

Gravity drainage systems inside buildings —

Part 2: Sanitary pipework, layout and calculation

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National foreword

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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:

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

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calculs

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

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

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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
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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of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by June 2001.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.

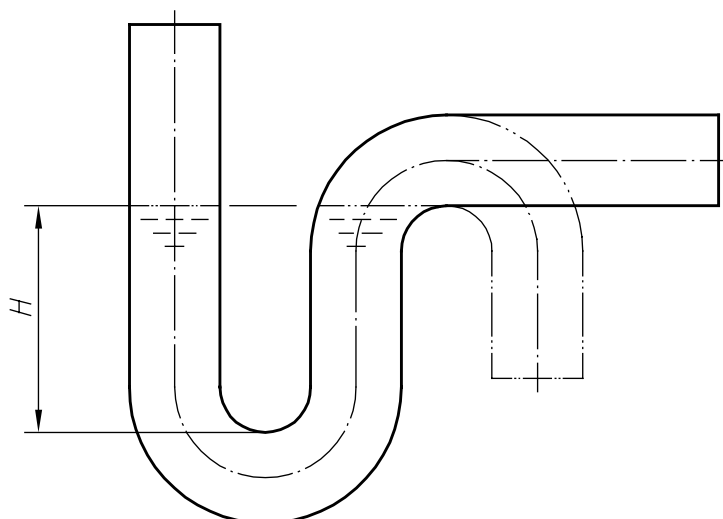


Figure 1 — Water depth in trap

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.

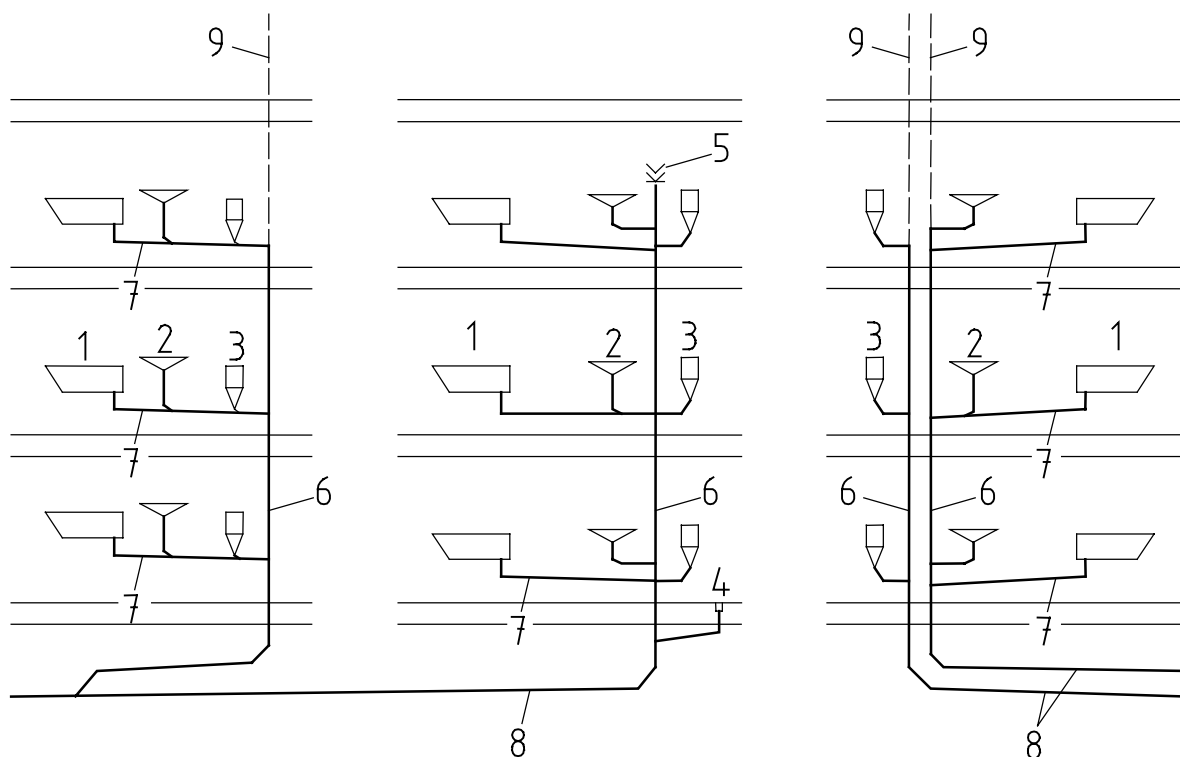


Figure 2 — Primary ventilated system configurations

- 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.

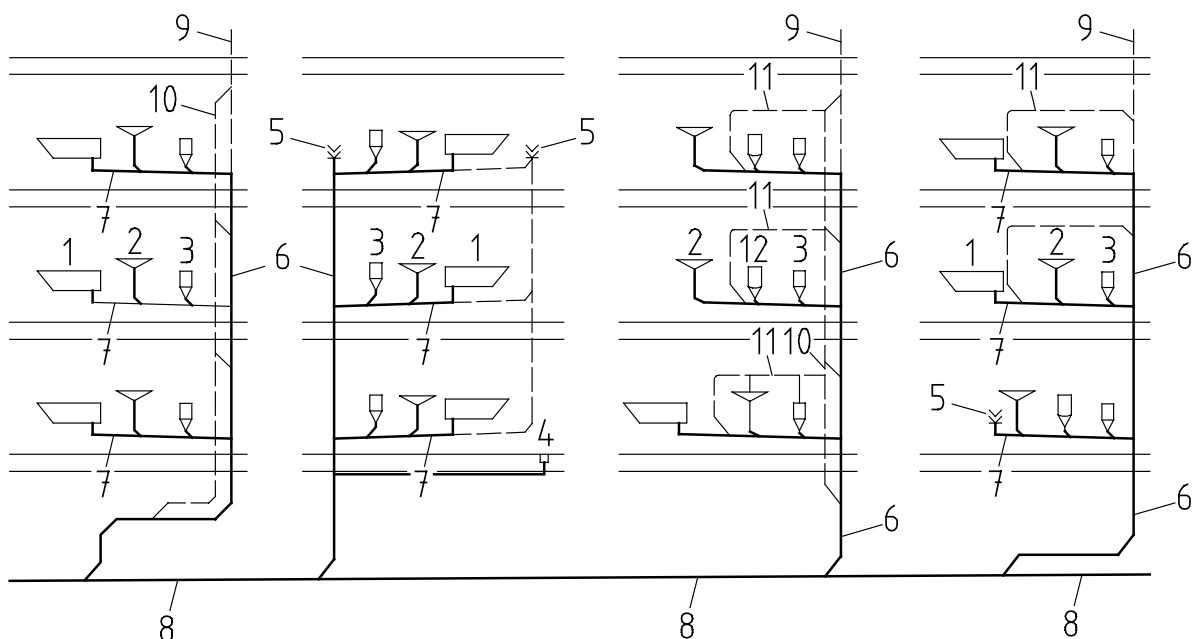


Figure 3 — Secondary ventilated system configurations

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).

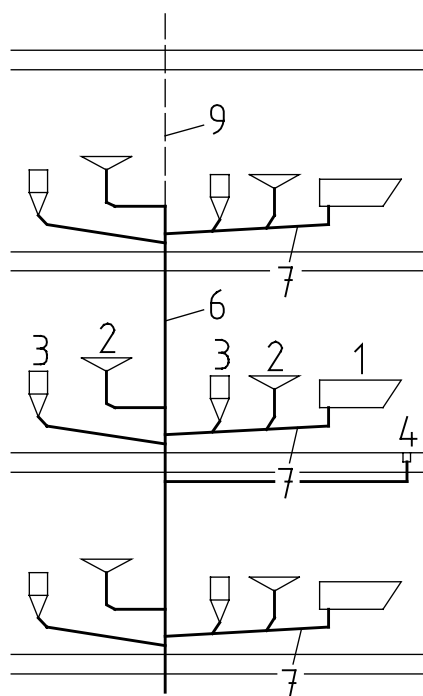


Figure 4 — Unventilated discharge branch configuration

- 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.

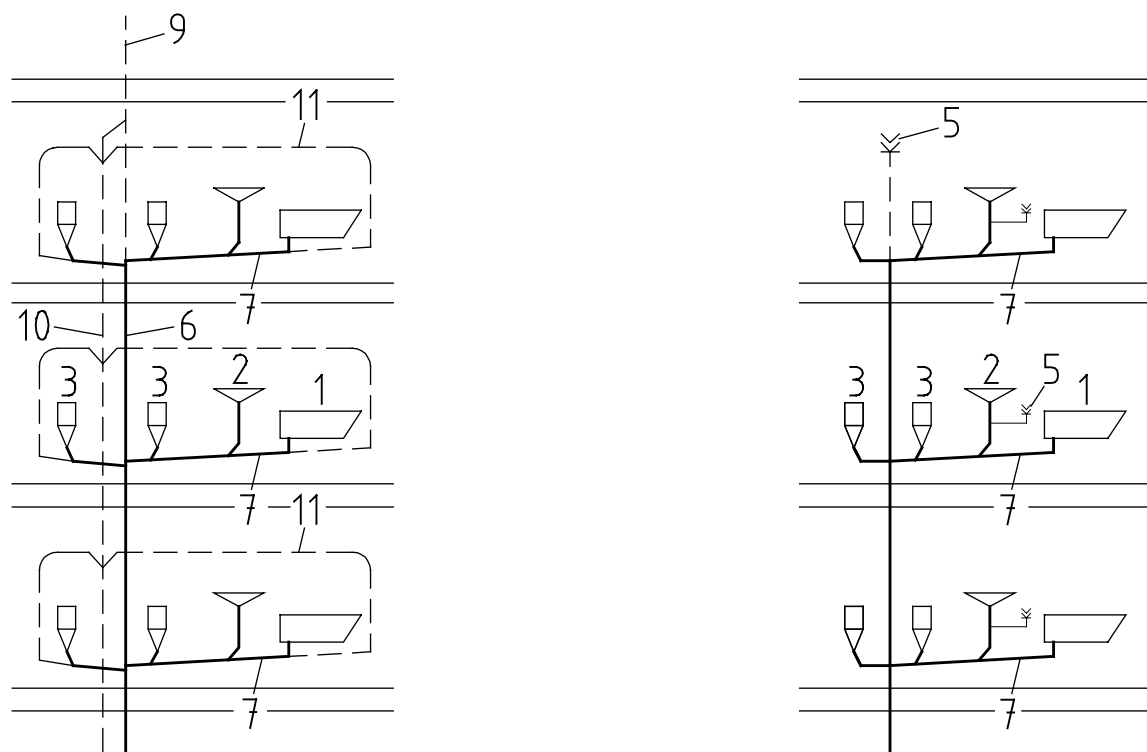


Figure 5 — Ventilated discharge branch configurations

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.

$$Q_{ww} = K \sqrt{\Sigma DU}$$

where:

$$\begin{aligned}
 Q_{ww} &= \text{Waste water flowrate (l/s)} \\
 K &= \text{Frequency factor} \\
 \Sigma DU &= \text{Sum of discharge units}
 \end{aligned}$$

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.

$$Q_{\text{tot}} = Q_{\text{ww}} + Q_{\text{c}} + Q_{\text{p}}$$

where:

$$\begin{aligned} Q_{\text{tot}} &= \text{Total flowrate (l/s)} \\ Q_{\text{ww}} &= \text{Waste water flowrate (l/s)} \\ Q_{\text{c}} &= \text{Continuous flowrate (l/s)} \\ Q_{\text{p}} &= \text{Pumped water flowrate (l/s)} \end{aligned}$$

6.3.4 Calculation rules

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

- the calculated waste water flowrate (Q_{ww}) or total flowrate (Q_{tot}); or
- 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 (<i>L</i>) of pipe	4,0 m	10,0 m	see Table 6	10,0 m
Maximum number of 90° bends	3*	1*		3*
Maximum drop (<i>H</i>) (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.				

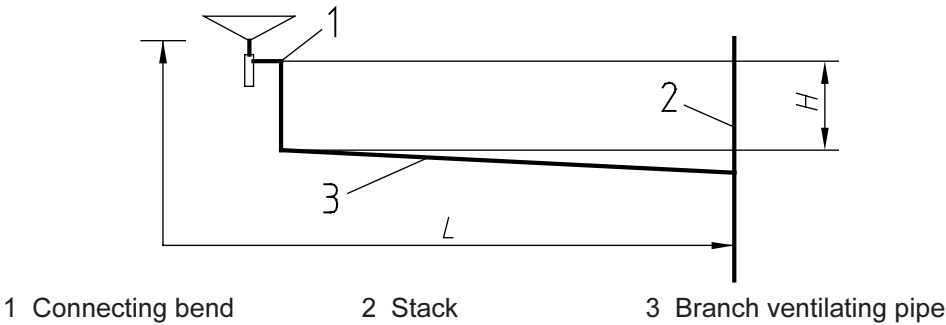


Figure 6 — Limitations for unventilated discharge branches in system I, II, IV

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

Appliance	Diameter	Min. trap seal depth	Max. length (L) of pipe from trap outlet to stack	Pipe gradient	Max. number of bends	Max. drop (H)
	DN	mm	m	%	No.	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	System II	System III	System IV
	DN	DN	DN	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 (<i>L</i>) 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 (<i>H</i>) (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.				

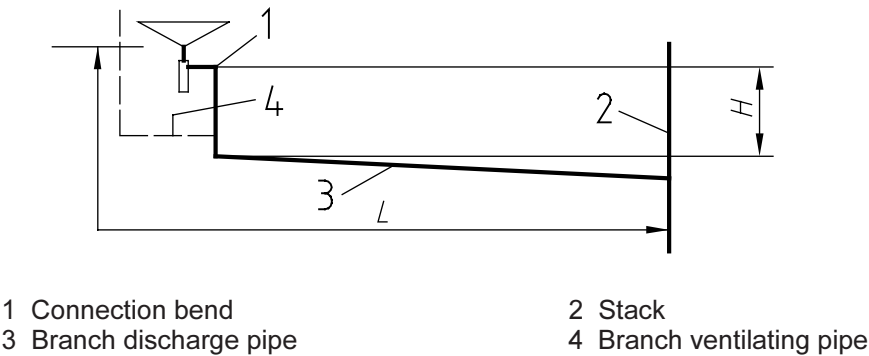


Figure 7 — Limitations for ventilated discharge branches in system I, II and IV

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

Appliance	Diameter	Min. trap seal depth	Max. length (L) of pipe from trap outlet to stack	Pipe gradient	Max. number of bends	Max. drop (H)
	DN	mm	m	%	No.	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.

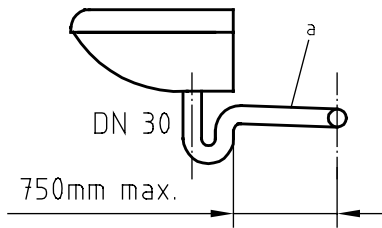


Figure 8 — Boundary conditions for ventilated discharge branches in system III with a gradient of 1,8 to 4,4 %

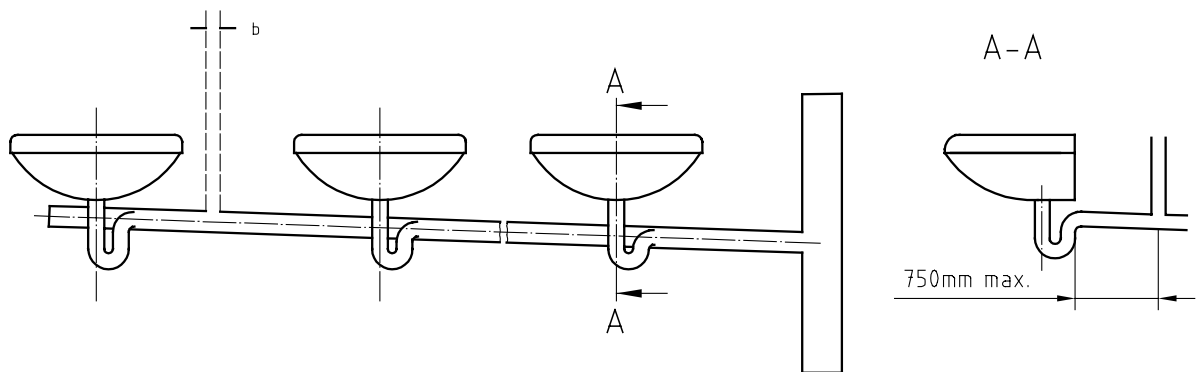


Figure 9 — Boundary conditions for ventilated discharge branches in system III with vent of 25 mm min

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 $8 \times Q_{\text{tot}}$.

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.