

Market Chambers Building

Above Ground Drainage Design Calculation - Flow Rate

Details		Appliance Discharge Units														Calculate Flow Rate			Pipe Selection			
Decription	Pipe Reference	Appliance Discharge Units														Total	Frequency Factor	Flow Rate	Stack & Stack Vent	Hydraulic Capacity Q _{max} (l/s)		Logic
		WC (6l Cistern)	WC (7.5l Cistern)	WC (9l Cistern)	Bath	WHB	Shower without Plug	Cleaners Sink	Kitchen Sink	Dishwasher	Washing Machine (6kg)	Washing Machine (12kg)	Slab Urinal	Floor Gully DN 100	ΣDU	K	Q _{ww} (l/s)	DN	Square Entries	Swept Entries		
		System 3																				
WC (2nd Flr)		1.7	1.8	2	1.3	0.3	0.4	0.6	1.3	0.2	0.6	1.2	0.2									
WC (1st Flr)		1				1																
Total	SVP02	2	0	0	0	2	0	0	0	0	0	0	0	0	4.0	0.5	1.00	100	5.6	7.3	PASS	
SVP02		2				2																
WC (2nd Flr)		1				1																
Accessible WC (2nd Flr)		1				1																
WC (1st Flr)		1				1																
Accessible WC (1st Flr)		1				1																
Total	SVP01	6	0	0	0	6	0	0	0	0	0	0	0	0	12.0	0.5	1.73	100	5.6	7.3	PASS	
Accessible WC (Unit 3 Grd Flr)	SS01	1				1									2.0	0.5	0.71	100	5.6	7.3	PASS	
Accessible WC (Unit 4 Grd Flr)	SS02	1				1									2.0	0.5	0.71	100	5.6	7.3	PASS	
Total for connection back via existing outfall		8	0	0	0	8	0	0	0	0	0	0	0	0	16.0	0.5	2.00	100	5.6	7.3	PASS	
Kitchenette (2nd Flr)														1	1							
Accessible WC (Grd Flr)		1																				
Total	SVP03	1	0	0	0	1	0	0	1	1	0	0	0	0	3.5	0.5	0.94	100	5.6	7.3	PASS	
Total for FW 01 Pumping Chamber		1	0	0	0	1	0	0	1	1	0	0	0	0	3.5	0.5	0.94	100	5.6	7.3	PASS	
CPCR (Chambers Basement)	SS03	1																				
WCs (Chambers Basement)	SS04	2																				
Total for FW 02 Pumping Chamber		3	0	0	0	3	0	0	0	0	0	0	0	0	6.0	0.5	1.22	100	5.6	7.3	PASS	
WCs (Market Basement)	SS05	3																				
WCs (Market Basement)	SS06	3																				
A WC (Market Basement)	SS07	1																				
Bar/ Servery (Market Basement)	SS08								1	1												
Kitchenette (Market Basement)	SS09								1													
Cleaners Sink (Market Basement)	SS10								1													

Design Notes

Calculation based upon Pozzoni Stage 4 layouts received **XXXXX**

Calculations in line with BS EN 12056-2 Gravity Drainage Systems 2000 - System 3

Hydraulic capacities based on primary ventilated discharge system

Reference Information

BS EN 12056_2 Extracts

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)

4.2 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 path

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.				

6.3.2

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

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

Stack and stack vent DN	System I, II, III, IV Q _{max} (l/s)	
	Square entries	Swept entries
80	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.		

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.

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.

where:

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

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

End

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.			

RADHUB_V2_Above Ground Drainage