TERRAIN

Technical Bulletin No.8 (2014)

Design And Installation Considerations: Soil Stack And Branch Pipe Sizing

This technical bulletin will provide you with data required to correctly size your soil stack and waste run outs.

Sizing Of Vertical Soil Stacks

To correctly size a soil stack firstly we need to calculate the waste water flow rate. This is done using the following calculation:

$Qww = K\sqrt{\Sigma DU}$

where:
Qww = Waste water flowrate (L/s)
K = Frequency factor (see Table B)
ΣDU = Sum of discharge units (see Table A)

Table A: Discharge units (DU) Values

Appliance	System III DU l/s
Wash basin, bidet	0.3
Shower without plug	0.4
Shower with plug	1.3
Single urinal with cistern	0.4
Urinal with flushing valve	-
Slab urinal	0.2*
Bath	1.3
Kitchen sink	1.3
Dishwasher (household)	0.2
Washing machine up to 6kg	0.6
Washing machine up to 12Kg	1.2
WC with 4.0L cistern	**
WC with 6.0L cistern	1.2 to 1.7***
WC with 7.5L cistern	1.4 to 1.8***
WC with 9.0L cistern	1.6 to 2.0***
Floor gully DN 50	-
Floor gully DN 70	-
Floor gully DN 100	-

* Per person.
** Not permitted.
*** Depending upon type (valid for WC's with siphon flush cistern only).

Table B: Typical frequency factors (K)

Usage of appliances	K
Intermittent use, e.g. in dwelling, guest-house, office	0.5
Frequent use, e.g. in hospital, school, restaurant, hotel	0.7
Congestred use, e.g. in toilets and/or showers open to public	1.0
Special use, e.g. laboratory	1.2

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Example

10 storey building with

4	WC	On each floor
2	WHB	
2	Baths	
2	Showers	
2	Sinks	
2	W/MC	

4 x 1.5 = 6.0
2 x 0.3 = 0.6
2 x 1.3 = 2.6
2 x 0.4 = 0.8
2 x 1.3 = 2.6
2 x 0.6 = 1.2

13.8 x 10 = 138 DU

Domestic Building Use K = 0.5

0.5 √138 = 5.87 l/s

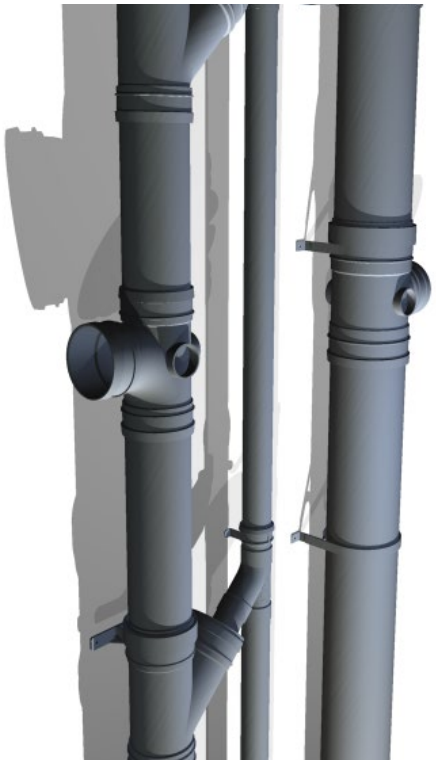

Table C: Stack with only Primary Vent

Stack & 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. # Equal branch junctions that are more than 45°, or has a centre line radius less than the internal pipe diameter.

Table D: Stack with Secondary Venting

Stack & 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. # Equal branch junctions that are more than 45°, or has a centre line radius less than the internal pipe diameter.

Using this example with a calculated flow rate of 5.87 L/s there are two options. The first option is to install a primary stack which has a diameter of 125mm; in the UK this would generally be installed as a 160mm stack. The other option would be to install a 110mm primary stack with 50mm secondary ventilation.

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Sizing of Branch Discharge Pipes

For branch pipe sizing the following sizing charts should be used.

Appliance	Dia. DN	Min. trap seal depth (mm)	Max. length (L) of pipe from trap outlet to stack (m)	Pipe gradient	Max. no. of bends	Max. drop (H) (m)
Limitations for unventilated branch discharge pipes, system III						
Washbasin, bidet (30mm diameter trap)	30	75	1.7	2.2[1)]	0	0
Washbasin, bidet (30mm diameter trap)	30	75	1.1	4.4[1)]	0	0
Washbasin, bidet (30mm diameter trap)	30	75	0.7	8.7[1)]	0	0
Washbasin, bidet (30mm 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[3)]	60	50	3.0[3)]	1.8 to 9.0	No Limit[4)]	1.5
Kitchen sink (40mm 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 80mm[6)]	75	50	No Limit	1.8 min	No Limit[4)]	1.5
WC with outlet greater than 80mm[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	50	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[3)]	50	75	No Limit[3)]	1.8 to 1.9	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 3m 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) Spray tap basins shall have flush-grated wastes without plugs.

Ventilated discharge branches: Sizes and limitations upon the use of ventilated discharge branches are given in the tables above. Limitations given in the second table are simplifications, for further information see national and local regulations and practice.

Appliance	Dia. DN	Min. trap seal depth mm	Max. length (L) of pipe from trap outlet to stack m	Pipe gradient	Max. no. of bends	Max. drop (H) m
Limitations for ventilated branch discharge pipes, system III						
Washbasin, bidet (30mm diameter trap)	30	75	3.0	1.8 min	2	3.0
Washbasin, bidet (30mm diameter trap)	40	75	3.0	1.8 min	No Limit	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[3)]	60	50	3.0[3)]	1.8 min	No Limit[4)]	3.0
Kitchen sink (40mm 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 80mm[6) & 14)]	75	50	No Limit	1.8 min	No Limit[4)]	1.5
WC with outlet greater than 80mm[6) & 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) & 10)]	50	75	10.0	1.8 to 1.9	No Limit	0
Bowl urinals[9) & 11)]	50	70	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[9)]	30 max	50	No Limit[3)]	1.8 to 4.4	No Limit[4)]	0

1) For maximum distances from trap to vent (see Figure 8 of BS EN 1205-2:2000).
2) If length is greater than 3m 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 of BS EN 12056-2:2000).
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 15m 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 50mm above the spill-over of the appliance.

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