows air to enter the system but not to escape in order to limit pressure fluctuations within the sanitary pipework

3.4 Appliances

3.4.1 domestic sanitary appliances
fixed appliances supplied with water and used cleaning or washing. For example: baths, showers, wash basins, bidets, WCs, urinals, sinks, dishwashers, washing machines

3.4.2 non-domestic sanitary appliances
special sanitary appliances used in commercial kitchens, laundries, laboratories, hospitals, hotels, swimming-pools, etc.

3.4.3 floor gully
discharge fitting intended to receive water from floors either through apertures in a grating or from pipes connected to the body of the gully. A gully may include a trap

3.4.4 trap
device that prevents the passage of foul air by means of water seal

3.4.5 depth of water seal (*H*)
the depth of water which would have to be removed from a fully charged trap before gases and odours at atmospheric pressure could pass through the trap shown as *H* in Figure 1.

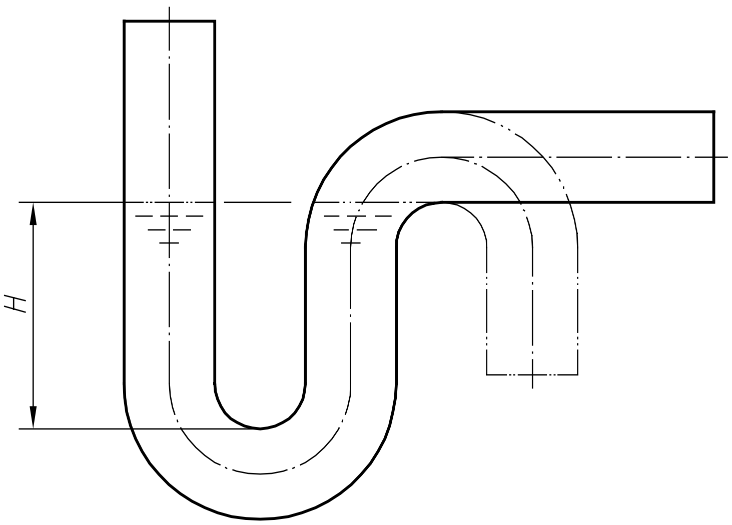


Figure 1 — Water depth in trap

3.5 Calculation

3.5.1 discharge unit (DU)
the average discharge rate of a sanitary appliance expressed in litres per second (l/s)

3.5.2 frequency factor (*K*)
variable to take into account the frequency of use of sanitary appliances (dimensionless)

3.5.3 waste water flow rate (Q_{ww})
total design flow rate from sanitary appliances in a drainage system or in a part of a drainage system in litres per second (l/s)

3.5.4 continuous flow rate (Q_c)
flow rate of all continuous flows, e.g. cooling water, etc., in litres per second (l/s)

3.5.5 pumped water flow rate (Q_p)
discharge rate of waste water pumps in litres per second (l/s)

3.5.6 total flow rate (Q_{tot})
the total flow rate is the sum of the waste water flow rate (Q_{ww}) and continuous flow rate (Q_c) and pumped water flow rate (Q_p), in litres per second (l/s)

3.5.7 hydraulic capacity (Q_{max})
maximum flow rate of water permitted in a branch, stack or drain in litres per second (l/s)

3.5.8 air flow rate (Q_a)
minimum flow rate of air through a ventilating pipe or air admittance valve, measured at 250 Pascal (Pa) pressure drop, in litres per second (l/s)

4 System configurations

4.1 General

There are many types of waste water drainage systems in use today. These have developed as a result of differences in the type and use of sanitary appliances in different countries and also different, justifiable technical traditions.

4.2 System types

The systems may be divided into four system types, although there are variations in detail within each system type [hence the need to refer to the national and local regulations and practice listed in annex A (informative)].

System I **Single discharge stack system with partly filled branch discharge pipes**
Sanitary appliances are connected to partly filled branch discharge pipes. The partly filled branch discharge pipes are designed with a filling degree of 0.5 (50 %) and are connected to a single discharge stack.

System II **Single discharge stack system with small bore discharge branch pipes**
Sanitary appliances are connected to small bore branch discharge pipes. The small bore branch discharge pipes are designed with a filling degree of 0.7 (70 %) and are connected to a single discharge stack.

System III **Single discharge stack system with full bore branch discharge pipes**
Sanitary appliances are connected to full bore branch discharge pipes. The full bore branch discharge pipes are designed with a filling degree of 1.0 (100 %) and each branch discharge pipe is separately connected to a single discharge stack.

System IV **Separate discharge stack system**
Drainage systems type I, II and III may also be divided into a black water stack serving WC's and urinals and a grey water stack serving all other appliances.

4.3 Configurations

Each system may be configured in a number of ways, governed by the need to control pressure in the pipework in order to prevent foul air from the waste water system entering the building. The principal configurations are described below but combinations and variations are often required.

4.3.1 Primary ventilated system configurations

Control of pressure in the discharge stack is achieved by air flow in the discharge stack and the stack vent (see Figure 2). Alternatively, air admittance valves may be used.

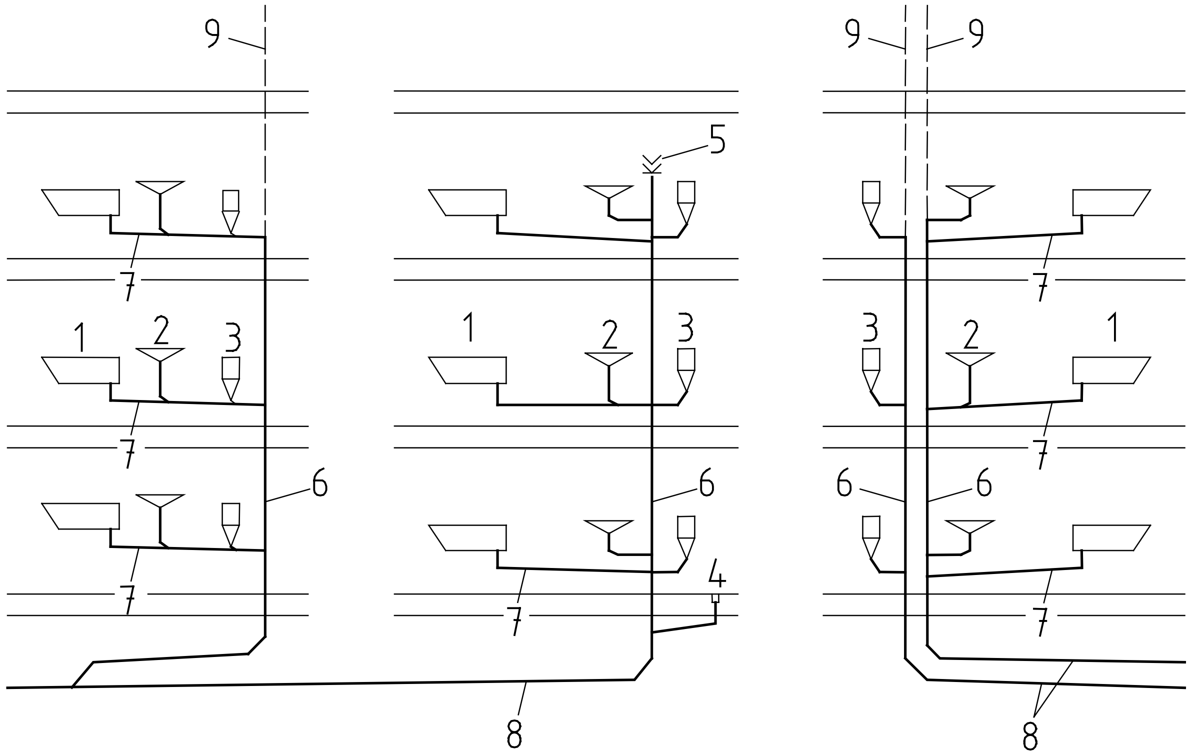


Figure 2 — Primary ventilated system configurations

Legend:
1 Bath
2 Wash basin
3 WC
4 Floor gully
5 Air admittance valve
6 Stack
7 Branch discharge pipe
8 Drain
9 Stack vent

4.3.2 Secondary ventilated system configurations

Control of pressure in the discharge stack is achieved by use of separate ventilating stacks and/or secondary branch ventilating pipes in connection with stack vents (see Figure 3).

Alternatively, air admittance valves may be used.

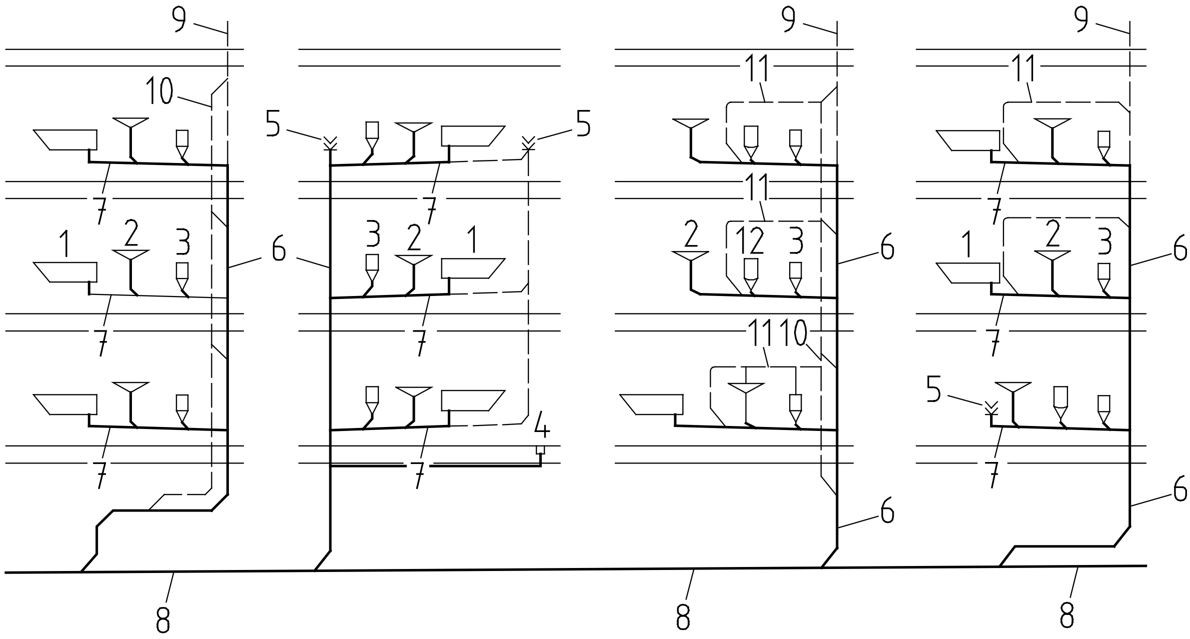


Figure 3 — Secondary ventilated system configurations

Legend:

1 Bath
2 Wash basin
3 WC
4 Floor gully
5 Air admittance valve
6 Stack
7 Branch discharge pipe
8 Drain
9 Stack vent
10 Ventilating stack
11 Branch ventilating pipe
12 Urinal

4.3.3 Unventilated discharge branch configurations

Control of pressure in the discharge branch is achieved by air flow in the discharge branch (see Figure 4).

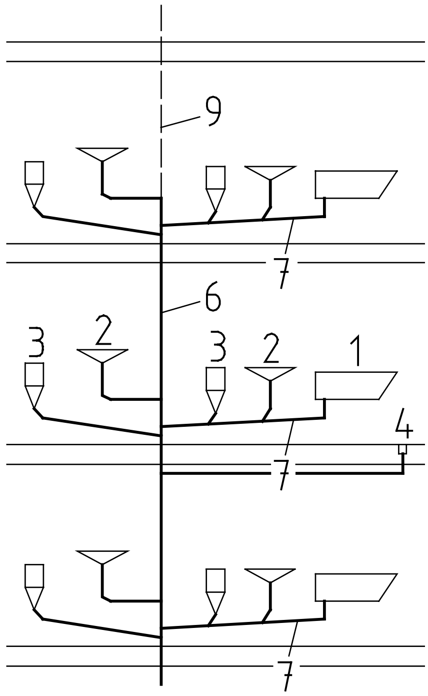


Figure 4 — Unventilated discharge branch configuration

Legend:
1 Bath
2 Wash basin
3 WC
4 Floor gully
6 Stack
7 Branch discharge pipe
9 Stack vent

4.3.4 Ventilated discharge branch configurations

Control of pressure in the discharge branch is achieved by ventilation of the discharge branch (see Figure 5). Alternatively, air admittance valves may be used.

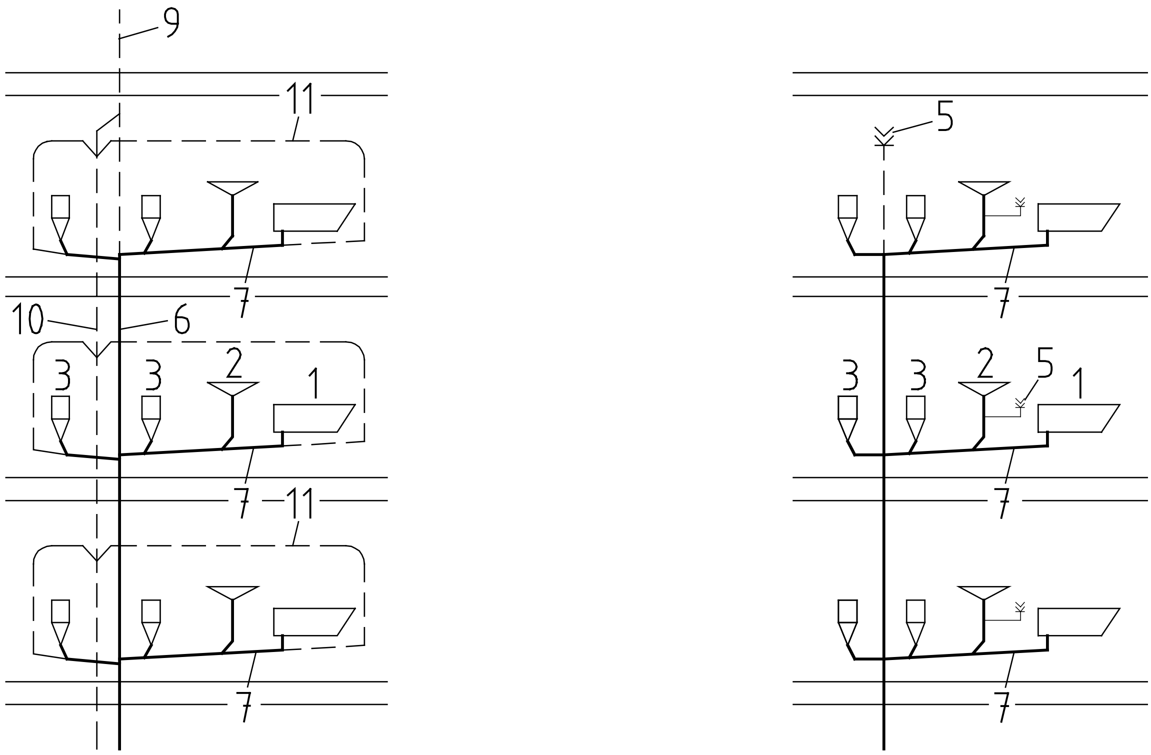


Figure 5 — Ventilated discharge branch configurations

Legend:	1	Bath
	2	Wash basin
	3	WC
	5	Air admittance valve
	6	Stack
	7	Branch discharge pipe
	9	Stack vent
	10	Ventilating stack
	11	Branch ventilating pipe

5 Layout rules

5.1 Compliance with European Standards

Appliances, pipes and fittings shall comply with relevant European Standards where applicable. European Standards of commonly used products are listed in annex D.

5.2 Protection against flooding

Drainage shall be provided for all water supply points inside a building.

5.3 Odour

Appliances connected to the drainage system shall be installed with a trap to prevent escape of foul air into the building.

5.4 Trap seal

The depth of water seal (*H*) shall be not less than 50 mm.

5.5 Reduction of nominal diameter

The nominal diameter (DN) of discharge pipes shall not be reduced in the direction of flow.

5.6 Ventilation

Sanitary pipework is often used to ventilate the external drain or sewer system. Therefore care should be taken to ensure that open vents are installed as necessary.

5.7 Air admittance valves

Where air admittance valves are used to vent drainage systems they shall comply with prEN 12380 and shall be sized in accordance with Table 10 for branches and Table 11 and for stacks respectively.

6 Calculation

6.1 General

The following calculation method is valid for all gravity drainage systems conveying domestic waste water. Systems conveying trade effluents, e.g. drainage from swimming pools and industrial buildings should be calculated individually.

6.2 Basic data

The following data is the basis for the calculation method.

6.2.1 Pipe diameter

All capacities given in this part are based on the minimum internal diameters shown in Table 1.

Table 1 — Nominal diameters (DN) and related minimum internal diameters ($d_{i\ min}$)

Nominal diameter	Minimum internal diameter
DN	$d_{i\ min}$ mm
30	26
40	34
50	44
56	49
60	56
70	68
80	75
90	79
100	96
125	113
150	146
200	184
225	207
250	230
300	290

6.2.2 Discharge units

Discharge units of a variety of sanitary appliances are given in Table 2. The values are given only for the purpose of calculation and are not related to discharge rates of sanitary appliances quoted in product standards.

Table 2 — Discharge units (DU)

Appliance	System I	System II	System III	System IV
	DU l/s	DU l/s	DU l/s	DU l/s
Wash basin, bidet	0,5	0,3	0,3	0,3
Shower without plug	0,6	0,4	0,4	0,4
Shower with plug	0,8	0,5	1,3	0,5
Single urinal with cistern	0,8	0,5	0,4	0,5
Urinal with flushing valve	0,5	0,3	-	0,3
Slab urinal	0,2*	0,2*	0,2*	0,2*
Bath	0,8	0,6	1,3	0,5
Kitchen sink	0,8	0,6	1,3	0,5
Dishwasher (household)	0,8	0,6	0,2	0,5
Washing machine up to 6 kg	0,8	0,6	0,6	0,5
Washing machine up to 12 kg	1,5	1,2	1,2	1,0
WC with 4,0 l cistern	**	1,8	**	**
WC with 6,0 l cistern	2,0	1,8	1,2 to 1,7***	2,0
WC with 7,5 l cistern	2,0	1,8	1,4 to 1,8***	2,0
WC with 9,0 l cistern	2,5	2,0	1,6 to 2,0***	2,5
Floor gully DN 50	0,8	0,9	-	0,6
Floor gully DN 70	1,5	0,9	-	1,0
Floor gully DN 100	2,0	1,2	-	1,3

* Per person.
** Not permitted.
*** Depending upon type (valid for WC's with siphon flush cistern only).
\- Not used or no data.

6.2.3 Discharge from non-domestic sanitary appliances

Discharges from non-domestic sanitary appliances (e.g. commercial kitchen) should be determined individually.

6.3 Calculation of flowrate

6.3.1 Waste water flowrate (Q_{ww})

Q_{ww} is the expected flowrate of waste water in a part or in the whole drainage system where only domestic sanitary appliances (see Table 2) are connected to the system.

$$Q_{ww} = K\sqrt{\sum \mathrm{DU}}$$

where:

Q_{ww} = Waste water flowrate (l/s)
K = Frequency factor
$\sum$DU = Sum of discharge units

6.3.2 Frequency factor (K)

Typical frequency factors associated with different usage of appliances are given in Table 3.

Table 3 — Typical frequency factors (*K*)

Usage of appliances	*K*
Intermittent use, e.g. in dwelling, guesthouse, office	0,5
Frequent use, e.g. in hospital, school, restaurant, hotel	0,7
Congested use, e.g. in toilets and/or showers open to public	1,0
Special use, e.g. laboratory	1,2

6.3.3 Total flowrate (Q_{tot})

Q_{tot} is the design flowrate in a part or in the whole drainage system where sanitary appliances, appliances with continuous flow and/or waste water pumps are connected to the system.

Continuous flows and pump discharge rates shall be added to the waste water flowrate without any reduction.

$$Q_{tot} = Q_{ww} + Q_c + Q_p$$

where:

Q_{tot} = Total flowrate (l/s)
Q_{ww} = Waste water flowrate (l/s)
Q_c = Continuous flowrate (l/s)
Q_p = Pumped water flowrate (l/s)

6.3.4 Calculation rules

The pipe capacity (Q_{max}) shall be at least the larger of:

a) the calculated waste water flowrate (Q_{ww}) or total flowrate (Q_{tot}); or

b) the flowrate of the appliance with the largest discharge unit (see Table 2).

For convenience some values of Q_{ww} or Q_{tot} calculated for different frequency factors (*K*) and sums of discharge units (DU) are tabulated in annex B.

6.4 Layout of branches

6.4.1 Unventilated discharge branches

Sizes and limitations upon the use of unventilated discharge branches are given in Tables 4 and 5. Where the limitations cannot be met, discharge branches shall be ventilated, unless national and local regulations and practice allow the use of larger pipe sizes or air admittance valves. Limitations given in Table 5 are simplifications. For further information see national and local regulations and practice.

Table 4 — Hydraulic capacity (Q_{max}) and nominal diameter (DN)

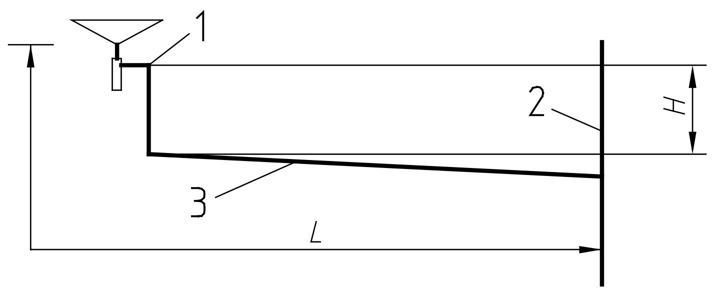
Q_{max}	System I	System II	System III	System IV
l/s	DN	DN	DN	DN
0,40	*	30	see Table 6	30
0,50	40	40		40
0,80	50	*		*
1,00	60	50		50
1,50	70	60		60
2,00	80**	70**		70**
2,25	90***	80****		80****
2,50	100	90		100

* Not permitted.
** No WC's.
*** Not more than two WC's and a total change in directions of not more than 90°.
**** Not more than one WC.

Table 5 — Limitations

Limitations	System I	System II	System III	System IV
Maximum length (*L*) of pipe	4,0 m	10,0 m	see Table 6	10,0 m
Maximum number of 90° bends	3*	1*		3*
Maximum drop (*H*) (45° or more inclination)	1,0 m	**6,0 m DN > 70 **3,0 m DN = 70		1,0 m
Minimum gradient	1 %	1,5 %		1 %

* Connection bend not included.
** If DN < 100 mm and a WC is connected to the branch no other appliances can be connected more than 1 m above the connection to a ventilated system.



1 Connecting bend 2 Stack 3 Branch ventilating pipe

Figure 6 — Limitations for unventilated discharge branches in system I, II, IV

Table 6 — Limitations for unventilated branch-discharge-pipes, system III

Appliance	Diameter DN	Min. trap seal depth mm	Max. length (*L*) of pipe from trap outlet to stack m	Pipe gradient %	Max. number of bends No.	Max. drop (*H*) m
Washbasin, bidet (30 mm diameter trap)	30	75	1,7	2,2[1)]	0	0
Washbasin, bidet (30 mm diameter trap)	30	75	1,1	4,4[1)]	0	0
Washbasin, bidet (30 mm diameter trap)	30	75	0,7	8,7[1)]	0	0
Washbasin, bidet (30 mm diameter trap)	40	75	3,0	1,8 to 4,4	2	0
Shower, bath	40	50	No Limit[2)]	1,8 to 9,0	No Limit	1,5
Bowl urinal	40	75	3,0[3)]	1,8 to 9,0	No Limit[4)]	1,5
Trough urinal	50	75	3,0[3)]	1,8 to 9,0	No Limit[4)]	1,5
Slab urinal[5)]	60	50	3,0[3)]	1,8 to 9,0	No Limit[4)]	1,5
Kitchen sink (40 mm diameter trap)	40	75	No Limit[2)]	1,8 to 9,0	No Limit	1,5
Household dishwasher or washing machine	40	75	3,0	1,8 to 4,4	No Limit	1,5
WC with outlet up to 80 mm[6)]	75	50	No Limit	1,8 Min.	No Limit[4)]	1,5
WC with outlet greater than 80 mm[6)]	100	50	No Limit	1,8 Min.	No Limit[4)]	1,5
Food waste disposal[7)]	40 Min.	75[8)]	3,0[3)]	13,5 Min.	No Limit[4)]	1,5
Sanitary towel disposal unit	40 Min.	75[8)]	3,0[3)]	5,4 Min.	No Limit[4)]	1,5
Floor drain	50	50	No Limit[3)]	1,8 Min.	No Limit	1,5
Floor drain	70	50	No Limit [3)]	1,8 Min.	No Limit	1,5
Floor drain	100	50	No Limit [3)]	1,8 Min.	No Limit	1,5
4 basins	50	75	4,0	1,8 to 4,4	0	0
Bowl urinals[8)]	50	75	No Limit[3)]	1,8 to 9,0	No Limit[4)]	1,5
Maximum of 8 WC's[6)]	100	50	15,0	0,9 to 9,0	2	1,5
Up to 5 spray tap basins[9)]	30 Max.	50	4,5[3)]	1,8 to 4,4	No Limit[4)]	0

1) Steeper gradient permitted if pipe is less than maximum permitted length.
2) If length is greater than 3 m noisy discharge may result with an increased risk of blockage.
3) Should be as short as possible to limit problems with deposition.
4) Sharp throated bend should be avoided.
5) For slab urinal for up to 7 persons. Longer slabs to have more than one outlet.
6) Swept-entry branches serving WC's.
7) Includes small potato-peeling machines.
8) Tubular not bottle or resealing traps.
9) Spray tap basin shall have flush-grated wastes without plugs.

6.4.2 Ventilated discharge branches

Sizes and limitations upon the use of ventilated discharge branches are given in Table 7 and 8. Limitations given in Table 8 are simplifications, for further information see national and local regulations and practice.

Table 7 — Hydraulic capacity (Q_{max}) and nominal diameter (DN)

Q_{max} l/s	System I DN	System II DN	System III DN	System IV DN
	Branch/Vent	Branch/Vent	Branch/Vent	Branch/Vent
0,60	*	30/30	see Table 6	30/30
0,75	50/40	40/30		40/30
1,50	60/40	50/30		50/30
2,25	70/50	60/30		60/30
3,00	80/50**	70/40**		70/40**
3,40	90/60***	80/40****		80/40****
3,75	100/60	90/50		90/50

* Not permitted.

** No WC's.

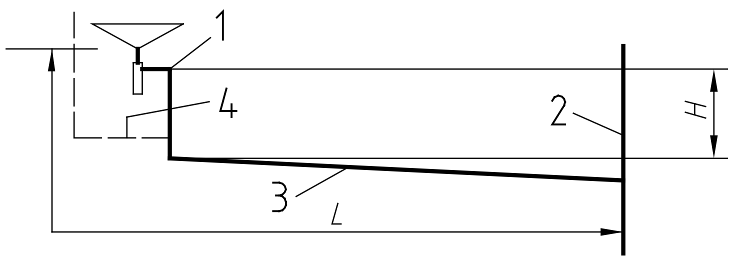
*** Not more than two WC's and a total change in directions of not more than 90°.

**** Not more than one WC.

Table 8 — Limitations

Limitations	System I	System II	System III	System IV
Maximum length (L) of pipe	10,0 m	No Limit	see Table 9	10,0 m
Maximum number of 90° bends*	No Limit	No Limit		No Limit
Maximum drop (H) (45° or more inclination)	3,0 m	3,0 m		3,0 m
Minimum gradient	0,5 %	1,5 %		0,5 %

* Connection bend not included.



1 Connection bend
2 Stack
3 Branch discharge pipe
4 Branch ventilating pipe

Figure 7 — Limitations for ventilated discharge branches in system I, II and IV

Table 9 — Limitations for ventilated branch discharge pipes in system III

Appliance	Diameter DN	Min. trap seal depth mm	Max. length (*L*) of pipe from trap outlet to stack m	Pipe gradient %	Max. number of bends No.	Max. drop (*H*) m
Washbasin, bidet (30 mm diameter trap)	30	75	3,0	1,8 Min.	2	3,0
Washbasin, bidet (30 mm diameter trap)	40	75	3,0	1,8 Min.	No Limit	3,0
Shower, bath	40	50	No Limit[2)]	1,8 Min.	No Limit	No Limit
Bowl urinal	40	75	3,0[3)]	1,8 Min.	No Limit[4)]	3,0
Trough urinal	50	75	3,0[3)]	1,8 Min.	No Limit[4)]	3,0
Slab urinal[5)]	60	50	3,0[3)]	1,8 Min.	No Limit[4)]	3,0
Kitchen sink (40 mm diameter trap)	40	75	No Limit[2)]	1,8 Min.	No Limit	No Limit
Household dishwasher or washing machine	40	75	No Limit[3)]	1,8 Min.	No Limit	No Limit
WC with outlet up to 80 mm[6) and 14)]	75	50	No Limit	1,8 Min.	No Limit[4)]	1,5
WC with outlet greater than 80 mm[6) and 14)]	100	50	No Limit	1,8 Min.	No Limit[4)]	1,5
Food waste disposal[7)]	40 Min.	75[8)]	3,0[3)]	13,5 Min.	No Limit[4)]	3,0
Sanitary towel disposal unit	40 Min.	75[8)]	3,0[3)]	5,4 Min.	No Limit[4)]	3,0
Bath drain, floor drain	50	50	No Limit[3)]	1,8 Min.	No Limit	No Limit
Floor drain	70	50	No Limit[3)]	1,8 Min.	No Limit	No Limit
Floor drain	100	50	No Limit[3)]	1,8 Min.	No Limit	No Limit
5 basins[9)]	50	75	7,0	1,8 to 4,4	[2)]	0
10 basins[9)and 10)]	50	75	10,0	1,8 to 4,4	No Limit	0
Bowl urinals[9) and 11)]	50	75	No Limit[3)]	1,8 Min.	No Limit[4)]	No Limit
More than 8 WC's[6)]	100	50	No Limit	0,9 Min.	No Limit	No Limit
Up to 5 spray-tap basins[12)]	30 Max.	50	No Limit[3)]	1,8 to 4,4	No Limit[4)]	0

1) For maximum distance from trap to vent; see Figure 8.
2) If length is greater than 3 m, noisy discharge may result with an increased risk of blockage.
3) Should be as short as possible to limit problems with deposition.
4) Sharp throated bends should be avoided.
5) For slab urinal for up to 7 persons. Longer slabs to have more than one outlet.
6) Swept-entry branches serving WC's.
7) Includes small potato-peeling machines.
8) Tubular not bottle or resealing traps.
9) See Figure 9.
10) Every basin shall be individually ventilated.
11) Any number.
12) Spray tap basins shall have flush-grated wastes without plugs.
13) The size of ventilating pipes to branches from appliances can be DN 25 but, if they are longer than 15 m or contain more than five bends, a DN 30 pipe shall be used.
14) If the connection of the ventilating pipe is liable to blockage due to repeated splashing or submergence, it should be DN 50, up to 50 mm above the spill-over level of the appliance.

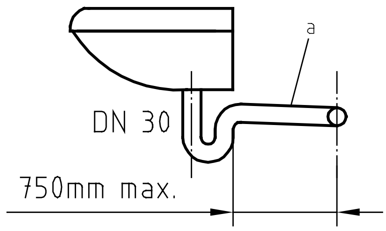


Figure 8 — Boundary conditions for ventilated discharge branches in system III with a gradient of 1,8 to 4,4 %

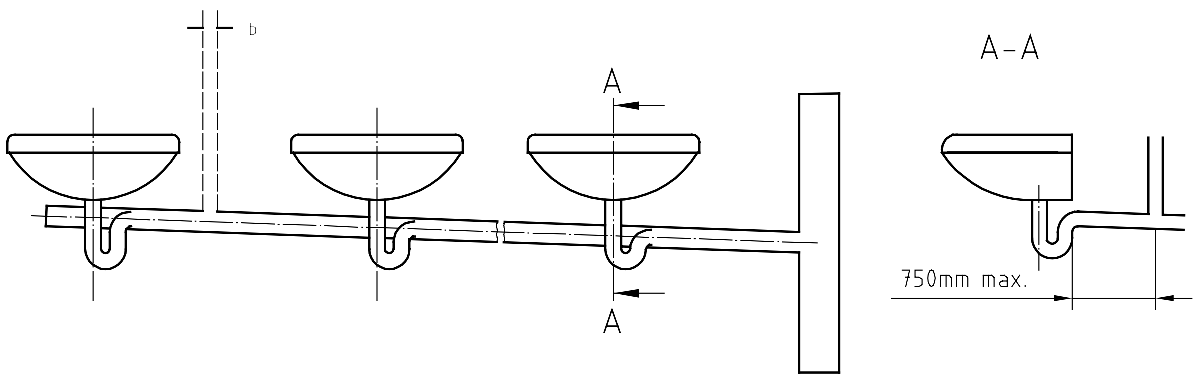


Figure 9 — Boundary conditions for ventilated discharge branches in system III with vent of 25 mm min

6.4.3 Air admittance valves for branches

Where air admittance valves are used to vent branches or appliances they shall comply with prEN 12380 and shall be sized in accordance with Table 10.

Table 10 — Minimum air flow rates for air admittance valves in branches

System	Q_a l/s
I	$1 \times Q_{tot}$
II	$2 \times Q_{tot}$
III	$2 \times Q_{tot}$
IV	$1 \times Q_{tot}$
Q_a = Minimum air flow rate in litres per second (l/s). Q_{tot} = Total flow rate in litres per second (l/s).	

6.5 Layout of discharge stacks

6.5.1 Primary ventilated discharge stacks

Sizes and limitations of primary ventilated discharge stacks are given in Table 11.

Table 11 — Hydraulic capacity (Q_{max}) and nominal diameter (DN)

Stack and stack vent	**System I, II, III, IV** Q_{max} (l/s)	
DN	Square entries	Swept entries
60	0,5	0,7
70	1,5	2,0
80*	2,0	2,6
90	2,7	3,5
100**	4,0	5,2
125	5,8	7,6
150	9,5	12,4
200	16,0	21,0

* Minimum size where WC's are connected in system II.
** Minimum size where WC's are connected in system I, III, IV.

6.5.2 Secondary ventilated discharge stacks

Sizes and limitations of secondary ventilated discharge stacks are given in Table 12.

Table 12 — Hydraulic capacity (Q_{max}) and nominal diameter (DN)

Stack and stack vent	**Secondary vent**	**System I, II, III, IV** Q_{max} (l/s)	
DN	DN	Square entries	Swept entries
60	50	0,7	0,9
70	50	2,0	2,6
80*	50	2,6	3,4
90	50	3,5	4,6
100**	50	5,6	7,3
125	70	7,6	10,0
150	80	12.4	18,3
200	100	21,0	27,3

* Minimum size where WC's are connected in system II.
** Minimum size where WC's are connected in system I, III, IV.

6.5.3 Air admittance valves for stacks

Where air admittance valves are used to ventilate stacks they shall comply with prEN 12380 and shall be sized with Q_a not less than $8 \times Q_{tot}$.

6.5.4 Ventilating pipework

Stack vents, ventilating stacks or ventilating branch pipes shall be increased in size if they are long or have many bends. For further information, see national and local regulations and practice.

6.6 Layout of drains

6.6.1 General

The capacity of drains should be calculated using any established hydraulic formula, using tables or charts as convenient. However, in cases of dispute the Colebrook-White equation*, shall be used.

For convenience drain capacities calculated using the Colebrook-White equation are given in annex B (informative).

For buried drains outside of buildings, refer to EN 752.

* The Colebrook-White equation is also known as the Prandtl-Colebrook equation.

Annex A (informative)

A.1 National and local regulations and practice

The following documents contain details which should be considered within the framework of this standard. This list was correct at the time of publication of this standard but should not be considered to be exhaustive. Users of this standard should check for the latest applicable.

Austria

ÖNORM B 2501 "Entwässerungsanlagen für Gebäude und Grundstücke; Bestimmungen für Planung und Ausführung"

ÖNORM B 2506-1 "Regenwasser-Sickeranlagen für Abläufe von Dachflächen und befestigten Flächen – Teil 1: Anwendung, hydraulische Bemessung, Bau und Betrieb"

ÖWAV Regelblatt 5 "Richtlinien für die hydraulische Berechnung von Abwasserkanälen"

ÖWAV Regelblatt 11 " Richtlinien für die abwassertechnische Berechnung von Schmutz-, Regen- und Mischwasserkanälen"

Belgium

According to the Royal Decree of 24.06.1988 on the municipalities, drainage installations inside buildings are of the competence of the municipalities. Drainage systems have thus to comply with the municipal regulations.

Only drainage system I shall be used.
If authorized by the local regulations, only class A I-air admittance valves can be used.

Denmark

Bygningsreglement BR 1995. Udgivet af By- og Boligministeriet.
Danish Building Regulation BR 1995. Published by the National Building and Housing Agency.

available from	Schultz Information Herstedvang 10 DK-2620 Albertslund Telefon: + 45 43 63 23 00 Telefax: + 45 43 63 19 69

DS 432:1994 Norm for afløbsinstallationer.
DS 432:1994 Code of Practice for sanitary drainage - Waste water installations.

DS 432:1995/Ret.1 Norm for afløbsinstallationer.
DS 432:1995/Corr.1 Code of Practice for sanitary drainage - Waste water installations.

France

Règlement sanitaire départemental, titre III "Locaux d'habitation et assimilés" (circulaire du 9 août 1978 modifiée par les circulaires des 26 avril 1982, 20 janvier 1983, 18 mai 1984, 31 juillet 1995, 22 mai 1997).

Germany

National regulations require drainage system I to be used.
For EN 12056-1 refer to DIN 1986-1 and -2, DIN EN 1610 and DIN 18381.
For EN 12056-2 refer to DIN 1986-1 and -2, DIN EN 1610 and DIN 18381.
For EN 12056-3 refer to DIN 1986-1 and -2, DIN EN 1610 and DIN 18381.
For EN 12056-4 refer to DIN 1986-1 and -2 and DIN EN 12050-1 to -4.
For EN 12056-5 refer to DIN 1986-1 and -2 and DIN EN 1610 and DIN 18381.

Ireland

National Regulations: Building Regulations 1997 Technical Guidance Document H Drainage and Waste Water Disposal.

Local Regulations: Local Authorities have different requirements concerning the use of types of drainage systems, and the use of air admittance valves. Drainage System No 1 is the accepted method of gravity drainage inside buildings in Ireland.

Italy

LEGGE m.319 (Legge Merli) 10-05-76
Norme per la tutela delle acque dall'inquinamento coordinate con le modifiche ed integrazioni apportate dalla Legge 8/10/1976 n.690, dalla Legge 24/12/1979, n.650, dalla Legge 23/4/1981, n.153. G.U. n.48 del 21/2/1977

Decreto Legge n. 544, 10-08-76
Proroga dei termini di cui agli articoli 15, 17 e 18 della Legge 319 (Legge Merli) del 10/5/1976, recante G.U. n.211 dell'11/8/1976

Delibera MINISTERO LL.PP. COMITATO MINISTRI TUTELA ACQUE, 4-02-77
Criteri, metodoligie e norme tecniche generali di cui all'Art. 2 lettera b), d), e) della legge 319 (Legge Merli) del 10/5/1976, recante norme per la tutela delle acque dall'inquinamento

Decreto Legge n.467, 24-09-79
Proroga dei termini ed integrazioni delle Leggi 171 del 16/4/1973 e 319 (Legge Merli) del 10/5/1976, in materia di tutela delle acque dallo inquinamento, G.U. n.263 del 25/9/1979

LEGGE n.650, 24-12-79
Integrazioni e modifiche delle Leggi n.171 del 16/4/1973 e n.319 del 10/5/1976 (Legge Merli) in materia di tutela delle acque dall'inquinamento, G.U. n.352 del 29/12/1979

Decreto Legge n.620, 4-11-81
Provvedimento urgenti in materia di tutela delle acque dallo inquinamento, G.U. n.303 del 4/11/1981

LEGGE n.62, 5-03-82
Conversione in legge, con modificazioni, del D.L. 30/12/1981 n. 801 concernente provvedimenti urgenti in materia di tutela delle acque dallo inquinamento, G.U. n.63 del 5/3/1982

Circolare n.3035/SI/AC del MINISTERO DELL'AMBIENTE, 27-07-87
Indagine sugli impianti di depurazione delle acque reflue, G.U. n.183 del 7/8/1987

Decreto Legislativo n.132, 27-01-92
Attuazione della direttiva CEE n.80/68 concernente la protezione delle acque sotterranee dall'inquinamento provocato da alcune sostanze pericolose, Suppl. Ord. n.24 alla G.U. n.41 del 19/2/1992

Decreto n.309 del PRESIDENTE DELLA REPUBBLICA, 27-07-87
Regolamento per l'organizzazione del Servizio per la tutela delle acque, la disciplina dei rifiuti, il risanamento del suolo e la prevenzione dell'inquinamento di natura fisica e del Servizio per l'inquinamento acustico, atmosferico e per le industrie a rischo del Ministero dell'ambiente, G.U. n.136 dell'11/6/1992

Decreto Legge n.454, 15-11-93
Modifica alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.268 del 15/11/1993

Decreto Legge n.31, 14-01-94
Modifica alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.13 del 18/1/1994

Decreto Legge n.177, 17-03-94
Modifiche alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.64 del 18/3/1994

Decreto Legge n.292, 16-05-94
Modifiche alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.114 del 18/5/1994

Decreto Legge n.449, 15-07-94
Modifiche alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, nonché riorganizzazione degli organi collegiali del Ministero dell'Ambiente, G.U. n.166 del 18/7/1994

Decreto Legge n.537, 17-09-94
Modifiche alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.218 del 17/9/1994

Decreto Legge n.629, 16-11-94
Modifica alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.269 del 17/11/1994

Decreto Legge n.9, 16-01-95
Modifica alla disciplina degli scarichi delle pubbliche fognature e degli insediamenti civili che non recapitano in pubbliche fognature, G.U. n.12 del 16/1/1995

LEGGE n.135, 23-05-97
Conversione in Legge, con modificazioni, del Decreto Legge 25 marzo 1997, n.67, recante disposizioni urgenti per favorire l'occupazione, G.U. n.119 del 24/5/1997

Netherlands

NEN 3215	Binnenriolering in woningen en woongebouwen - mei 1997 Eisen en bepalingsmethoden Sewerage inside dwellings - Requirements and determination methods
NTR 3216	Binnenriolering - Richtlijn voor ontwerp en uitvoering Sewerage inside dwellings - Guideline for design and installation

Sweden

Boverkets Byggregler BBR 94
Swedish Building Regulations 94 with mandatory provisions and general advisory notes

Boverkets Författningssamling BFS 1993:57, kapitel 6: Hygien, hälsa och miljö
Code of Statutes 1993:57 of the Swedish National Board of Housing, Building and Planning, chapter 6: Hygiene, Health and Environment

VA-handboken 10- Vatten och avlopp (Svensk Byggtjänst)
Water Supply and Sewer System Handbook 10 (Svensk Byggtjänst)

Switzerland

1. National regulations require drainage system I to be used.
2. The permission of air admittance valves is subject to local bodies.
3. Swiss standard SN 592000 is applicable for all layout rules which are not contained in EN 12056 Parts 1 to 5.

United Kingdom

1. Building Regulations 1991; Approved Document H
   available from Department of the Environment, Transport and the Regions (DETR)
   HMSO Publications Centre
   PO Box 276
   London
   SW8 5DT
   Great Britain
   Telephone: + 44 171 873 9090
   Telefax: + 44 171 873 8200

2. Technical Standards for Compliance with the Building Standards (Scotland) Regulations 1990; Part M: Drainage and sanitary facilities.
   available from Scottish Office (SO)
   New St Andrew's House
   Edinburgh
   EH1 3TG
   Great Britain
   Telephone: + 44 131 244 4553

3. The Building Regulations (Northern Ireland) 1994; Technical booklet N: Drainage.
   available from Department of the Environment for Northern Ireland (DON)
   c/o HMSO Bookshops
   16 Arthur Street
   Belfast
   BT1 4GD
   Great Britain
   Telephone: + 44 1232 238451
   Telefax: + 44 1232 235401

4. National annexes to BS EN 12056-2

5. National annexes to BS EN 12056-3

Annex B (informative)

B.1 Capacities of drains

For convenience, drain capacities calculated from Colebrook-White formula using an effective roughness of k_b = 1,0 mm and clean water with a viscosity of ν = 1,31 $\times$ 10^{-6} m^2/s are listed in Tables B.1 and B.2.

Table B.1 — Capacity of drains, filling degree 50 %, (*h/d* = 0,5)

Slope	**DN 100**		**DN 125**		**DN 150**		**DN 200**		**DN 225**		**DN 250**		**DN 300**	
i	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*
cm/m	L/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,50	1,8	0,5	2,8	0,5	5,4	0,6	10,0	0,8	15,9	0,8	18,9	0,9	34,1	1,0
1,00	2,5	0,7	4,1	0,8	7,7	0,9	14,2	1,1	22,5	1,2	26,9	1,2	48,3	1,4
1,50	3,1	0,8	5,0	1,0	9,4	1,1	17,4	1,3	27,6	1,5	32,9	1,5	59,2	1,8
2,00	3,5	1,0	5,7	1,1	10,9	1,3	20,1	1,5	31,9	1,7	38,1	1,8	68,4	2,0
2,50	4,0	1,1	6,4	1,2	12,2	1,5	22,5	1,7	35,7	1,9	42,6	2,0	76,6	2,3
3,00	4,4	1,2	7,1	1,4	13,3	1,6	24,7	1,9	389,2	2,1	46,7	2,2	83,9	2,5
3,50	4,7	1,3	7,6	1,5	14,4	1,7	26,6	2,0	42,3	2,2	50,4	2,3	90,7	2,7
4,00	5,0	1,4	8,2	1,6	15,4	1,8	28,5	2,1	45,2	2,4	53,9	2,5	96,9	2,9
4,50	5,3	1,5	8,7	1,7	16,3	2,0	30,2	2,3	48,0	2,5	57,2	2,7	102,8	3,1
5,00	5,6	1,6	9,1	1,8	17,2	2,1	31,9	2,4	50,6	2,7	60,3	2,8	108,4	3,2

Table B.2 — Capacity of drains, filling degree 70 %, (*h/d* = 0,7)

Slope	**DN 100**		**DN 125**		**DN 150**		**DN 200**		**DN 225**		**DN 250**		**DN 300**	
i	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*	Q_{max}	*v*
cm/m	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
0,50	2,9	0,5	4,8	0,6	9,0	0,7	16,7	0,8	26,5	0,9	31,6	1,0	56,8	1,1
1,00	4,2	0,8	6,8	0,9	12,8	1,0	23,7	1,2	37,6	1,3	44,9	1,4	80,6	1,6
1,50	5,1	1,0	8,3	1,1	15,7	1,3	29,1	1,5	46,2	1,6	55,0	1,7	98,8	2,0
2,00	5,9	1,1	9,6	1,2	18,2	1,5	33,6	1,7	53,3	1,9	63,6	2,0	114,2	2,3
2,50	6,7	1,2	10,8	1,4	20,3	1,6	37,6	1,9	59,7	2,1	71,1	2,2	127,7	2,6
3,00	7,3	1,3	11,8	1,5	22,3	1,8	41,2	2,1	65,4	2,3	77,9	2,4	140,0	2,8
3,50	7,9	1,5	12,8	1,6	24,1	1,9	44,5	2,2	70,6	2,5	84,2	2,6	151,2	3,0
4,00	8,4	1,6	13,7	1,8	25,8	2,1	47,6	2,4	75,5	2,7	90,0	2,8	161,7	3,2
4,50	8,9	1,7	14,5	1,9	27,3	2,2	50,5	2,5	80,1	2,8	95,5	3,0	171,5	3,4
5,00	9,4	1,7	15,3	2,0	28,8	2,3	53,3	2,7	84,5	3,0	100,7	3,1	180,8	3,6

where:

Q_{max} = Capacity of drains (l/s)
v = Velocity (m/s)

B.2 Values of waste water flow rates

Waste water flow rates are listed in Table B.3. The values are calculated using the equation in 6.3.1.

Table B.3 — Waste water flow rates (Q_{ww})

Sum of discharge units	***K*** **0,5**	***K*** **0,7**	***K*** **1,0**	***K*** **1,2**
ΣDU	Q_{ww}	Q_{ww}	Q_{ww}	Q_{ww}
	l/s	l/s	l/s	l/s
10	1,6	2,2	3,2	3,8
12	1,7	2,4	3,5	4,2
14	1,9	2,6	3,7	4,5
16	2,0	2,8	4,0	4,8
18	2,1	3,0	4,2	5,1
20	2,2	3,1	4,5	5,4
25	2,5	3,5	5,0	6,0
30	2,7	3,8	5,5	6,6
35	3,0	4,1	5,9	7,1
40	3,2	4,4	6,3	7,6
45	3,4	4,7	6,7	8,0
50	3,5	4,9	7,1	8,5
60	3,9	5,4	7,7	9,3
70	4,2	5,9	8,4	10,0
80	4,5	6,3	8,9	10,7
90	4,7	6,6	9,5	11,4
100	5,0	7,0	10,0	12,0
110	5,2	7,3	10,5	12,6
120	5,5	7,7	11,0	13,1
130	5,7	8,0	11,4	13,7
140	5,9	8,3	11,8	14,2
150	6,1	8,6	12,2	14,7
160	6,3	8,9	12,6	15,2
170	6,5	9,1	13,0	15,6
180	6,7	9,4	13,4	16,1
190	6,9	9,6	13,8	16,5
200	7,6	9,9	14,1	17,0
220	7,4	10,4	14,8	17,8
240	7,7	10,8	15,5	18,6
260	8,1	11,3	16,1	19,3
280	8,4	11,7	16,7	20,1
300	8,7	12,1	17,3	20,8
320	8,9	12,5	17,9	21,5
340	9,2	12,9	18,4	22,1
360	9,5	13,3	19,0	22,8
380	9,7	13,6	19,5	23,4
400	10,0	14,0	20,0	24,0

Annex C (informative)

C.1 Calculation example

Calculation of the size of the discharge stacks and the drain shown in Figure C.1.

C.2 Data and parameters

Basement:	1	
Floors:	3	
Apartments:	12	(4 on each Floor, 6 on each stack)
Laundry:	in basement	
Discharge Units:	System I	
Frequency factor (*K*)	0,5	
Stacks:	2	(square-entries)
Drain:	1	slope = 2 %, filling-degree = 0,5.

C.3 Sum of discharge units

Table C.1 — Sum of discharge units (ΣDU) of one apartment

Appliance	Amount	DU	ΣDU
WC (7,5 l)	2	2.0	4,0
Wash basin	3	0,5	1,5
Bath	1	0,8	0,8
Shower (no plug)	1	0,6	0,6
Kitchen sink	1	0,8	0,8
Dishwasher	1	0,8	0,8
Total			**8,5**

Table C.2 — Sum of discharge units (ΣDU) in the laundry

Appliance	Amount	DU	ΣDU
Washing machine 6 kg	2	0,8	1,6
Wash basin	2	0,5	1,0
Total			**2,6**

C.4 Calculation of the stack size

6 apartments with 8,5 DU each	=	51,0 DU
$Q_{ww} = 0{,}5 \times \sqrt{51{,}0}$	=	3,6 l/s
The nominal diameter of the stack is (Table 11)	=	**DN 100**

Both stacks are of the same size.

C.5 Calculation of the drain sizes

Section A

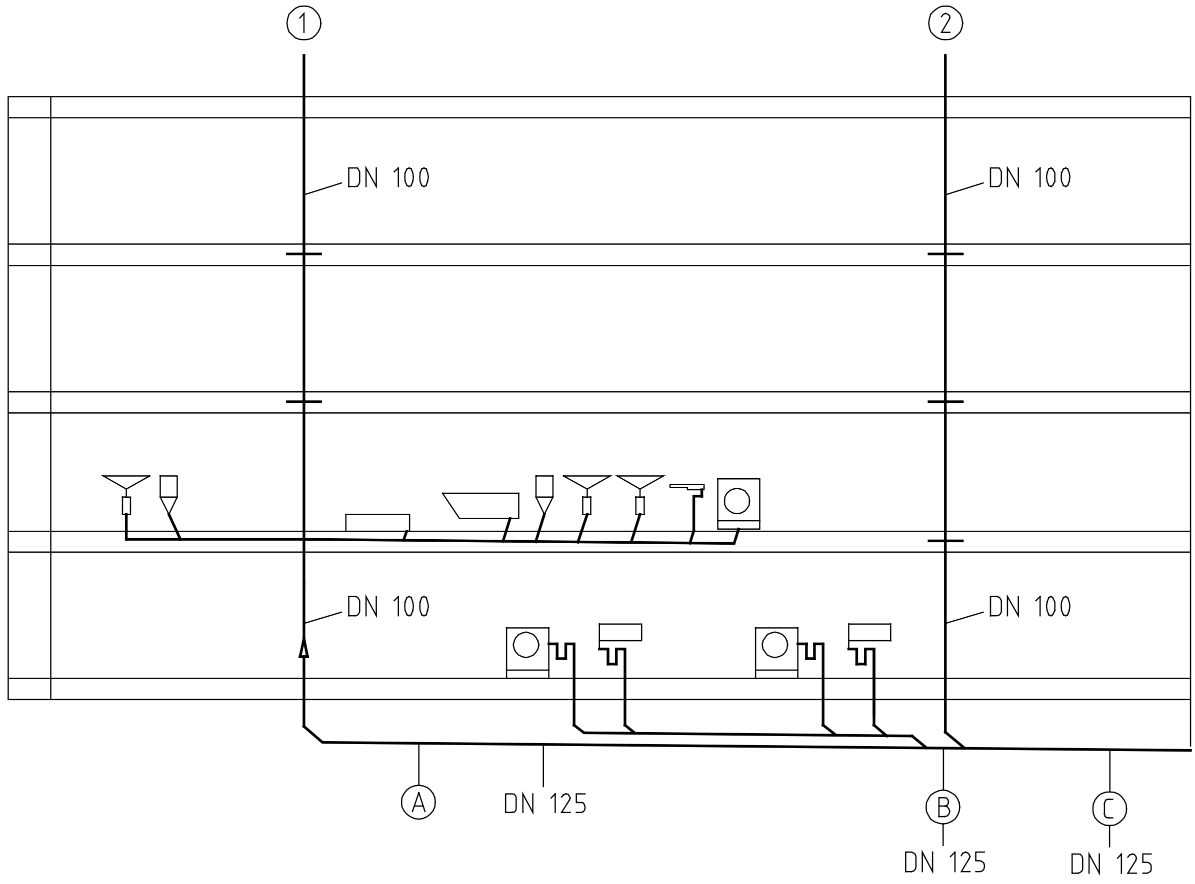
Q_{ww} as calculated in C.4	=	3,6 l/s
according to Table B.1, the nominal diameter of the drain is	=	**DN 125**

Section B

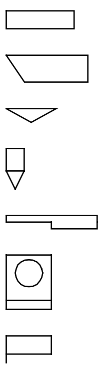
$Q_{ww} = 0{,}5 \times \sqrt{51{,}0 + 2{,}6(\mathit{Laundry})} = 0{,}5 \times \sqrt{53{,}6}$	=	3,7 l/s
according toT B.1, the nominal diameter of the drain is still	=	**DN 125**

Section C

$Q_{ww} = 0{,}5 \times \sqrt{51{,}0 + 2{,}6 + 51{,}0} = 0{,}5 \times \sqrt{104{,}6}$	=	5,1 l/s
according to Table B.1, the nominal diameter of the drain is still	=	**DN 125**



Legend:



Shower

Bath

Wash basin

WC

Sink

Washing machine or dishwasher

Sink for laundry

Figure C.1 — Illustration of calculation example

Annex D (informative)

D.1 European Standards of commonly used products and additional European Standards in the field of waste water systems

EN 31	Pedestal wash basins - Connecting dimensions.
prEN 32	Wall hung wash basins - Connecting dimensions.
prEN 33	Pedestal WC pans with close-coupled flushing cistern - Connecting dimensions.
EN 34	Wall hung WC pan with close coupled cistern - Connecting dimensions.
EN 35	Pedestal bidets over-rim supply only - Connecting dimensions.
prEN 36	Wall-hung bidets with over-rim supply - Connecting dimensions.
prEN 37	Pedestal WC pans with independent water supply - Connecting dimensions.
prEN 80	Wall-hung urinals - Connecting dimensions.
prEN 111	Wall-hung hand rinse basins- Connecting dimensions.
EN 198	Specification for finished baths for domestic purposes made of acrylic material.
EN 232	Baths - Connecting dimensions.
prEN 249	Specification for shower trays for domestic purposes made of acrylic materials.
EN 251	Shower trays - Connecting dimensions.
EN 263	Specification for cast acrylic sheet for baths and shower trays for domestic purposes.
EN 274	Sanitary tapware - Waste fittings for basins, bidets and baths - General technical specifications.
EN 295-1	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 1: Requirements (includes Amendment A1:1996 and Amendment A2:1996) 295-1:1991 + A1:1996 + A2:1996.
EN 295-2	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 2: Quality control and sampling.
EN 295-3	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 3: Test methods.
EN 295-4	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 4: Requirements for special fittings, adaptors and compatible accessories.
EN 295-6	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 6: Requirements for vitrified clay manholes.
EN 295-7	Vitrified clay pipes and fittings and pipe joints for drains and sewers - Part 7: Requirements for vitrified clay pipes and joints for pipe jacking.
EN 329	Sanitary tapware - Waste fittings for shower trays - General technical specifications.
EN 411	Sanitary tapware - Waste fittings for sinks - General technical specifications.
EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods.

EN 588-1 Fibre-cement pipes for sewers and drains - Part 1: Pipes, joints and fittings for gravity systems.

prEN 588-2 Fibre-cement pipes for sewers and drains - Part 2: Manholes and inspection chambers.

EN 598 Ductile iron pipes, fittings, accessories and their joints for sewerage application - Requirements and test methods.

EN 681-1 Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 1: Vulcanized rubber.

EN 695 Kitchen sinks - Connecting dimensions.

EN 752-1 Drain and sewer systems outside buildings - Part 1: Generalities and definitions.

EN 752-2 Drain and sewer systems outside buildings - Part 2: Performance requirements.

EN 752-3 Drain and sewer systems outside buildings - Part 3: Planning.

EN 752-4 Drain and sewer systems outside buildings - Part 4: Hydraulic design and environmental considerations.

EN 752-5 Drain and sewer systems outside buildings - Part 5: Rehabilitation.

EN 752-6 Drain and sewer systems outside buildings - Part 6: Pumping installation.

EN 752-7 Drain and sewer systems outside buildings - Part 7: Maintenance and operations.

EN 773 General requirements for components used in hydraulically pressurized discharge pipes, drains and sewers.

EN 858-1 Installations for separation of light liquids (e.g. oil and petrol) - Part 1: Principles of design, performance and testing, marking and quality control.

EN 877 Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings - Requirements, test methods and quality assurance.

EN 1123-1 Pipes and fittings of longitudinally welded hot-dip galvanized steel pipes with spigot and socket for waste water systems - Part 1: Requirements, testing, quality control.

EN 1124-1 Pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for waste water systems - Part 1: Requirements, testing, quality control.

EN 1253-1 Gullies for buildings - Part 1: Requirements.

EN 1253-2 Gullies for buildings - Part 2: Test methods.

EN 1293 General requirements for components used in pneumatically pressurized discharge pipes, drains and sewers.

EN 1329-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Requirements for pipes, fittings and the system.

EN 1451-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polypropylene (PP) - Part 1: Requirements for pipes, fittings and the system.

prEN 1453-1 Plastics piping systems with structured wall pipes for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Requirements for pipes, fittings and the system.

EN 1455-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Acrylonitrile-butadiene-styrene (ABS) - Part 1: Requirements for pipes, fittings and the system.

prEN 1456-1 Plastics piping systems for underground drainage and sewerage under pressure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: General.

EN 1519-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polyethylene (PE) - Part 1: Requirements for pipes, fittings and the system.

EN 1565-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Styrene-Copolymer-Blends (SAN + PVC) - Part 1: Requirements for pipes, fittings and the system.

EN 1566-1 Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Chlorinated poly(vinyl chloride) (PVC-C) - Part 1: Requirements for pipes, fittings and the system.

EN 1610 Construction and testing of drains and sewers.

EN 1671 Pressure sewerage systems outside buildings.

prEN 1825-1 Installation for separation of grease - Part 1: Principles of design, performance and testing, marking and quality control.

EN 1852-1 Plastics piping systems for non-pressure underground drainage and sewerage - Polypropylene (PP) - Part 1: Specifications for pipes, fittings and the system.

prEN 12050-1 Waste water lifting plants for buildings and sites - Principles of construction and testing - Part 1: Lifting plants for waste water containing faecal matter.

prEN 12050-2 Waste water lifting plants for buildings and sites - Principles of construction and testing - Part 2: Lifting plants for faecal-free effluent.

prEN 12050-3 Waste water lifting plants for buildings and sites - Principles of construction and testing - Part 3: Lifting plants for waste water containing faecal matter for limited application.

EN 12109 Vacuum drainage system inside buildings.

prEN 12200-1 Plastics rainwater piping systems for above ground external use - Unplasticized poly(vinyl chloride) (PVC-U) - Part 1: Components and functional requirements.

prEN 12380 Ventilating pipework - Air admittance valve systems (AVS).

EN 12666-1 Plastics piping systems for non-pressure underground drainage and sewerage - Polyethylene (PE) - Part 1: Specifications for pipes, fittings and the system.

prEN 12763 Fibre-cement pipes and fittings for discharge systems for buildings - Dimensions, technical terms of delivery.

prEN 12764 Sanitary appliances - Specification for whirlpool baths.

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National annex NA (informative)

Additional definitions

NA.1 General

This annex defines terminology used in national annexes NB, NC, ND, NE, NF and NG.

NA.2 Terms and definitions

For the purposes of these national annexes, the following additional terms and definitions apply.

NA.2.1 access cover

removable cover on pipework to provide access to the interior for the purposes of inspection, testing and cleansing

NA.2.2 criterion of satisfactory service

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

NA.2.3 crown of trap

topmost point of the inside of a trap outlet

NA.2.4 discharge pipe

pipe which conveys the discharge from a sanitary appliance

NA.2.5 size

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

NA.2.6 anti-siphon trap

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

NA.2.7 resealing trap

trap with physical minimum depth of water seal of 50 mm that retains sufficient liquid after siphonage to ensure a reduced seal of at least 25 mm depth is retained

National annex NB (informative)

Exchange of information

NB.1 General

This annex gives guidance on the information that needs to be exchanged when designing a sanitary pipework system.

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 drains, sewers and any precautions necessary to ensure satisfactory working of the discharge systems should be obtained from the bodies responsible for the systems, for example, information on the possibility of drains and sewer surcharging and statutory regulations. Any specific requirements of the sewerage undertaker should be ascertained.

Alterations or extensions to existing work may need a survey and the report should include:

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

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

c) a description of the existing pipework and its condition;

d) details of the ventilation of the system;

e) the results of tests (see annex NG).

NB.2 Building regulations

Building control officers and approved inspectors are responsible for the enforcement of the relevant regulations, and information required by them may include:

a) information on the number, position and types of appliances to be installed and details of the proposed use of the premises;

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

c) drawings and specifications.

Before commencing work, the installer should be in possession of 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.

National annex NC (informative)

Design principles — Background information

NC.1 General

Information required for design is given in the normative part of this standard. This annex provides background information on the design principles used and contains information previously within BS 5572:1994, which has been withdrawn.

NC.2 Hydraulics and pneumatics

NC.2.1 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 NC.1) will be affected by:

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

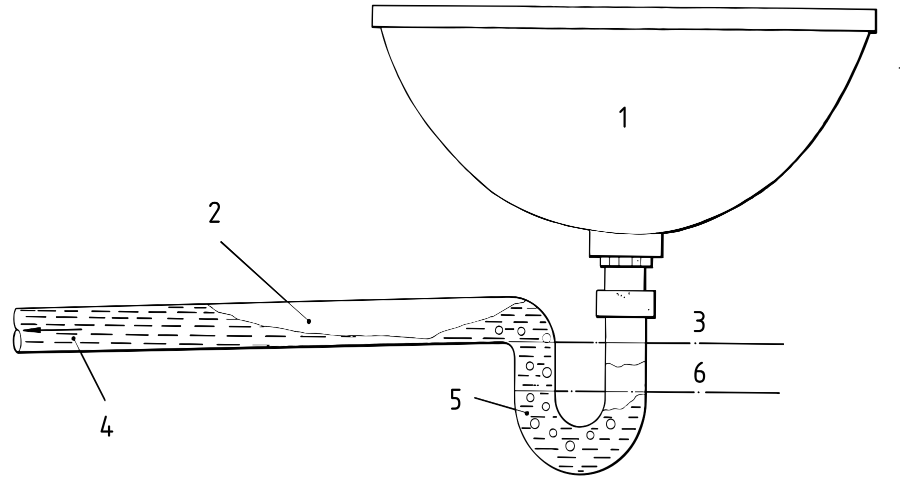
b) the length, gradient and diameter of the pipe;

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 that is connected into the waste fittings or to the trap;

e) the design of pipework fittings, particularly bends;

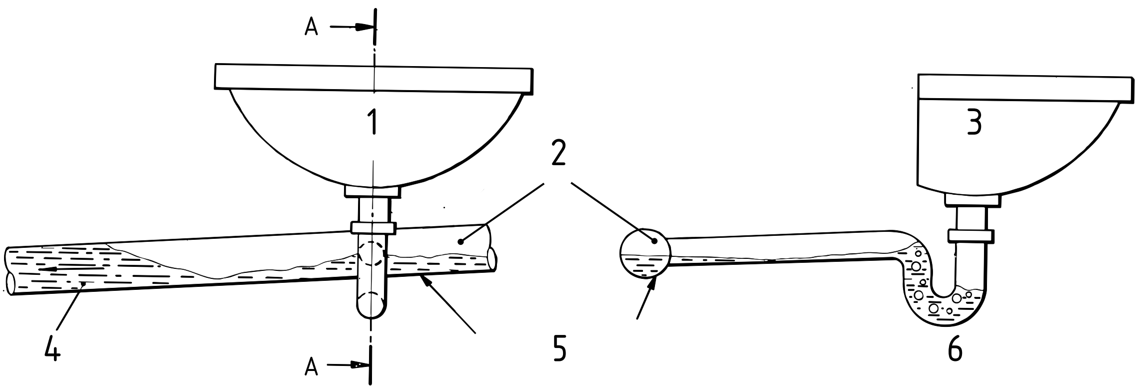
f) the provision, or not, of venting.



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

Legend:

1 Sanitary appliance
2 Negative pressure area
3 Water level before discharge
4 Pipe running full
5 Air passing through trap causes further water loss due to pumping action
6 Possible water level after self-siphonage



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

Legend:

1 Sanitary appliance
2 Negative pressure area
3 Sanitary appliance
4 Pipe running full
5 Main branch pipe
6 View A-A

Figure NC.1 — Seal loss due to flow in branch pipes

NC.2.2 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 NC.2) will be affected by:

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, with 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;

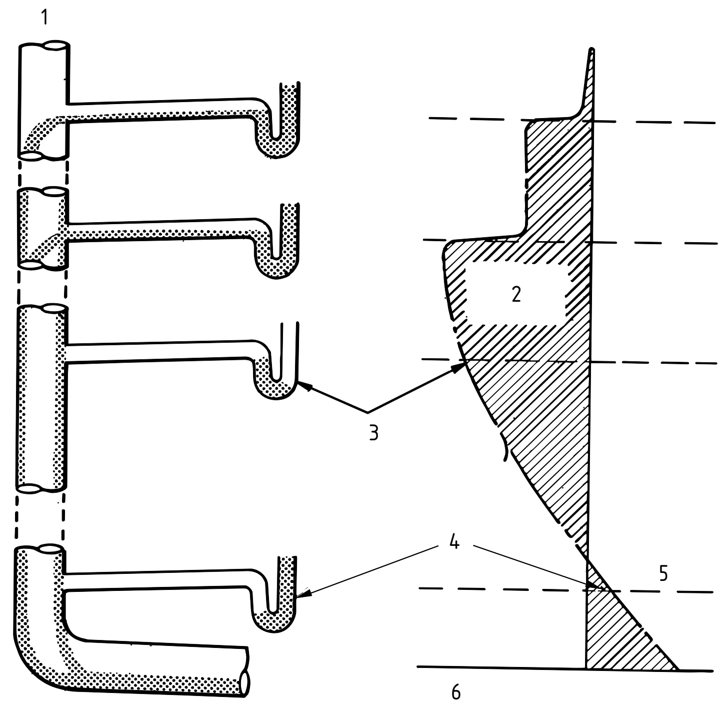
c) the design of pipe fittings, particularly the shape and the size of branch inlets and the radius of the bend at the base of the stack connecting it to the drain;

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 interceptor trap in the drain.



Legend:

1 Open to atmosphere
2 Negative pressure
3 Induced siphonage related to suction (negative pressure) in the stack
4 Back pressure related to positive pressure in stack
5 Positive pressure
6 Typical air pressure distribution in stack with two branches discharging

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

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

NC.2.3 Shape and size of branch inlets

Suction is produced in the discharge stack below discharging branch inlets and its magnitude is affected by the radius or slope of the branch inlet. A large radius or a 45º entry will tend to minimize the amount of 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 annex ND).

NC.2.4 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 annex ND).

NC.2.5 Surcharging of drains

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 may be required.

NC.2.6 Interceptor traps

Where a single discharge stack is connected to a drain fitted with an interceptor trap in close proximity, large pressure fluctuations can occur. Additional stack ventilation may be necessary.

NC.2.7 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 annex ND).

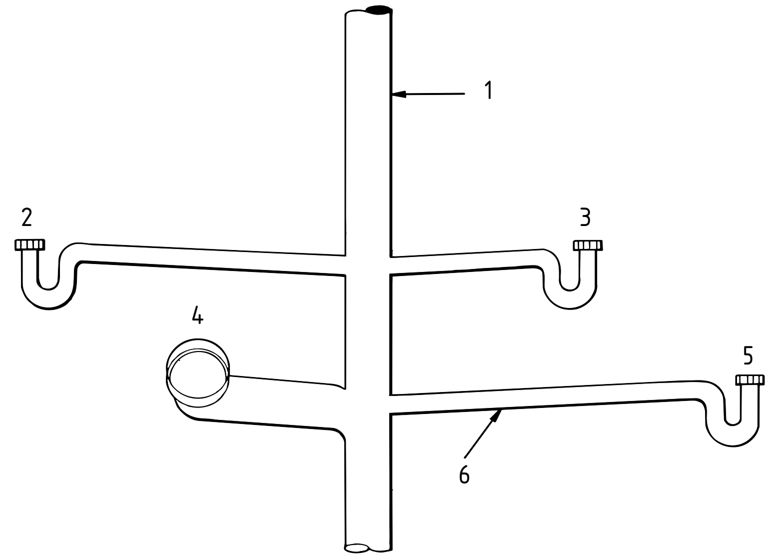
NC.3 Configurations of discharge systems

The discharge systems can conveniently be classified as follows.

a) Primary ventilated stack system (previously know as single stack system) (see Figure NC.3 and Figure NC.4)
A primary ventilated stack system is used in situations where the discharge stack is large enough to limit pressure fluctuations without the need for a ventilating stack.

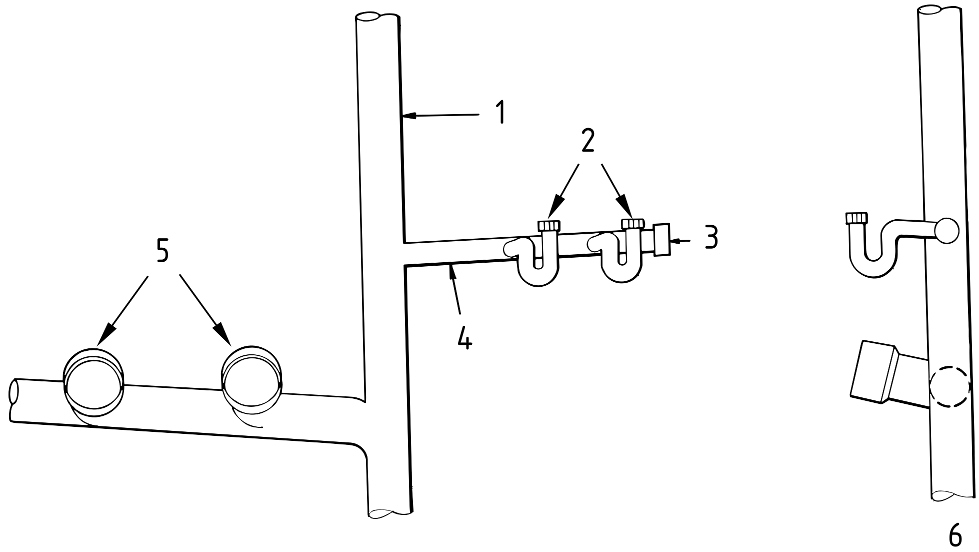
b) Secondary ventilated stack system (previously know as ventilated stack system) (see Figure NC.5)
A secondary ventilated stack system is used in situations where close grouping of appliances makes it practicable to provide branch discharge pipes without the need for branch ventilating pipes. Trap seals are safeguarded by extending the stack(s) to the atmosphere and by cross-connecting the ventilating stack to the discharge stack.

c) Ventilated branch system (previously know as ventilated system or modified single stack system) (see Figure NC.6)
A ventilated branch 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 maintained by extending the discharge and ventilating stacks to atmosphere and providing individual branch ventilating pipes.



a) Single appliances

Legend:
1 Discharge stack
2 Sink
3 Wash basin
4 WC
5 Bath
6 Discharge pipe

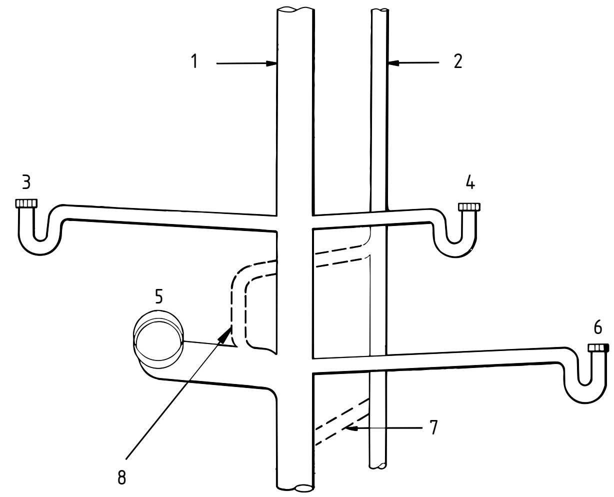


b) Multiple appliances

Legend:
1 Discharge stack
2 Wash basins
3 Cleaning eye
4 Discharge pipe
5 WC
6 Side view

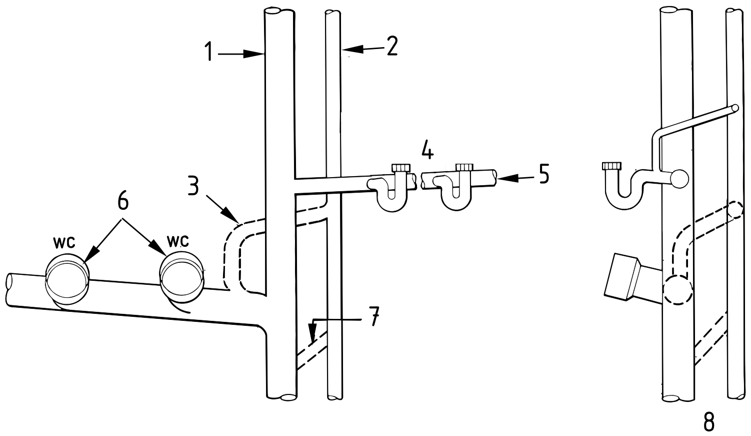
NOTE For use in situations described in the note to Figure NC.4, but where the discharge stack is large enough to limit pressure fluctuations without the need for a ventilating stack.

Figure NC.3 — Ventilated branch system



a) Single appliances

Legend:
1 Discharge stack
2 Ventilating stack
3 Sink
4 Wash basin
5 WC
6 Bath
7 Cross-connection as an alternative to the connection to the WC branch
8 Connection to the WC branch is preferable when the ventilating stack is less than 50 mm in diameter (see ND.3.6.2.1)

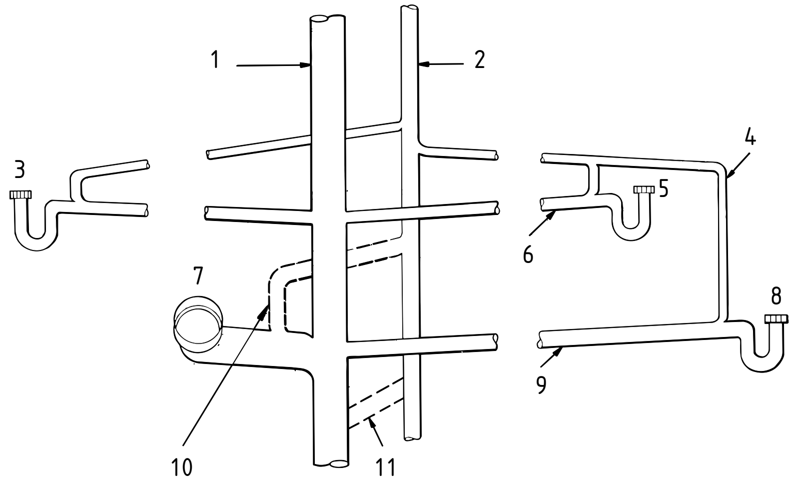


b) Multiple appliances

Legend:
1 Discharge stack
2 Ventilating stack
3 Connection to the WC branch is preferable when the ventilating stack is less than 50 mm in diameter (see ND.3.6.2.1)
4 Wash basins
5 Cleaning eye
6 WC
7 Cross-connection as an alternative to the connection to the WC branch
8 Side view

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

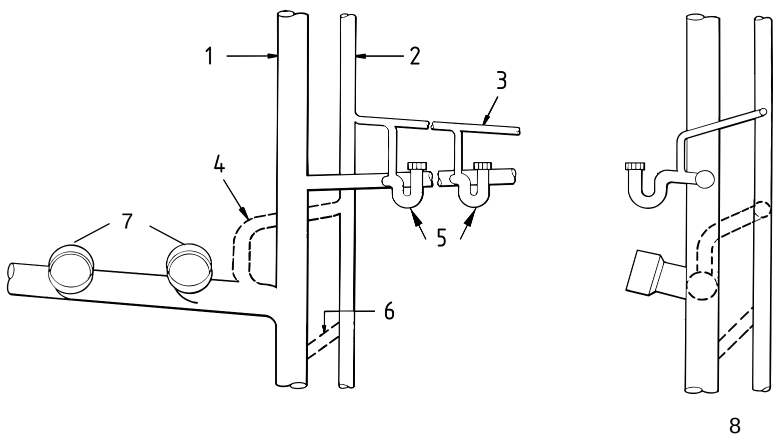
Figure NC.4 — Secondary ventilated stack system



a) Single appliances

Legend:

1 Discharge stack
2 Ventilating stack
3 Sink
4 Ventilating pipe
5 Wash basin
6 Discharge pipe
7 WC
8 Bath
9 Discharge pipe
10 Connection to the WC branch is preferable when the ventilating stack is less than 50 mm in diameter (see ND.3.6.2.1)
11 Cross-connection as an alternative to the connection to the WC branch



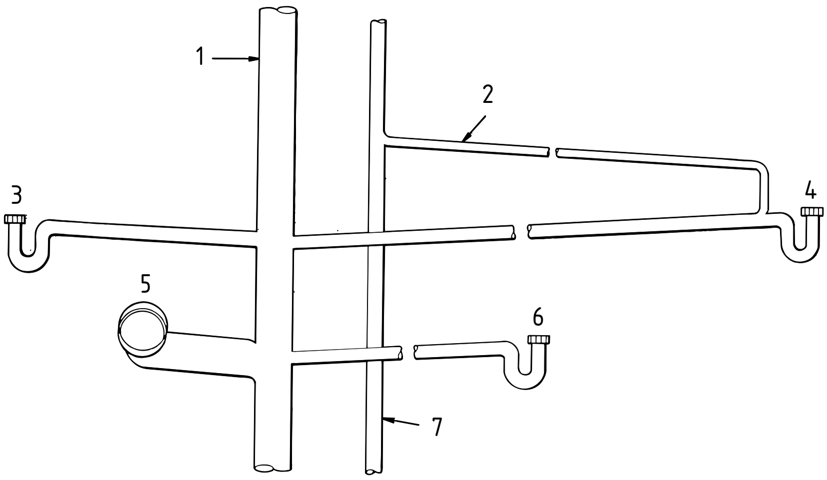
b) Multiple appliances

Legend:

1 Discharge stack
2 Ventilating stack
3 Ventilating pipe
4 Connection to the WC branch is preferable when the ventilation stack is less than 50 mm in diameter (seeND.3.6.2.1)
5 Wash basins
6 Cross-connection as an alternative to the connection to the WC branch
7 WC
8 Side view

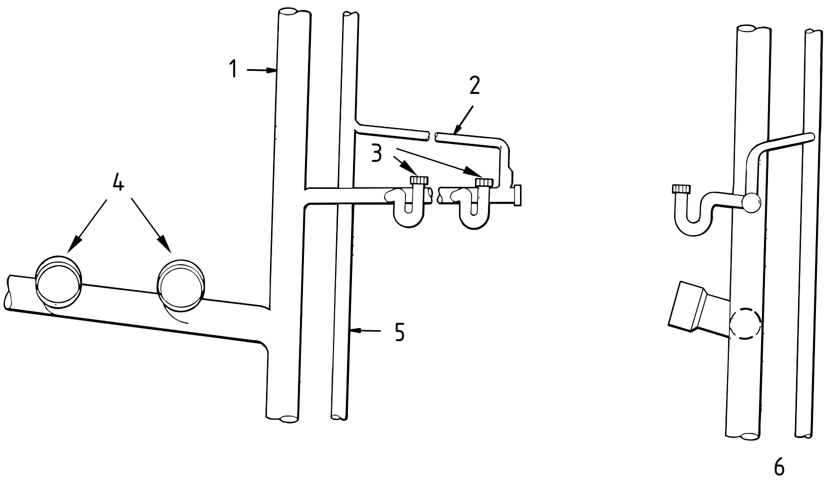
NOTE For use in situations where there are large numbers of sanitary appliances in ranges or where they have to be widely dispersed and it is impracticable to provide discharge stacks in close proximity to the appliances.

Figure NC.5 — Primary ventilated stack system



a) Single appliances

Legend:
1 Discharge stack
2 Ventilating pipe
3 Sink
4 Wash basin
5 WC
6 Bath
7 Ventilating stack acting only as a common connection to ventilating pipes



b) Multiple appliances

Legend:
1 Discharge stack
2 Ventilating pipe
3 Wash basins
4 WC
5 Ventilating stack acting only as a common connection to ventilating pipes
6 Side view

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

Figure NC.6 — Modified primary ventilated stack system

National annex ND (informative)

System III design details

ND.1 General

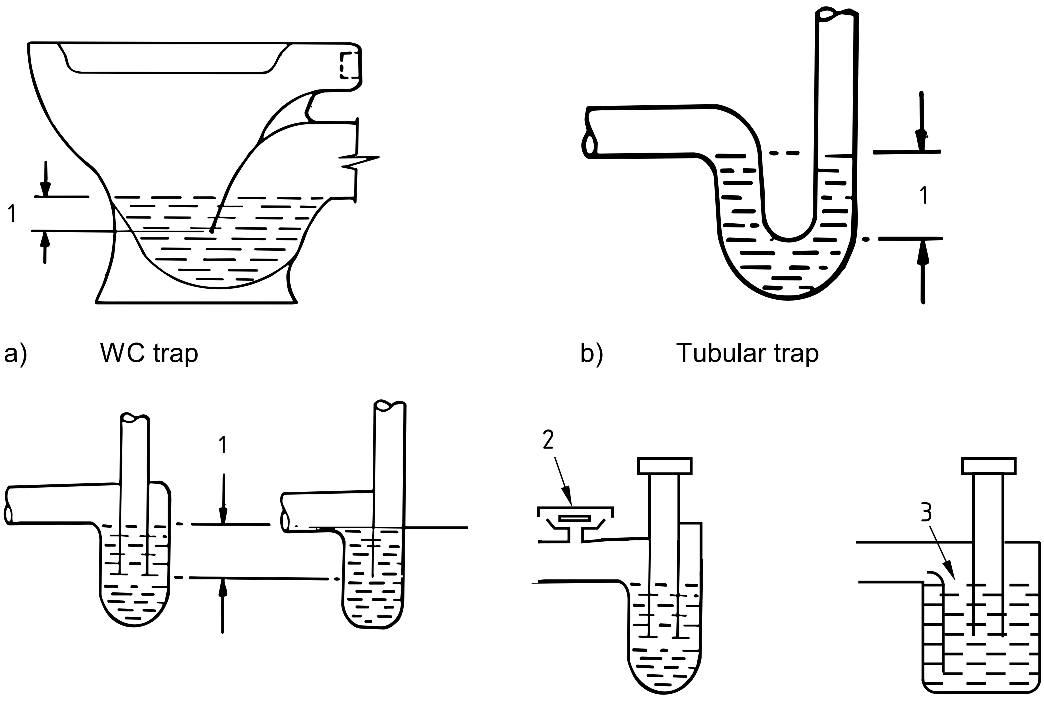
This national annex provides specific information for the design of sanitary pipework system 3. Designs in this standard are based on the use of water sealed traps.

ND.2 Traps (see Figure ND.1)

ND.2.1 General

Traps should be designed so that deposits do not accumulate. The internal surface of the trap should be smooth throughout. All traps should be accessible and provided with an adequate facility for cleansing, for example, traps that are capable of being readily removed or dismantled. In general, 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. However, traps that are not connected to the appliance should be as close as possible and be self-cleansing. There should be no reduction in cross-sectional flow area through the trap. There should be no more than one trap on the discharge pipework from any appliances.

For ease of maintenance, a trap may be positioned a maximum of 750 mm from a shower waste outlet.



a) WC trap

b) Tubular trap

c) Bottle traps

d) Anti-vacuum trap

e) Resealing trap

Legend:

1 Water seal
2 One way valve
3 Air bypass

Figure ND.1 — Trap types

ND.2.2 Trap seal

Traps with outlets for pipes up to and including DN 50 should have a minimum water seal of 50 mm on baths and showers, provided they are fitted with flush-grated wastes without plugs on spray-tap basins; 75 mm trap seals should be used with all other appliances.

Traps with outlets for pipes over DN 50 should have a minimum water seal of 50 mm.

Traps used on appliances with flat bottoms (trailing waste discharge) and discharging to a gully with a grating may have a reduced water seal of not less than 38 mm.

ND.2.3 Bottle traps

This type of trap has a division between the inlet and outlet legs formed by a dip tube or vane within the body of the trap, with the lower part of the trap being removable for access. Bottle traps should only be used with wash basins.

ND.2.4 Resealing and anti-vacuum traps

These are specially designed traps for unventilated small diameter discharge pipes fitted to appliances where, because of the arrangement of the pipework, siphonage would otherwise occur. These traps should be regularly inspected and maintained. Some types can be noisy in operation.

ND.2.5 Floor drain (internal gullies)

Floor drains should be trapped, are normally connected to branch pipes of DN 80 or larger and, therefore, are not subject to seal loss due to self-siphonage. However, infrequent use can 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.

ND.2.6 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 and/or dish washing machine provided the total length of pipework joining the waste outlets of the sinks to the trap does not exceed 750 mm.

ND.3 Discharge pipes and stacks

ND.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, although for buildings up to three storeys discharge stacks and branch discharge pipes may be installed externally.

ND.3.2 Branch discharge pipes

ND.3.2.1 Diameters

Branch pipes should not be reduced in diameter in the direction of flow. Oversizing branch pipes to avoid self-siphonage problems can be uneconomic and can lead to an increased rate of deposit accumulation.

ND.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 1º or 1¼º (18 mm/m or 22 mm/m), but flatter gradients down to ½º (9 mm/m) may be imposed on long runs of DN 100 and DN 150 size pipe when space is restricted. This can be undesirable and adequate self-cleansing of such an arrangement is only possible with high design flow rate (i.e. of not less than 2,5 l/s) and workmanship of a high standard.

Pipe diameters, gradients and pipe capacities are interrelated and this relationship is vital for the DN 30 branches normally connected to wash basins. Vertical DN 30 pipe may run full bore and ventilating pipework may be needed to prevent self-siphonage and noisy discharge.

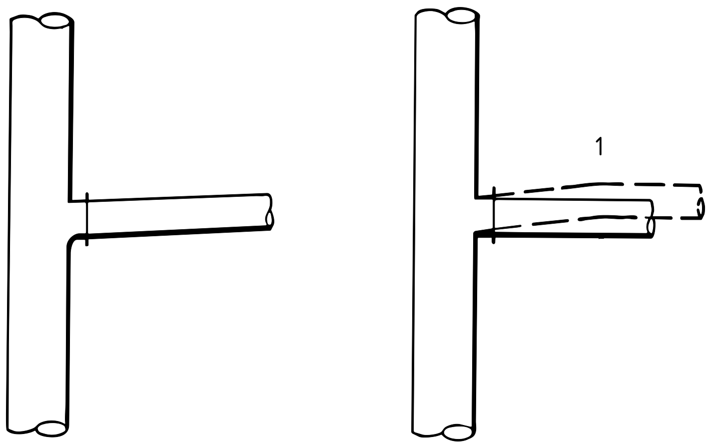
ND.3.2.3 Lengths

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.

ND.3.2.4 Branch pipe bends and junctions

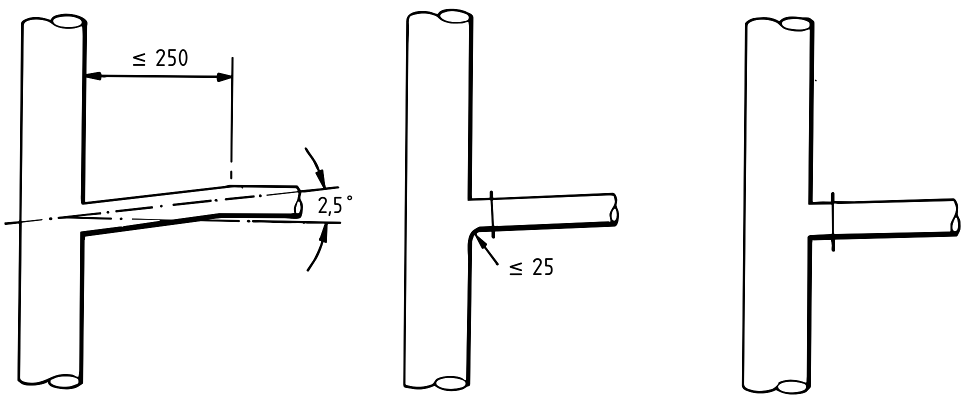
Bends in branch discharge pipes should be avoided, especially for single and ranges of wash basins, as they can cause blockages and increase self-siphonage effects. When they are unavoidable, they should be of a large radius.

Junctions between branch discharge pipes of about the same diameter should be swept in the direction of flow using swept entry branches, with a 25 mm minimum root radius, (see Figure ND.2); otherwise, 45º branches should be used. To minimize the risk of blockage, branches up to DN 40 size joining larger diameter horizontal branches of DN 100 or over should, if practicable, connect to the upper part of the pipe wall of the larger branch. For the same reason, opposed branch connection in the horizontal place to a main branch discharge pipe should be avoided.



a) With radius b) Without radius

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

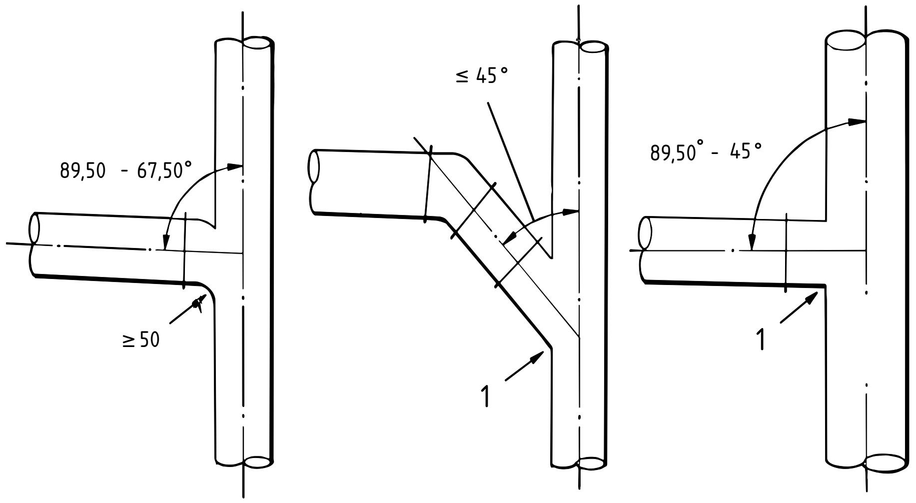


c) Using 87½º boss when pipe gradient has to be less than 2½º (45 mm/m) d) With small radius e) Without radius

— For branch discharge pipes of 32 mm diameter serving wash basins

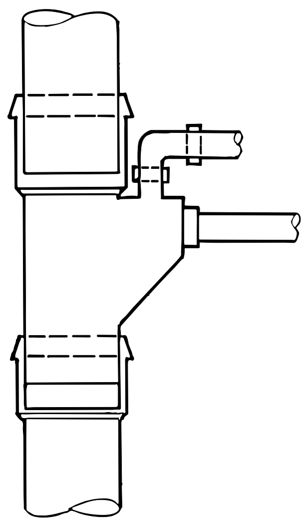
Legend:
1 Change in gradient if required

Figure ND.2 — Branch discharge pipe connections to discharge stacks



f) Equal branch g) Equal branch h) Unequal branch

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



i) Typical waste manifold

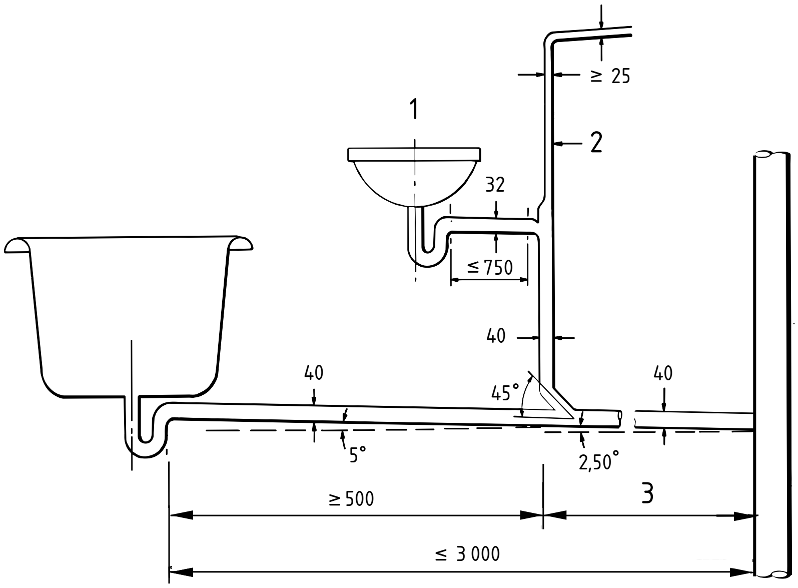
Legend:
1 Radius not essential

Figure ND.2 — Branch discharge pipe connections to discharge stacks (concluded)

ND 3.2.5 Combined branches for bath and wash basins (see Figure ND.3)

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.

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 basins 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 behavior of a particular arrangement, but the layout shown in Figure ND.3 has been shown to function satisfactorily.



Legend:

1 Wash basin and 32 mm branch pipe (slope 1¼º to 2½º:22 mm/m to 45 mm/m) may be mounted in a plane at 90º to that shown

2 Ventilating pipe

3 Short as practicable but 1,5 m (max.)

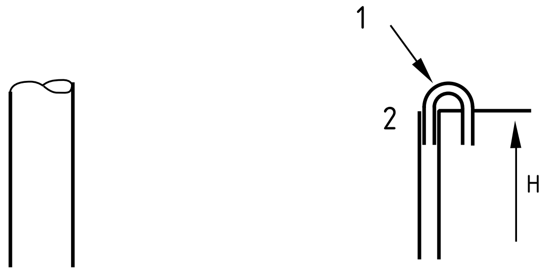
NOTE 1 A bend in the horizontal plane can be included in the 40 mm pipe. (Minimum radius 150 mm to centre line.)
NOTE 2 Any deviation from the dimensions (and limits) shown may cause self-siphonage or back flow into the bath.
NOTE 3 Resealing traps can be used instead of venting but noisy bath and wash basin discharge may result.
NOTE 4 See also Figure ND.2 for branch connection to stack.

Figure ND.3 — Combined branch discharge pipe arrangement for a bath and wash basin

ND 3.2.6 Domestic automatic washing machines and dish washing machines (see Figure ND.4)

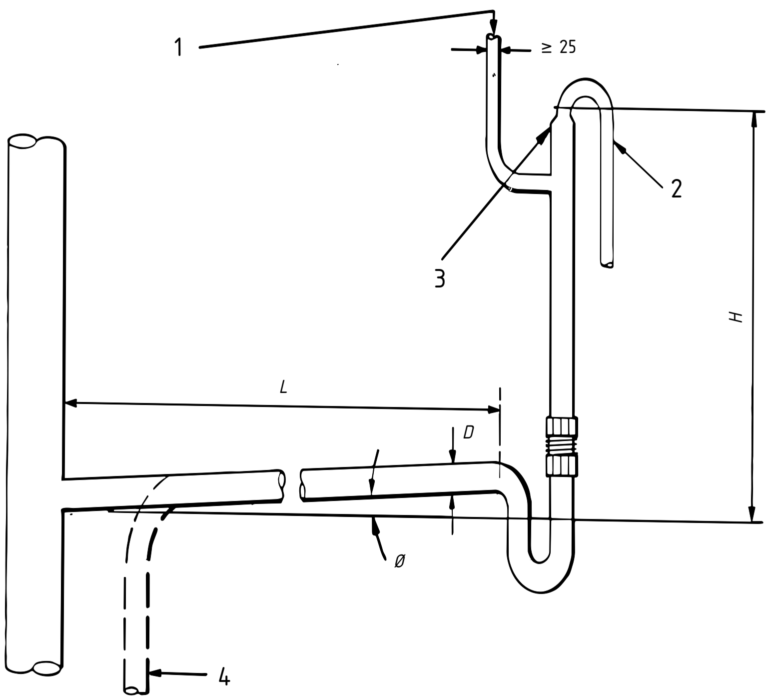
Requirements may vary slightly but the arrangements shown in Figure ND.4 should suit most machines. A DN 40 discharge pipe is necessary, which can be connected directly to a discharge stack, gully/floor drain, a sink trap or branch pipe. Normally a trap should be fitted in the horizontal section of the discharge pipe but this is not required for connections via a sink trap using a suitable fitting.

NOTE Some of the arrangements in Figure ND.4 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 stack develops a blockage, water will overflow during the emptying cycle.



a) Without venting

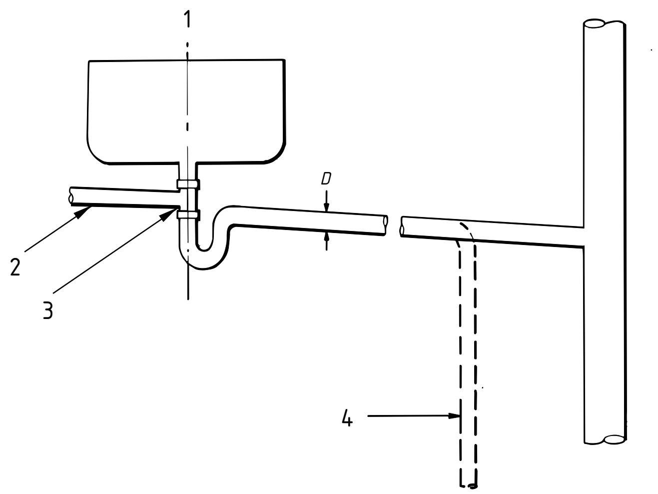
Legend:
1 Machine hose
2 Air gap
H is 600 mm to 900 mm (depends on washing or dish washing machine design)



b) With venting

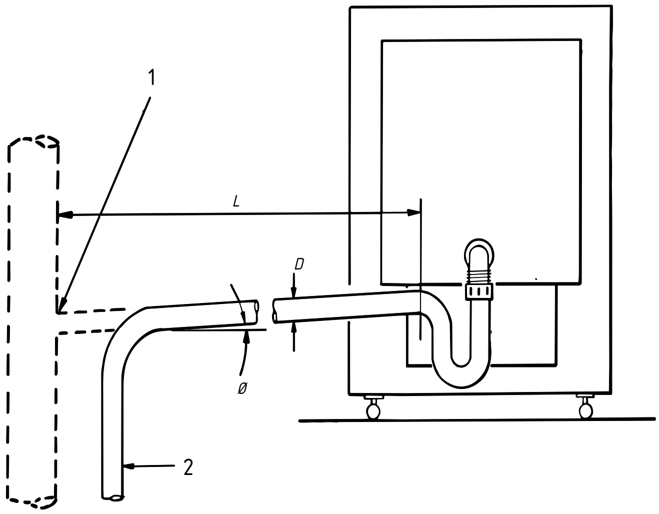
Legend:
1 Ventilation pipe (to atmosphere) – do not connect to ventilating stack
2 Machine hose
3 Water-tight connection
4 To gully
D is 40 mm
L < 3 m
H is 600 mm to 900 mm (depends on washing or dish washing machine design)
Θ is 1º to 2½º (18 mm/m to 45 mm/m)
Trap of 75 mm seal depth and 40 mm diameter

Figure ND.4 — Branch discharge pipes for washing and dish washing machines



c) Connection to sink discharge pipe

Legend:
1 Air gap [or arrangement b) can be used]
2 Machine hose
3 Proprietary fitting
4 To gully
D is 40 mm



d) Machines with low level outlets

Legend:
1 Alternative connection
2 To gully
D is 40 mm
L < 3 m
Θ is 1º to 2½º (18 mm/m to 45 mm/m)
Trap

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 or trap will cause machine water to back up into 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.

Figure ND.4 — Branch discharge pipe connections to discharge stacks (concluded)

ND.3.3 Connections to discharge stacks

ND.3.3.1 General (see Figure ND.5)

Small diameter branch discharge pipes up to DN 70 may be connected to stacks of DN 90 or larger with straight entry branch connections and some change in gradient close to the stack is permissible to allow the use of a standard 87½º branch boss.

For DN 30 pipes serving wash basins the root radius should be greater than 25 mm [see Figures ND.2c),d) and e)] and the change in gradient should be within 250 mm from the stack.

A branch inlet of DN 80 to DN 150 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 89½º to 67½º [see Figure ND.2f)].

Branch pipe connections at 45º or less do not need swept inlets [see Figure ND.2g)].

Branch inlets of DN 80 joining DN 100 or DN 150 discharge stacks and branch inlets of DN 100 joining DN 150 stacks may be swept or straight entry [see Figure ND.2h)].

Branch discharge pipes should not discharge over a hopper head.

ND.3.3.2 Waste manifolds

Branch discharge pipes may connect to a waste manifold of cross-sectional area equal to or larger than the pipework connecting to it. A waste manifold should be designed to prevent cross-flow of the discharge. Pipework connecting to waste manifolds should be installed to prevent self-siphonage.

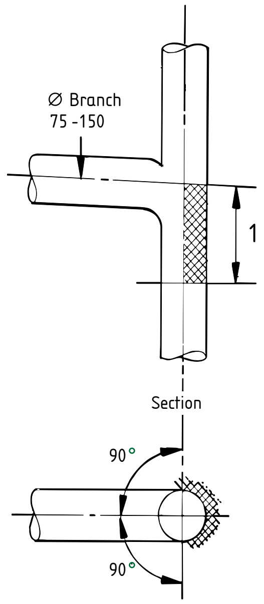
ND.3.3.3 Prevention of cross-flow (see Figure ND.5)

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

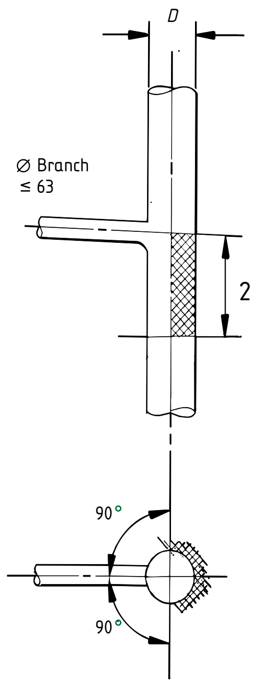
To prevent cross-flow from the discharge from a large diameter branch connection (e.g. a WC branch) into a smaller diameter branch (e.g. a bath branch), the latter should be connected to the stack at or above the centre line level of the larger branch connection or be at right angles or less to the branch connection, (see Figure ND.5) or at least 200 mm below. Similar rules apply to opposed small diameter branches (see Figure ND.5).

A branch creates a no connection zone on a stack, as shown shaded in Figure ND.5. 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.

Linear dimensions in millimetres



a) No connection zone opposite a large branch



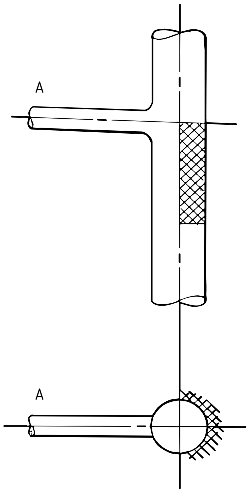
Stack diameter *D*	**Height of zone *A***
75	90
100	110
125	210
150	250

b) No connection zone opposite a small branch

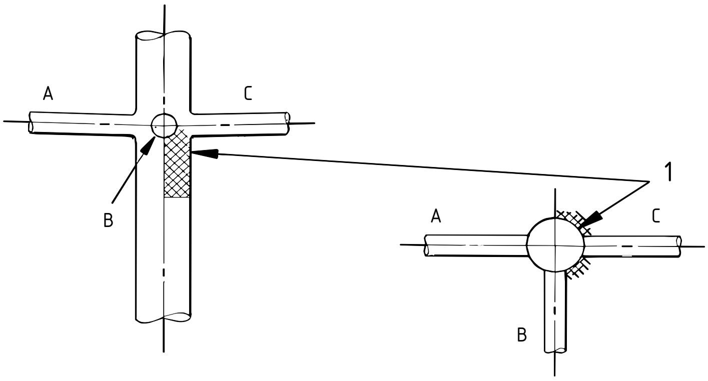
Legend:
1 200 independent of stack diameter
2 *A* (see table)

— No connection zones for the prevention of cross-flow

Figure ND.5 — Prevention of cross-flow

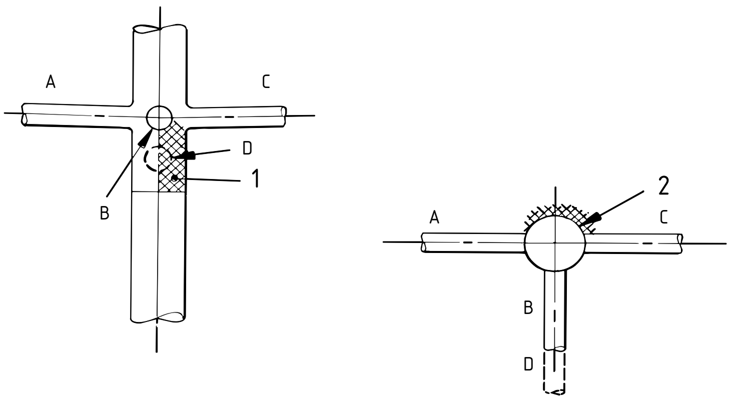


c) Consider a stack with branch A and its no connection zone, shown shaded



d) 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.

Legend:
1 Zone of branch A



e) 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 no connection zone on the far side of the stack, it would not be possible to fit a branch opposite branch D.

Legend:
1 Zone of branch A
2 Zone of branch B

— Examples of permitted connections for the prevention of cross-flow

Figure ND.5 — Prevention of cross-flow (concluded)

ND.3.4 Direct connections to an underground drain

ND.3.4.1 Gullies/floor drains

It is often convenient on the ground floor of buildings to discharge the wash basins and sinks into an external gully or floor drain. 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/floor drains.

This arrangement usually requires a length of vertical, or near vertical, discharge pipe that can cause self-siphonage of the trap seals and some noise. Self-siphonage is less likely with baths and sinks because trail off at the end of discharge will refill the traps sufficiently. However, wash basin branches may require venting or the use of a resealing or anti-vacuum trap. Noisy discharges may be prevented by venting the waste run.

ND.3.4.2 WC connections

WCs can be connected directly to a drain, without individual venting, provided that the vertical distance from the centre line of the WC branch to the invert of the drain is not more than 1,5 m. ND.3.4.3 Stub stacks

A stub stack consists of a short straight discharge stack equal to the drain diameter, 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 5 l/s, 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 ND.4a)]. 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 the atmosphere.

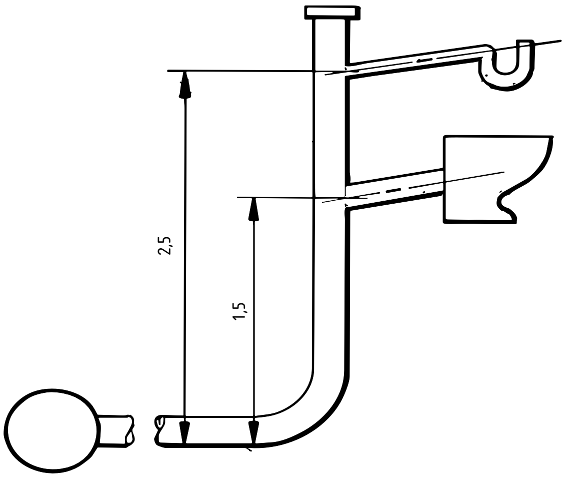
ND.3.5 Discharge stacks

ND.3.5.1 Diameter

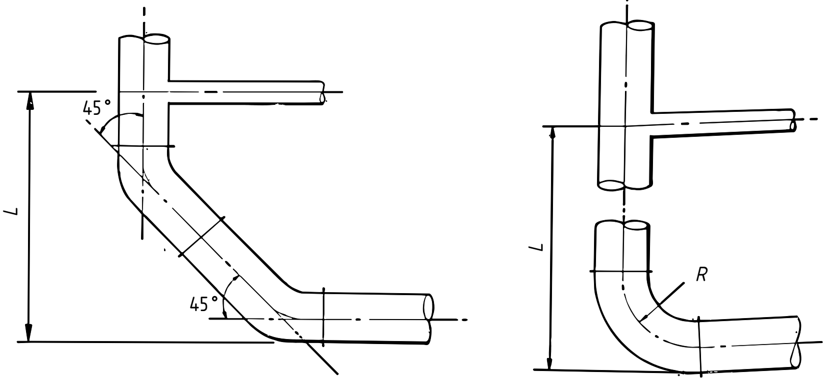
The internal diameter of a discharge stack should be not less than that of the largest trap or branch discharge pipe connected to it. The stack primary vent should be continued to the point of termination without any reduction in size to the discharge stack. In certain cases of one and two storey housing economies can be made by using a DN 80 stack vent without detriment to the performance of the system.

ND.3.5.2 Bends at the base of stacks (see Figure ND.6b)

Bends at the base of a discharge stack should be of large radius (minimum centre line radius 200 mm) or two 45º radius bends may 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.



a) Stub stack



b) Preferable arrangement c) Alternative arrangement

— Bend and branch connections at base of discharge stack

Legend:

$L \geq$ 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 ($ID \times 2$)]

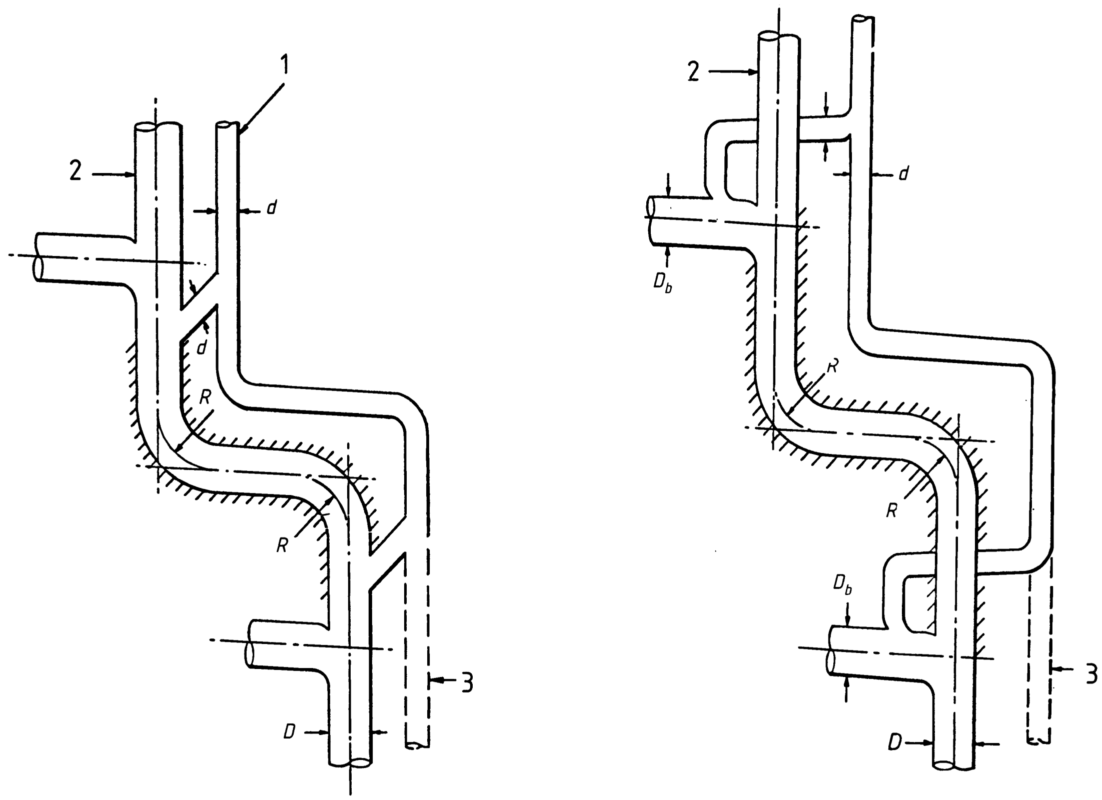
Figure ND.6 — Discharge from stub stack

ND.3.5.3 Branches at the base of stacks (primary ventilated 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 450 mm is adequate for low rise single dwellings. For larger multi-storey systems, it is better to connect the ground floor appliances to their own stack or the horizontal drain and not directly to the main stack. For buildings over 20 storeys high, it may be necessary to connect both the ground and first floor appliances in the same manner.

ND.3.5.4 Offsets (see Figure ND.7)

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 ND.3.5.2. In secondary ventilated stack system connections to the discharge stack should be made above and below the offset (see Figure ND.7). Offsets above the topmost appliance or branch connection do not require venting.



a) Direct connection to ventilation stack b) Indirect connection to ventilation stack

Legend:

1 Ventilating stack to atmosphere (or connected to stack vent)
2 Discharge stack
3 For ventilated systems sized
R is as large as possible (*ID* × 2 min.)
d D/2, or for ventilated systems if larger than *D*/2
D_b ≥ 75 mm (see note 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 for lightly loaded systems of up to three storeys in height.

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

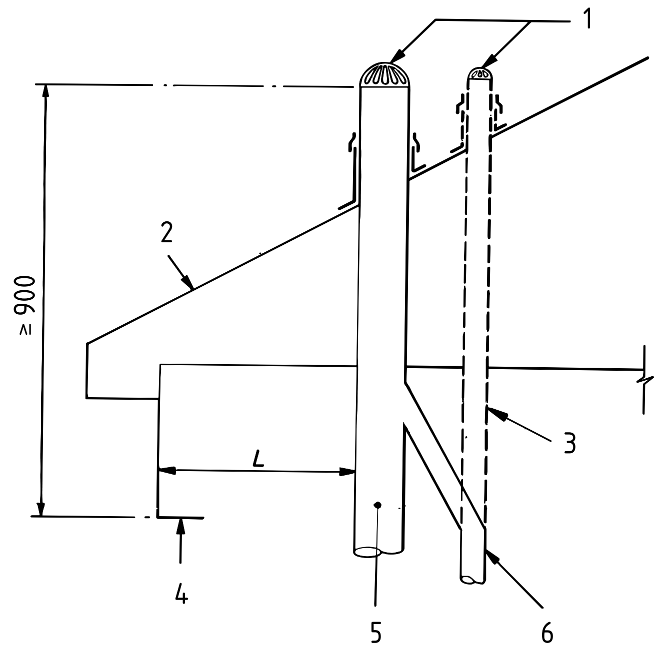
Figure ND.7 — Offsets in discharge stacks

ND.3.5.5 Interceptor traps

Interceptor traps are generally no longer installed except for rodent control measures, but if a stack is to be connected to a drain in which an interceptor trap is fitted, the size of the ventilating stack should be as for a surcharged drainage system (see NC.2.5).

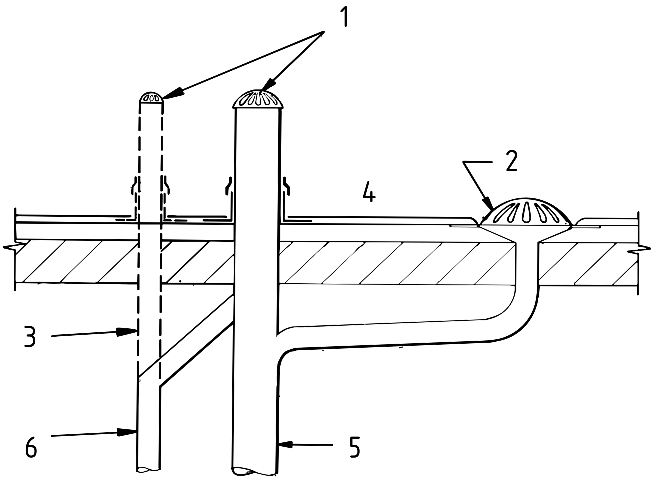
ND.3.5.6 Termination of stack vents (see Figure ND.8)

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 (see NC.2.7 with respect to wind affects).



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

Legend:
1 Domical cage
2 Roof
3 Alternative arrangement
4 Window or other opening
5 Stack vent
6 Ventilating stack to connect to stack vent



b) For stack vents also collecting rainwater from roofs

Legend:
1 Domical cage
2 Rainwater outlet
3 Alternative arrangement
4 Roof
5 Stack vent
6 Ventilating stack

Figure ND.8 — Termination of stack vents and ventilating stacks

ND.3.5.7 Air admittance valves (AAVs)

Underground drainage systems are ventilated through traditional ventilating pipes, and these preferably should 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 comply with the manufacturer's instructions. Dust laden atmospheres (e.g. caused by industrial processes) may clause AAVs to malfunction. To aid clearance of blockages, AAVs should be removable.

NOTE Approved Document H of the Building Regulations 1991 [1] 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 [2] also has restrictions on their use.

ND.3.5.8 Stacks serving only urinals

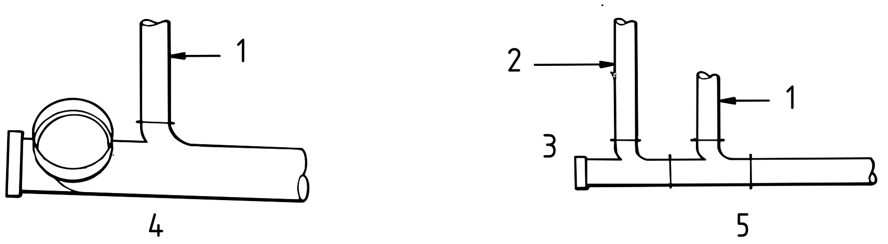
A stack carrying only discharges from urinals is likely to become rapidly encrusted with sediment and special attention to access and regular cleaning is necessary. It is an advantage to connect other appliances, such as WCs and hot water discharges, to a urinal stack to reduce this deposition.

ND.3.5.9 Stacks serving only sinks and/or washing machines

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 considerable deposits, especially with soft water, which will require frequent removal if restriction 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.

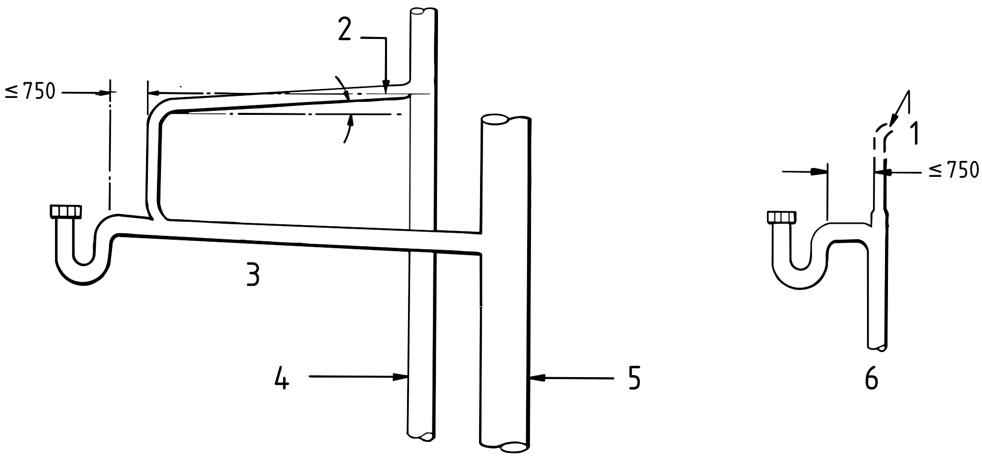
ND.3.6 Ventilating pipes and stacks

ND.3.6.1 Branch ventilating pipes (see Figure ND.9)



a) End of branch

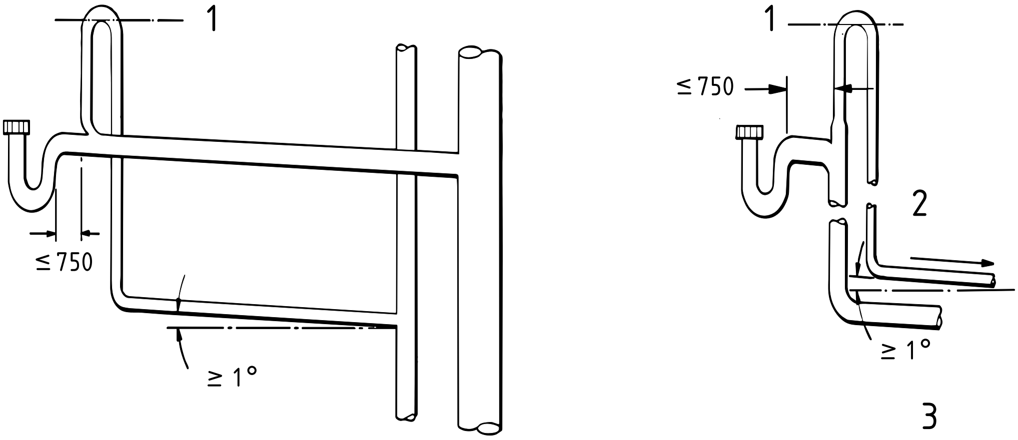
Legend:
1 Ventilating pipe
2 Branch connection
3 Tee junction
4 Large diameter – branch
5 Small diameter – branch



b) Single appliance

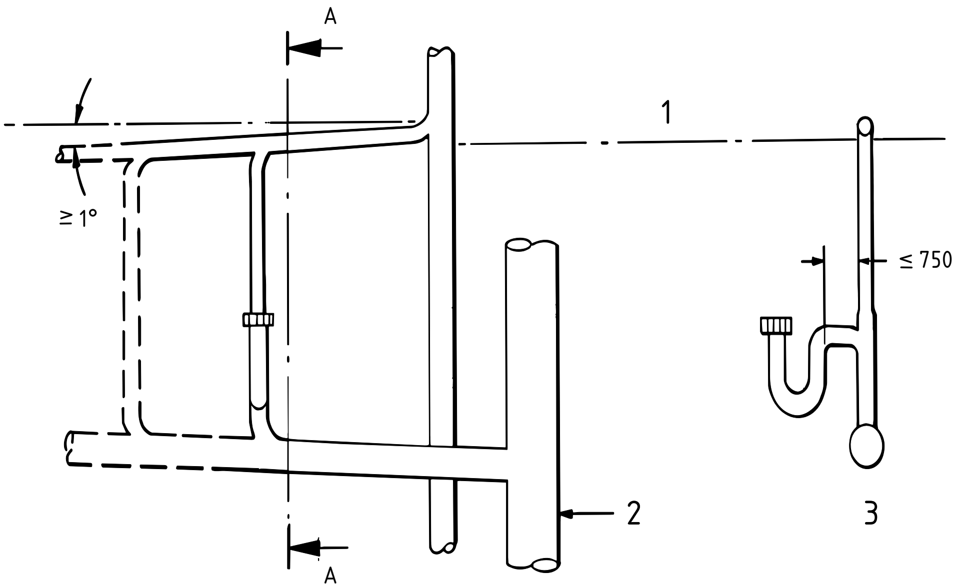
Legend:
1 Ventilating pipe
2 Above spill-over level of appliance
3 Crown of trap
4 Ventilating stack
5 Discharge stack
6 Alternative arrangement

Figure ND.9 — Ventilating pipes to branches



c) Avoiding unsightly pipes to single appliances

Legend:
1 Above spill-over level of appliance
2 To ventilating stack (or discharge stack if connection is above highest branch)
3 Alternative arrangement



d) Ranges of appliances

Legend:
1 Above spill-over level of appliance
2 Discharge stack
3 View A-A

NOTE Alternatively, air admittance valves may be used.

Figure ND.9 — Ventilating pipes to branches (concluded)

ND.3.6.1.1 Diameter

The size of ventilating pipes to branches from individual appliances can be DN 25 but, if they are longer than 15 m or contain more than five bends, a DN 30 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 ND.7), it should be larger but it can be reduced when above the spill-over level of the appliance.

ND.3.6.1.2 Connections to stacks

Any ventilating pipes should be connected to the stack above the spill-over level of the highest appliance.

ND.3.6.1.3 Connections to discharge pipes

Connections to the appliance discharge pipe should normally be as close to the trap as practicable but within 750 mm.

Ventilating pipe connections to the end of branch runs should be at the top of the branch pipe, away from any likely backflow which could cause blockage.

ND.3.6.1.4 Installation

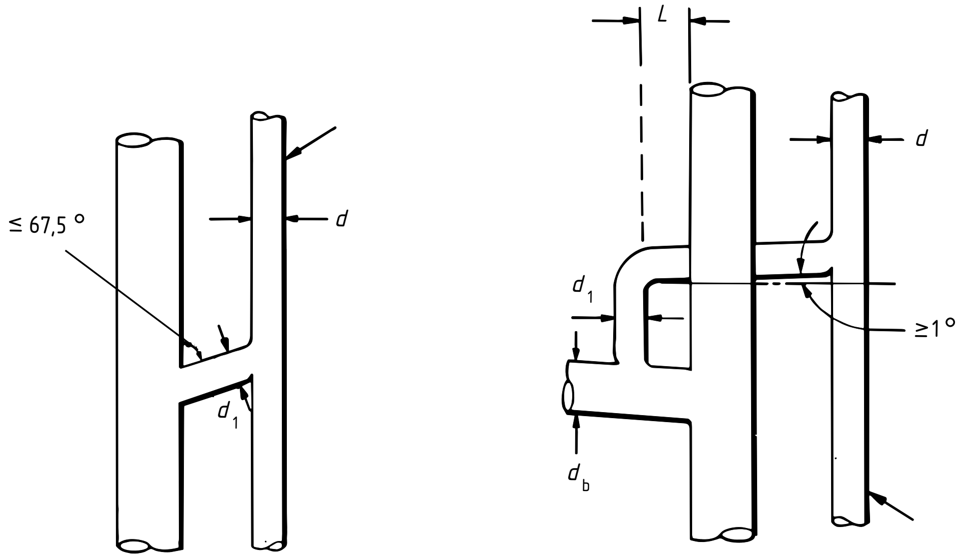
To prevent the possibility of a condensation waterlock preventing the movement of air through the ventilating system and to minimize the risk of internal corrosion, ventilating pipes should normally be installed so that there is a continuous backfall to the branch discharge pipe system; an alternative arrangement is illustrated in Figure ND.6 in which the fall is towards the vent stack via a high level loop.

ND.3.6.2 Ventilating stacks (see Figure ND.10)

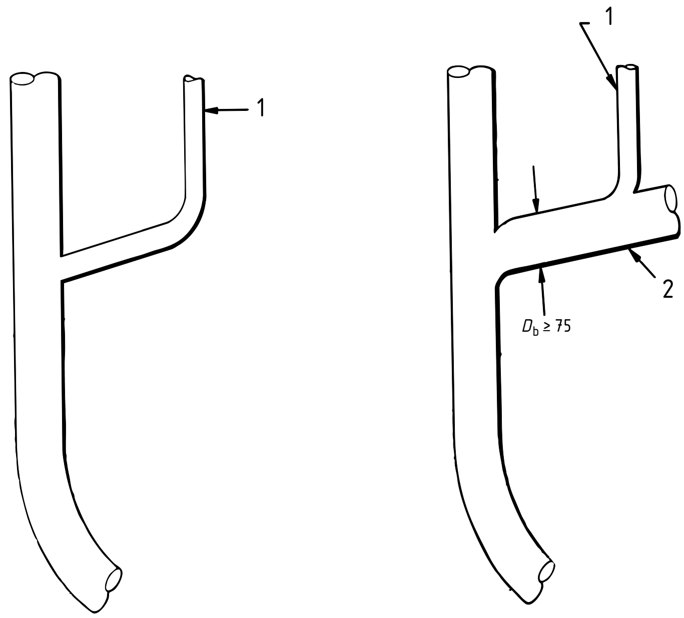
ND.3.6.2.1 Connections

In secondary ventilated stack systems (see Figure ND.5), 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 (67½º maximum) to prevent discharge water from entering the vent system and should be of the same diameter as the ventilating stack.

The lowest end of the ventilating stack should normally be connected to the discharge stack at or below the lowest branch connection; the upper end should preferably be connected to the stack vent or pass through the roof to the atmosphere.



a) Cross-connections for discharge stack ventilation



b) Bottom of stacks

Legend:

1 Ventilating stacks

2 Lowest branch

d_1 is same as ventilating stack

$D_b \geq 75$ mm [if d is smaller than 50 mm, the method shown in the right-hand figure of a) is preferable]

L is as small as practicable

Figure ND.10 — Ventilating stacks

ND.3.6.2.2 Installation

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

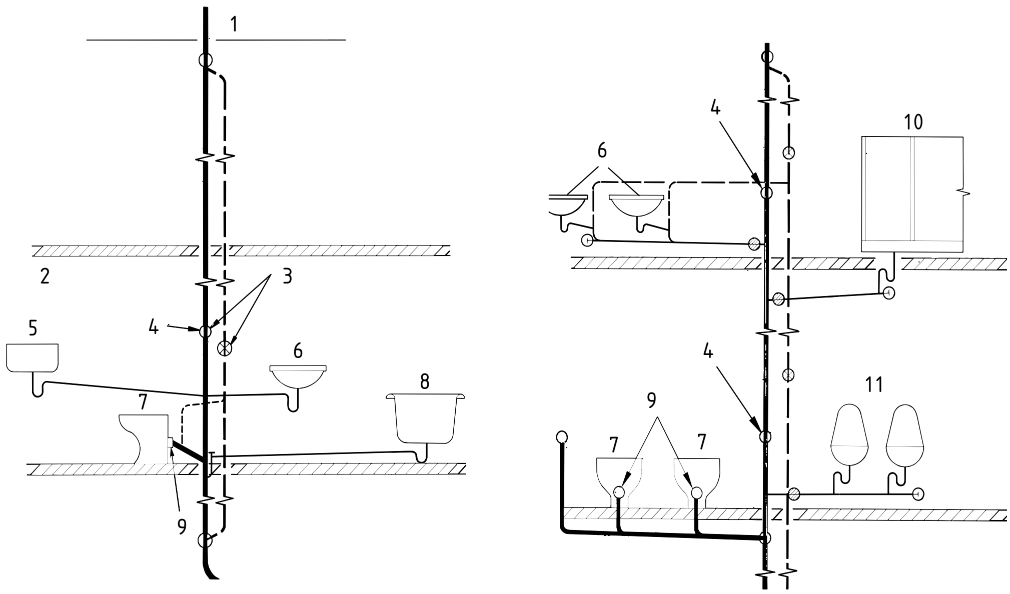
ND.3.6.2.3 Connections on ventilated branch system

For ventilated branch systems (see Figure NC.6), the ventilating stack is only acting as a common connection for the branch ventilating pipes, and there are no connections to the discharge stack. A ventilating stack of DN 30 is usually sufficient. However, if required, the ventilating stack can be connected to the primary vent stack, 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 ND.8, then the lowest end of the ventilating stack should be connected to the discharge stack via a large (DN 80 min.) branch.

ND.3.6.2.4 Termination of ventilating pipes (see Figure ND.8)

Ventilating pipes should be positioned as described for stack vents 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.

ND.4 Access (see Figure ND.11)



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

b) Example of commercial system

Legend:

1 Roof
2 Typical floor
3 Access to stacks at 3 storey intervals or less
4 Slightly above spill-over level of appliances
5 Sink
6 Wash basin
7 WC
8 Bath
9 Removable joint
10 Stall urinal
11 Bowl urinals

○ Access
⊘ Access required if waste not detachable
⊠ Test access

Figure ND.11 — Access for cleaning and testing purposes

ND.4.1 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 located so as to facilitate testing, cleaning and clearing. 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 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.

ND.4.2 Pipe ducts

Pipework enclosures, e.g. ducts and casings, should be of a suitable 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.

ND.4.3 Water closets

WCs are particularly prone to obstruction in or near the trap through misuse. One of the advantages of using a joint or jointing material to a WC pan is that it will allow the easy removal and replacement of the pan.

ND.4.4 Urinals

The discharge from urinals can cause 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.

ND.4.5 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.

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.

ND.4.6 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.

For multi-storey domestic buildings, access to the pipework should be provided at about three storey intervals. For multi-storey commercial buildings, access to the pipework should be provided on each floor.

ND.4.7 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 wastewater.

Access points are required above the spill-over level of appliances, and at the high end of the branch discharge pipes of food waste macerators and vegetable paring machines that there is a high risk of blockage. It is also necessary to ensure that access points are accessible after the appliances have been installed.

ND.5 Special design considerations

ND.5.1 Restaurant and canteen kitchens

ND.5.1.1 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 purposes sinks.

The time scale during which the operations may be carried out will not comply with 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/hr with a peak flow rate in the order of 80 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. It should be noted that discharges may be of large volume, and high temperatures necessitate the careful selection of drainage materials (see annex NE for material selection).

Kitchens are designed to ensure a natural flow of work and seldom permit the grouping of 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.

ND.5.1.2 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 habour 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.

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 wastewater discharge rates.

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, with the flap kept closed when not in use.

ND.5.1.3 Grease traps/convertors

Grease traps should be provided in circumstances where high loads of grease are expected which could interfere with the effectiveness of the drainage system; however where grease loads are not anticipated their use should be avoided. 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 discharges 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 in accordance with trade waste regulations. 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.

ND.5.2 Hairdressing salons

Special fittings should be provided at the outlet of basins to prevent the ingress of hair into the discharge pipe.

National annex NE (informative)

Materials

NE.1 General

Pipes and fittings should be suitable for their purpose and should comply with the requirements of the relevant standards.

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, fire resistance and maintenance requirements of the pipework (see also Part 5).

NE.2 Types of materials

NE.2.1 Metals

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

a) cast iron;

b) copper;

c) hot dipped galvanized steel;

d) 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:

a) zinc;

b) iron;

c) lead;

d) brass;

e) copper and stainless steel.

(For more information refer to PD 6484:1979.)

NE.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 (PE);

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 or European Standards should be consulted or expert advice sought if these conditions are likely.

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.

NE.2.3 Borosilicate glass

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

National annex NF (informative)

Work on site

NF.1 General

This annex provides information on site working, jointing and fixing method requirements for all materials used on above ground gravity sanitary pipework. This document covers domestic, commercial and public buildings, with the exception of trade waste discharges and any special requirements of building such as hospitals or laboratories.

NF.2 Jointing of pipes

NF.2.1 General

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 provisions should be made in the assembly of sanitary pipework to accommodate and control thermal movement. To comply with the electrical wiring regulations (BS 7671), pipework may require continuity of electrical bonding at each joint.

NF.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.

NF.2.3 Types of fixing

NF.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 (brackets) for building in, nailing or screwing to the structure;

c) purpose-made straps or hangers.

NF.2.3.2 Copper tubes

The following fixings may be used;

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

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

NF.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.

NF.2.3.4 Plastic pipes

Holderbats (brackets) of metal, plastics coated metal or any other suitable material may be used for fixing plastic pipes, but care should be taken to ensure that the pipe support does not bite into the external surface of the pipe when tightened. Where anchor points are required to control thermal movement, the holderbats (brackets) 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.

NF.2.4 Distance between pipe supports

The distance between pipe supports should not exceed those shown in Table NF.1. 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, 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.

Where the layout 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.

Table NF.1 — Maximum distance between pipe supports

Pipe material	DN	Pipe diameter Mm	Vertical pipes M	Low gradient pipes m
Acrylonitrile butadiene styrene ABS	30 40 50	32 40 50	1,2 1,2 1,2	0,5 0,5 0,6
Cast iron	—	All diameters	3,0	3,0
Copper	25 30 to 40 50 —	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
Unplastisized polyvinyl chloride PVC-U	—	32 to 40 50 75 to 100 150	1,2 1,2 2,0 2,0	0,5 0,6 1,0 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 in direction.				

NF.2.5 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.

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 clearing eyes should be fitted at the time of installation and be finally fixed and sealed after testing.

National annex NG (informative)

Inspection, testing and maintenance of completed installations

NG.1 General

This annex provides information on testing methods and maintenance of above ground gravity sanitary pipework and fittings. This document covers domestic, commercial and public buildings, with the exception of trade waste discharges and any special requirements of building such as hospitals or research laboratories.

Inspections and tests should be made during the installation of the discharge system as the work progresses to ensure that the pipework is properly secured and clear of obstruction, debris and superfluous matter and that all work which is to be concealed is free from defects before it is finally enclosed.

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

NG.2 Final inspection

On completion, the discharge system should be meticulously inspected to insure 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 joining material projects into the pipe bore. When this has been done, tests for the soundness of the pipework and for the performance should be made.

NG.3 Testing

NG.3.1 Air test

NOTE Normally this test is carried out to confirm that all pipes and fittings are airtight. It should be completed in one operation but for large multi-storey systems testing in sections may be necessary.

NG.3.1.1 Preparation

The water seals of 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, and 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.

NG.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.

NG.3.1.3 Leak location

NOTE Defects revealed by an air test may be located by the methods given in NG.3.1.3.1, NG.3.1.3.2 and NG.3.1.3.3.

NG.3.1.3.1 Smoke

A smoke producing machine may be used which will introduce smoke under any 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 naphtha having a detrimental effect, particularly on ABS, PVC-U and MUPVC. Rubber jointing components can also be adversely affected.

NG.3.1.3.2 Soap solution

With the pipework subject to an internal pressure using the smoke machine method as described in NG.3.1.3.1, a soap solution can be applied to the pipes and joints. Leakage can be detected by the formation of bubbles.

NG.3.1.3.3 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.

NG.3.2 Performance tests

NG.3.2.1 General

All appliances, whether discharged singly or in groups, should drain speedily, quietly and completely.

To ensure that adequate water seals are retained during peak working conditions, the tests described in NG.3.2.2 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.

NG.3.2.2 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 that should be discharged together is given in Table NG.1. 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.

Table NG.1 — 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 91 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.				

NG.3.2.3 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 NG.1 shows the number of appliances which should be discharged simultaneously.

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 NG.1 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.

NG.4 Maintenance

NG.4.1 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 national annex.

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 clearing eyes are removed, damaged packing, ring seals, washers and loose 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 the 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.

NG.4.2 Cleaning and descaling

NG.4.2.1 Types of blockage or deposit and method of removal

NG.4.2.1.1 Deposits due to misuse of the discharge system

Completely 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.

NG.4.2.1.2 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 descaling of the system using suitably inhibited acid-based cleaners. The discharge stacks and pipes should be inspected periodically, and the rate of scale formation notes. The required frequency of treatment and the strength of acid required to soften the scale can then be established, and 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 mat. It may be necessary to repeat the process to ensure that all deposits are removed.

NOTE Reference should be made to COSHH Regulations [3].

NG.4.2.1.3 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 soda dissolved in hot water (see Table NG.2). This should be established 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 washed into the waste pipes will combine with the grease and soap residues and considerably increase the risk of blockage.

NG.4.2.2 Cleaning and descaling techniques

NG.4.2.2.1 Plunger

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

NG.4.2.2.2 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 DN 80 and larger where only moderate flexibility is required to introduce the rods into the pipework.

Mechanically rotating versions are also available.

NG.4.2.2.3 Kinetic ram

A kinetic ram gun can be employed usefully 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 that is transmitted to the obstruction to dislodge and remove it.

A stubborn blockage can, however, produce a blowback 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 blowback may cause malfunction.

On installations where 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.

NG.4.2.2.4 Coring and scraping

Coring of the pipe can be considered in pipes of DN 100 and over, where the pipe bore is severely restricted or even completely blocked with hard lime scale or similar material. First however, the pipe material should 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 that 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.

NG.4.2.2.5 Chemical cleaning

Details of these methods are given in Table NG.2. Attention to safety precautions is vital if injury to the operator or damage to pipework and appliances is to be avoided.

NOTE 1 Refer to COSHH Regulations [3].
NOTE 2 Chemical de-sealing agents may damage some plastics fittings and mechanisms. Manufacturer's advice should be sought.

Table NG.2 — Chemical cleaning of discharge stack and branches

Application	Method	Notes
The removal of lime scale accumulations in discharge stacks and branch pipes	Apply diluted, inhibited, acid-based descaling fluid directly to scale. Apply these measured quantities of fluid into the pipes at predetermined points on the pipeline, 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 scrappers. 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 contract 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 formation of grease and soap residues 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.		

NG.4.2.3 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. Upon completion of the work all exposed surfaces of sanitary appliances should be thoroughly washed, using a appropriate cleanser to remove any acid or other chemicals which might otherwise come into contact with a person using the appliance. Adjacent finishes and decorations may need protecting while the work is in progress.

NG.4.3 Periodic inspection

In addition to general maintenance work, periodic inspections and tests may be advisable to ascertain if there is any misuse or negligence. All defects should be fixed.

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