GEBERIT

Siphonic Rainwater Systems

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CIBSE CPD

RIBA · CPD ASSESSED MATERIAL ·

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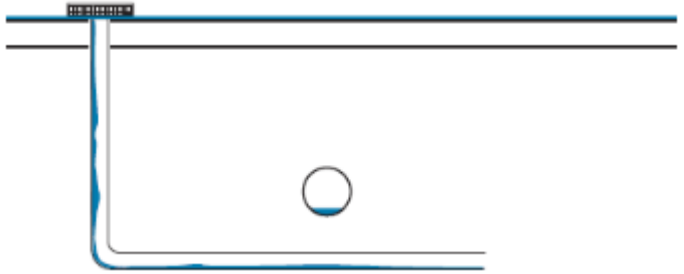
Objective

To differentiate between Gravity and Siphonic Rainwater drainage

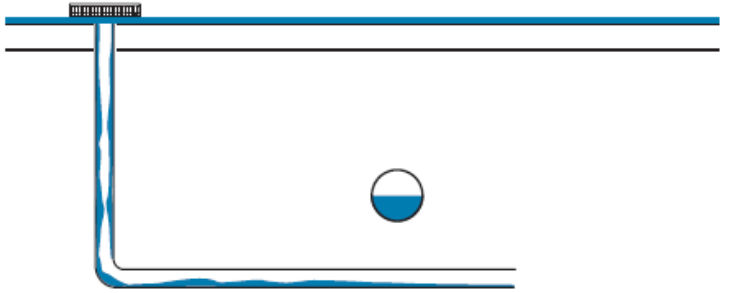
To understand the Principles of Siphonic Rainwater Systems in relation to design criteria and installation

Filling ratio

Conventional

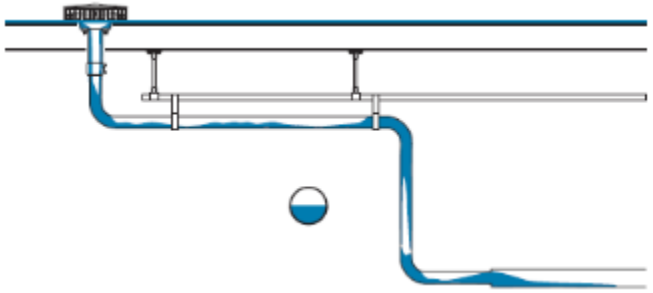


Function with light rain (partial filling)

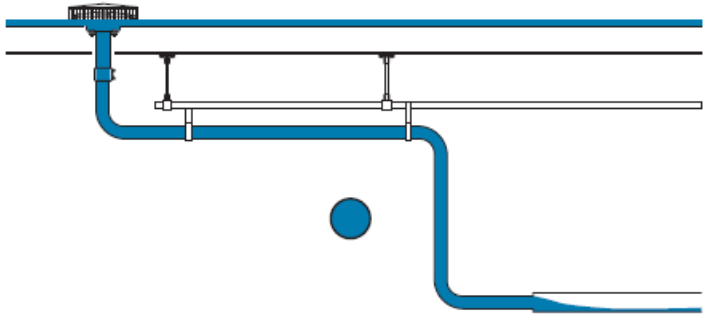


Function with heavy rain (still partial filling)

Geberit Pluvia



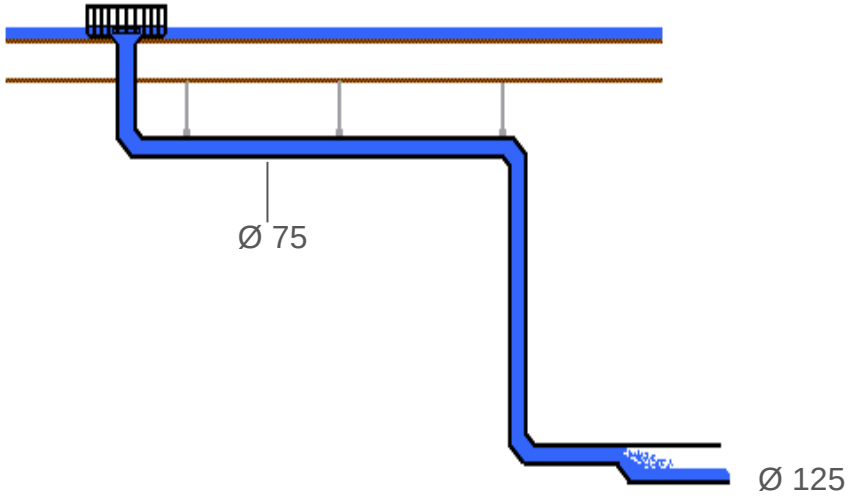
Function with light rain (partial filling)



Function with heavy rain (complete filling)

The siphonic system works with negative pressure, as a result of the full filling

Pipe diameter



Geberit Pluvia

9 l/s Pluvia pipe ø75 mm

Conventional

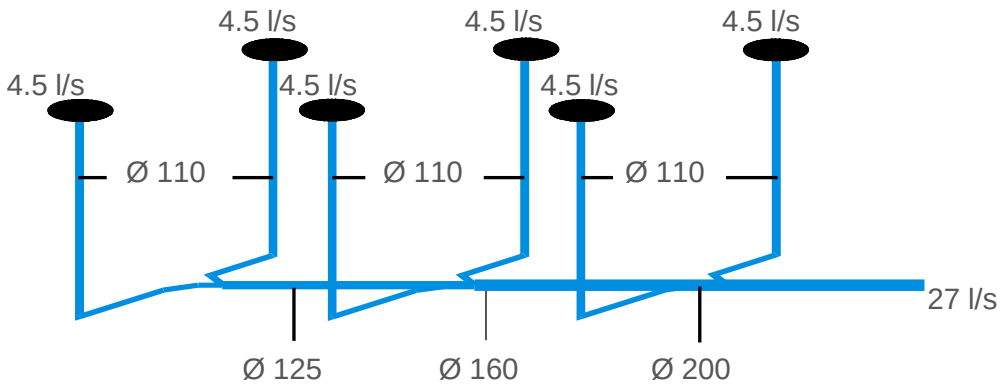
9 l/s conventional pipe ø125 mm

A Pluvia system has approx. ½ diameter of a conventional system

Pipe layout

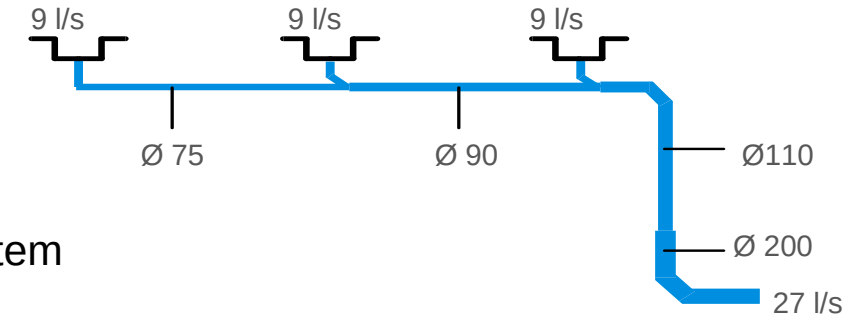
Conventional

- Big number of downpipes
- Many installation ducts needed



Geberit Pluvia

- Less downpipes
- Reduced diameters
- Reduced installation ducts
- Faster completion of installation
- Faster activation of roof drainage system



The Pluvia system allows you a simple pipe layout

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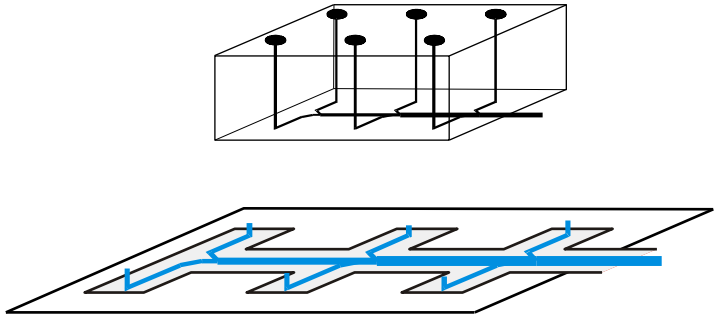
Stormwater network

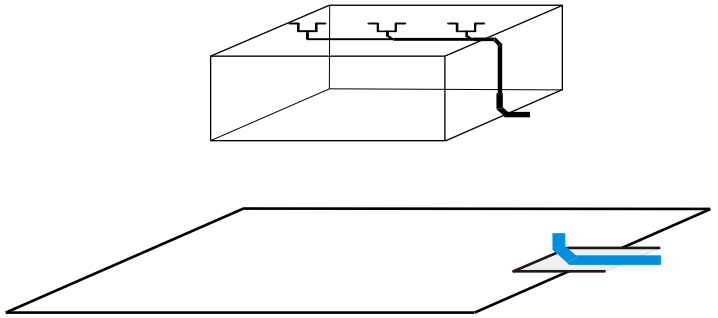
Conventional

- Extended and complex stormwater network
- Extensive excavation work
- Many penetrations through the foundation slab



Geberit Pluvia

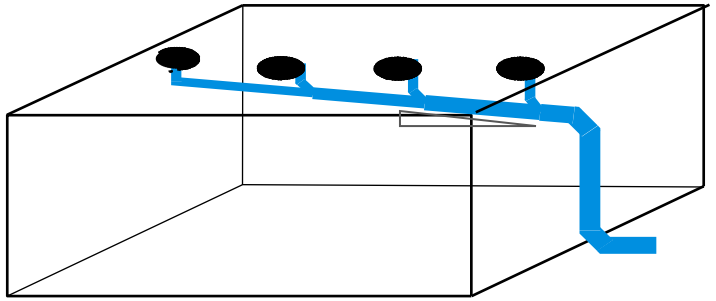
- Lesser underground pipes
- Lesser excavation work



Installation

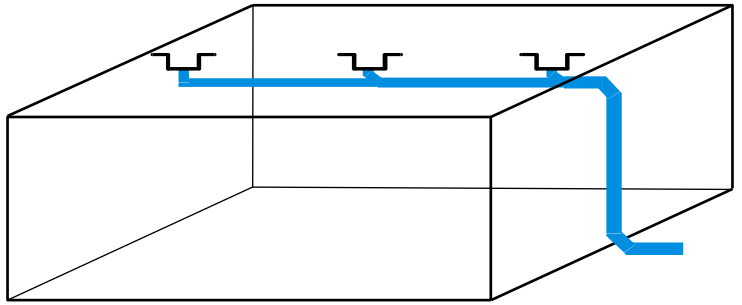
Conventional

- horizontal pipes need slope of 1-3%
- large diameters



Geberit Pluvia

- no slope required
- smaller diameters, higher flexibility
- Freedom of planning



Material requirements

Conventional

- Considerably more material
- Long installation time
- More storage space

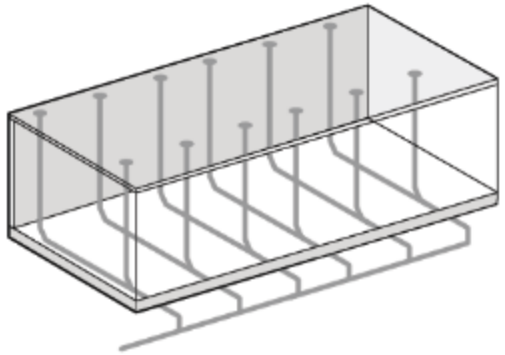
Geberit Pluvia

- Lower material cost
- Long life HDPE- pipes and fitting
- Complete system incl. fastening material
- System warranty

Summary

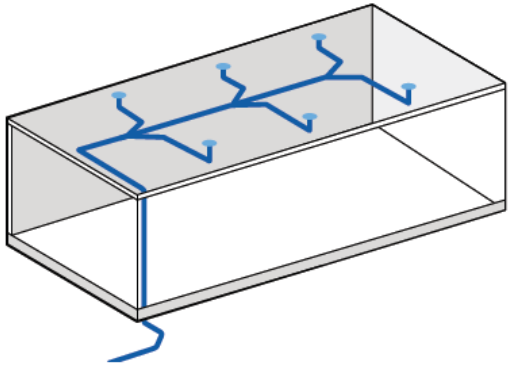
Conventional

- More roof outlets
- Larger pipe dimensions
- Pipe laying with slope
- Many stacks
- Complex underground pipes



Geberit Pluvia

- Less roof outlets
- Smaller pipe dimensions
- Architectonic freedom
- Reduced construction time
- Self- cleaning system due to high flow speed



The Pluvia system allows to drain large roof areas with few roof outlets and stacks

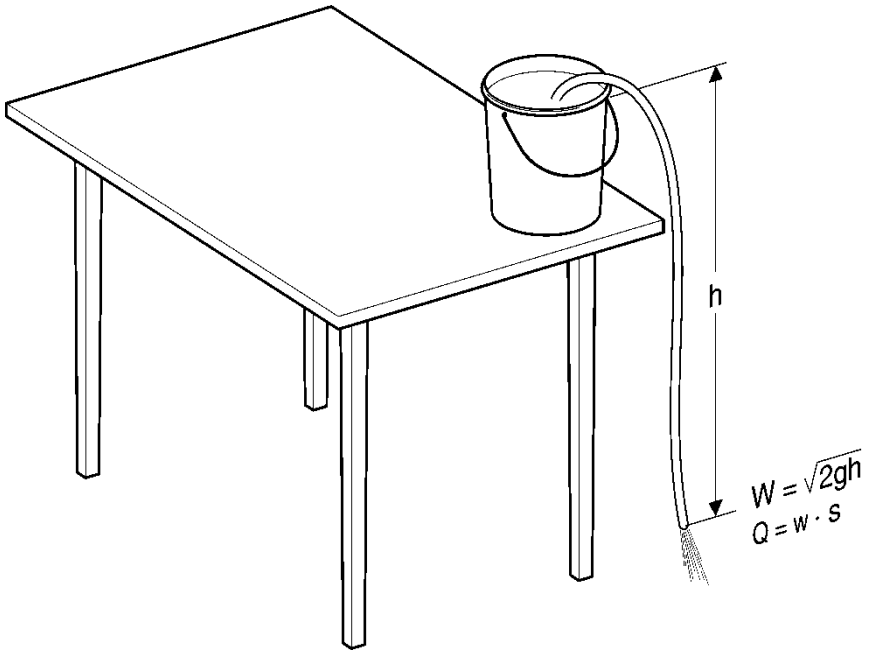
Agenda

- Introduction to Geberit
- How siphonic drainage differs to conventional
- How does siphonic rainwater drainage work ?
- Elements of a siphonic system
- Design of siphonic rainwater drainage
- Summary

Functional principle of the Pluvia system

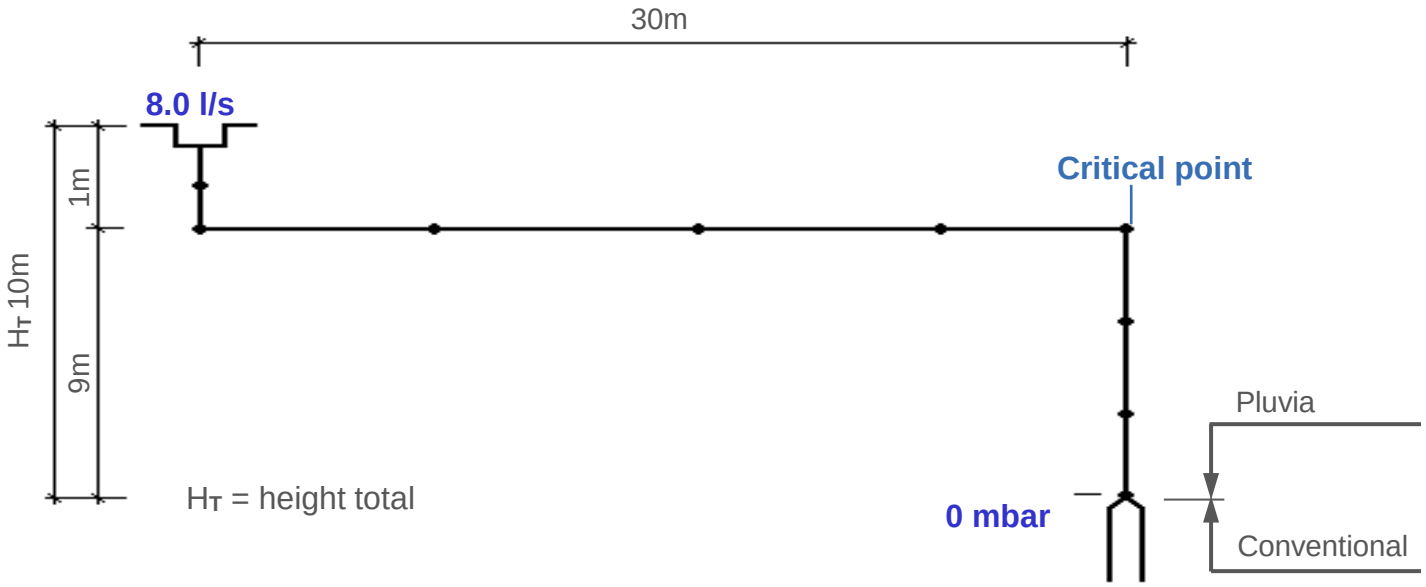
As soon as water enter the hose from the raised bucket, a pressure difference results between the bucket and outlet due to the water column in the system.

As a result, a negative pressure occurs in the pipe system, which causes the rainwater to be quickly sucked off the roof



The Pluvia system use physical principle of negative pressure

Hydraulic principles of Geberit Pluvia-System

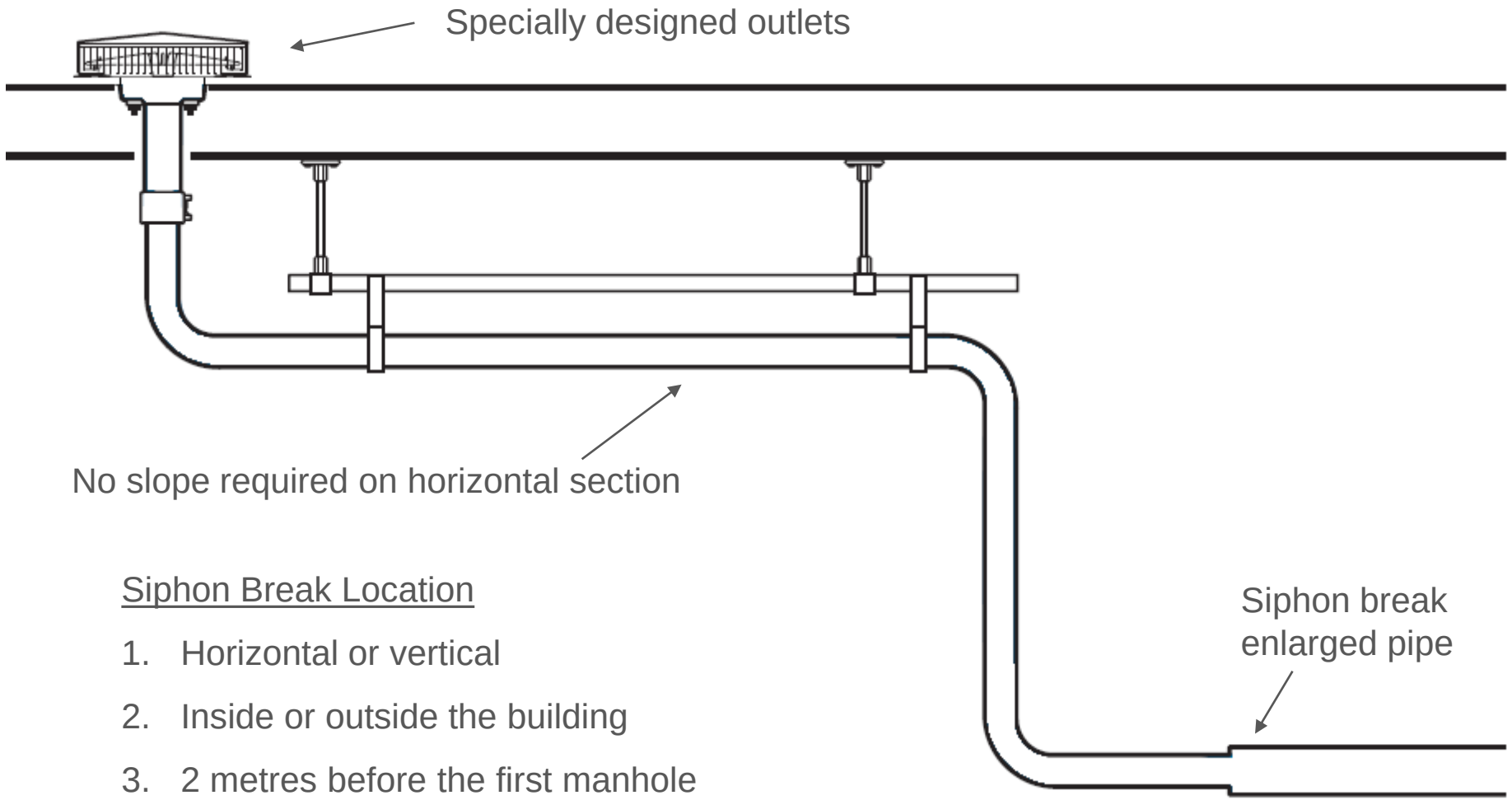


1.) H_T is the engine of the Geberit Pluvia-System, H_T = 10m

2.) The higher H_T, the smaller the pipe diameter

3.) The smaller H_T, the bigger the pipe diameter

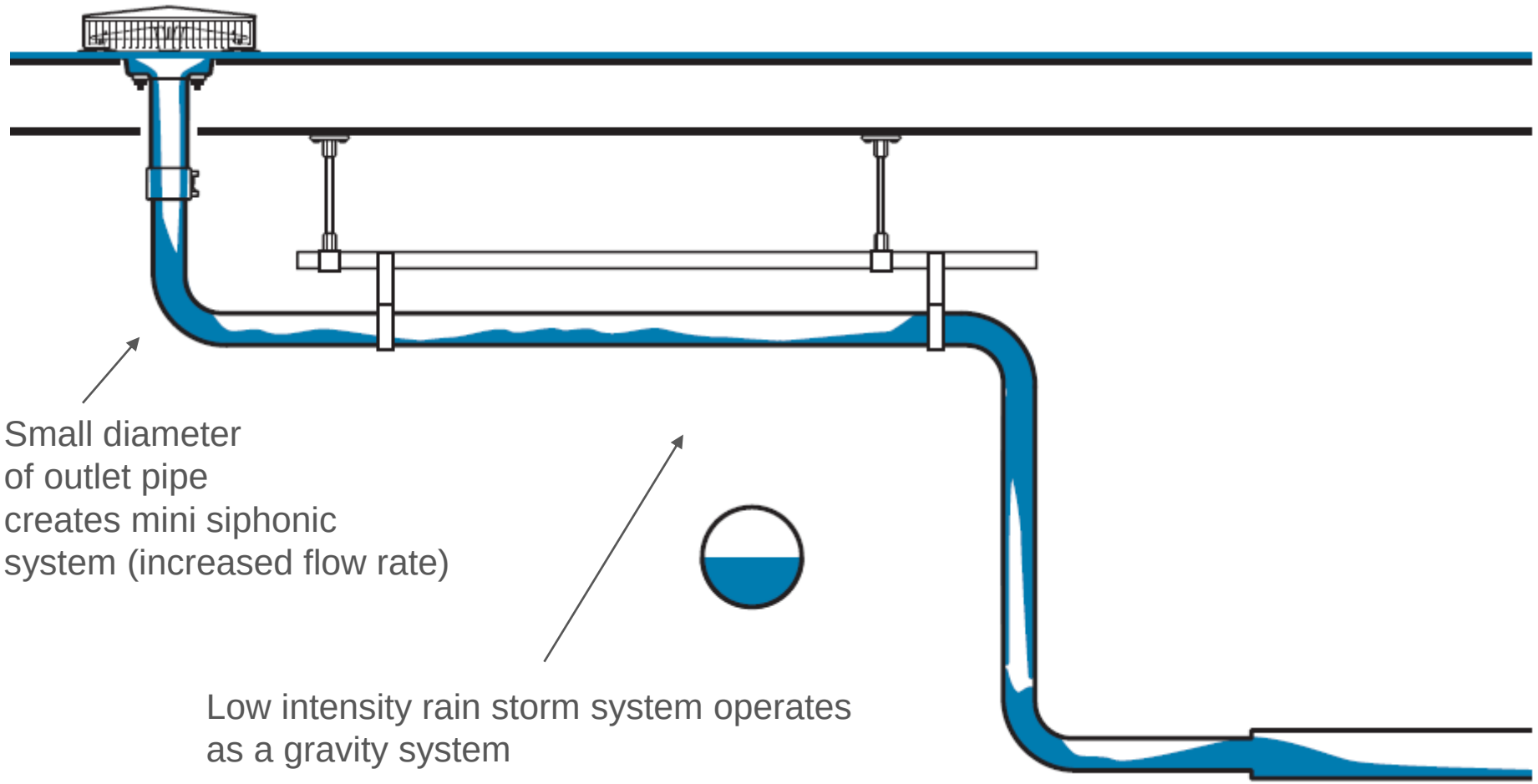
System overview



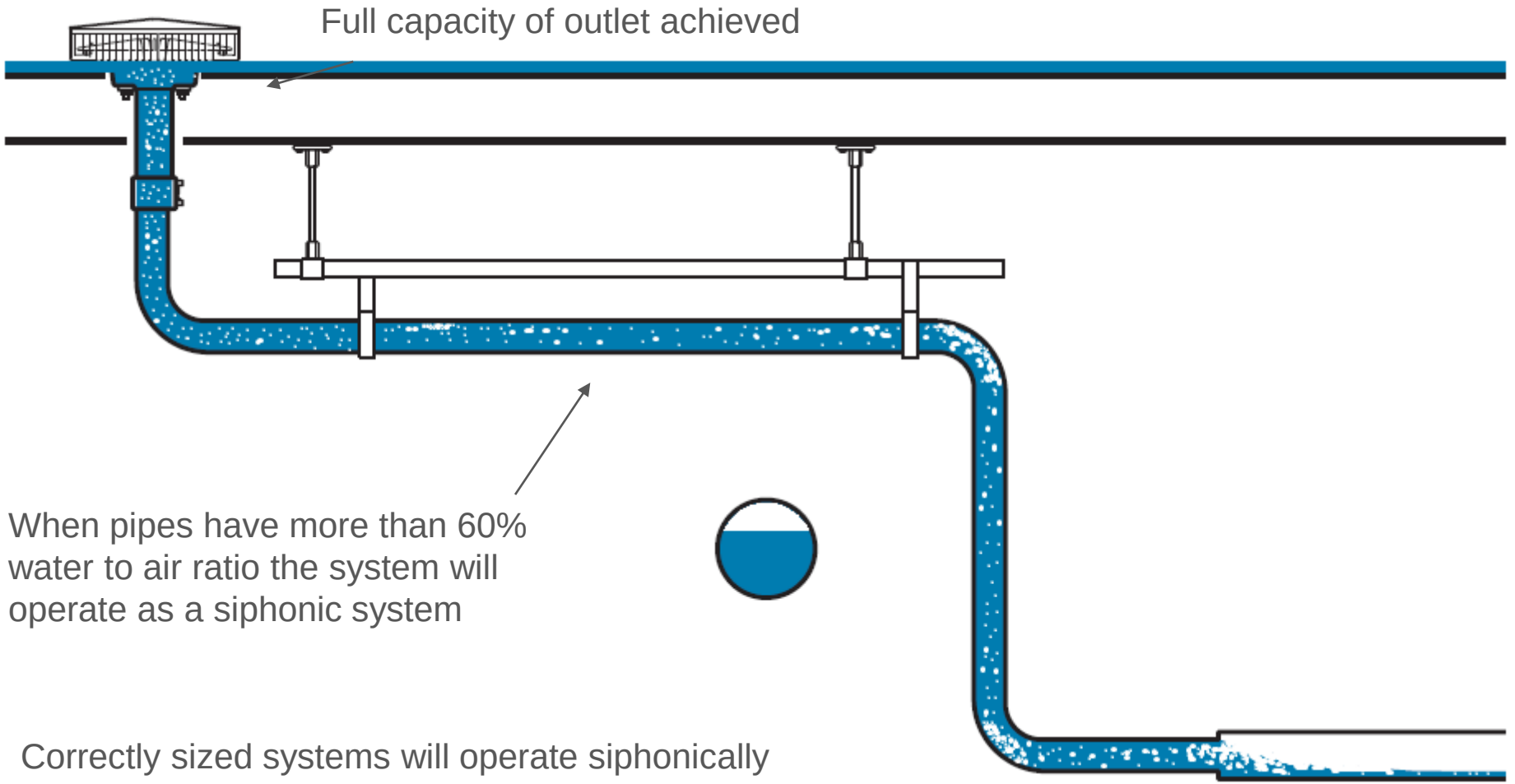
Siphon Break Location

1. Horizontal or vertical
2. Inside or outside the building
3. 2 metres before the first manhole
4. If within the manhole it must be vented

Part load conditions

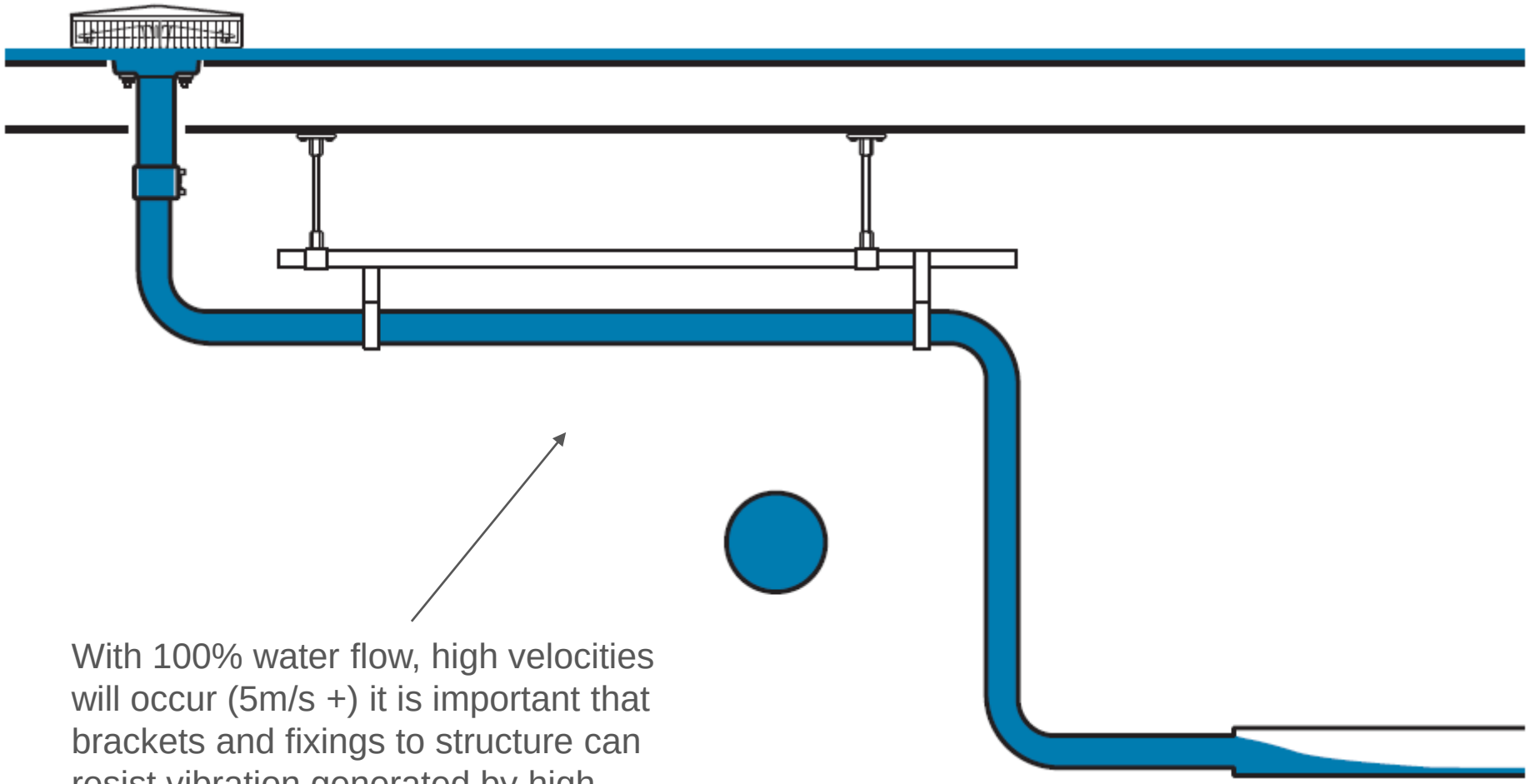


Part load conditions



Correctly sized systems will operate siphonically frequently to aid self-cleansing of the system

Full load conditions



With 100% water flow, high velocities will occur (5m/s +) it is important that brackets and fixings to structure can resist vibration generated by high velocities.

Geberit Drainage Tower

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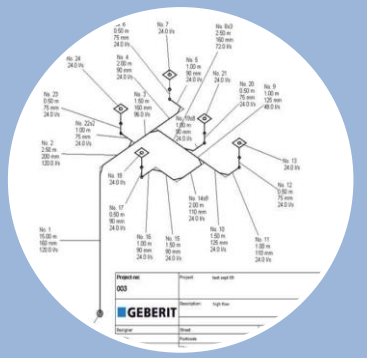
Elements of a system

Roof Outlets

Pipes and fittings

Fastening system

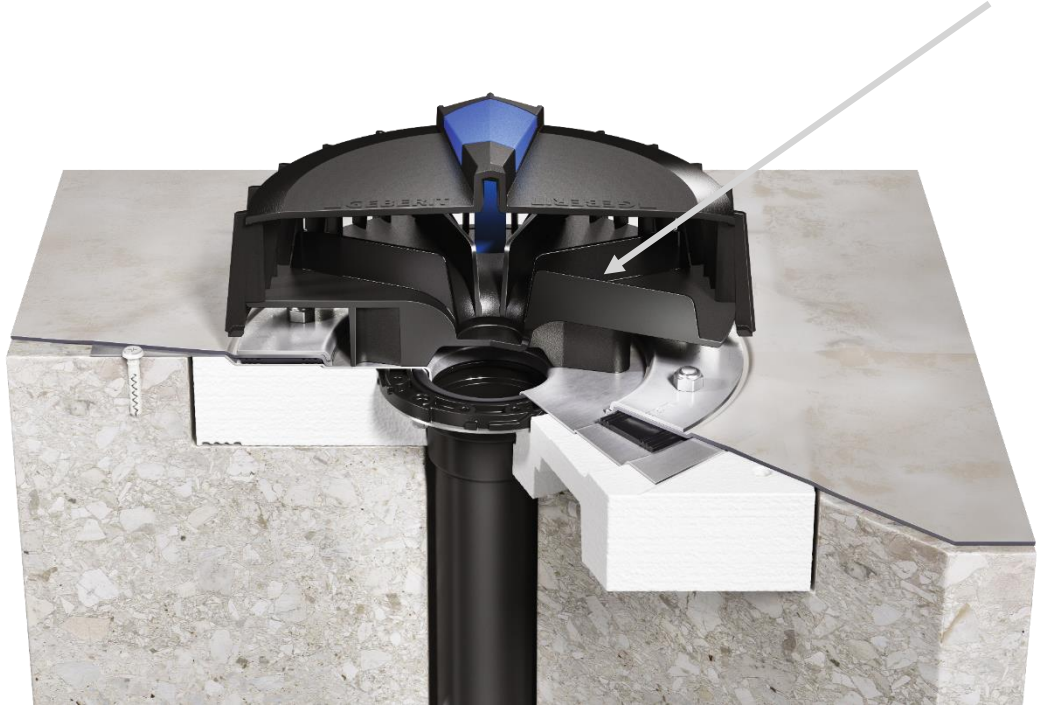


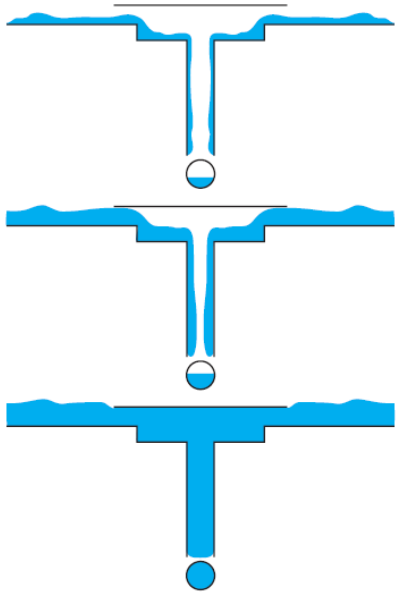
Design service

All must be compatible with each other

Roof outlets

Function disc stops air being drawn into the drainage pipes





Various types and capacities of outlet are available:

1 - 12 l/s and 1 - 25 l/s most commonly used

Pipes and Fittings

Cast Iron

Steel

HDPE

Fusion welding for greatest joint security

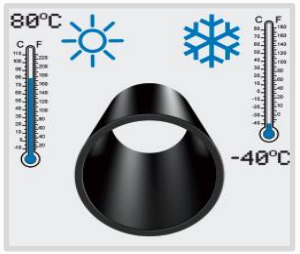
Ideal for prefabrication on/off site

Safe and non-toxic (used in food industry)

Lightweight – easy to handle

High resistance to chemicals

Impact and abrasion resistant



Both heat and cold resistant

Weatherproof and UV resistant

Installation savings in excess of 25% possible

Environmental benefits

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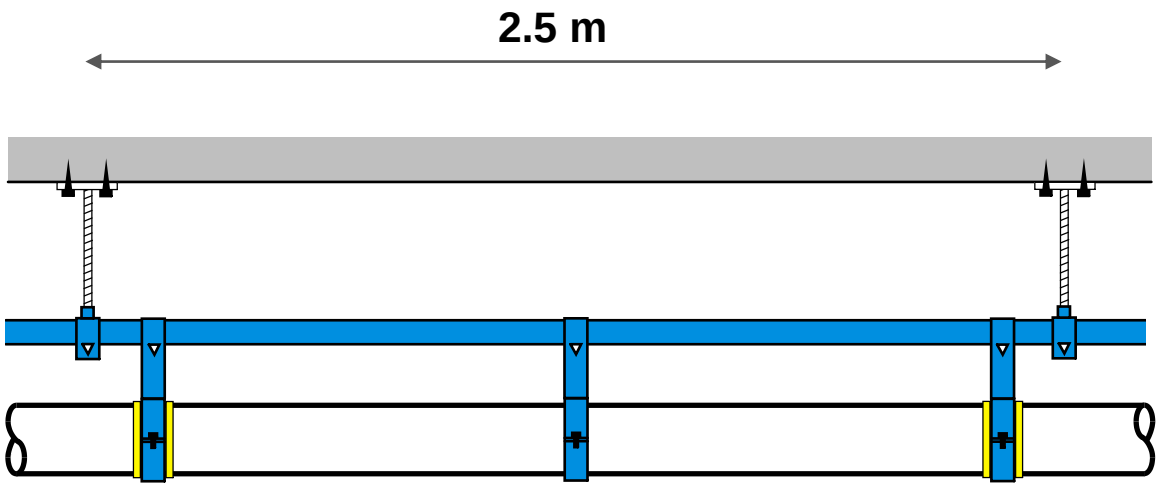
Fastening system

- Quick installation
- Fewer ceiling fastening points
- Rigid installation requires no horizontal expansion compensation
- Simple prefabrication is possible
- One fastening type for anchor and support brackets

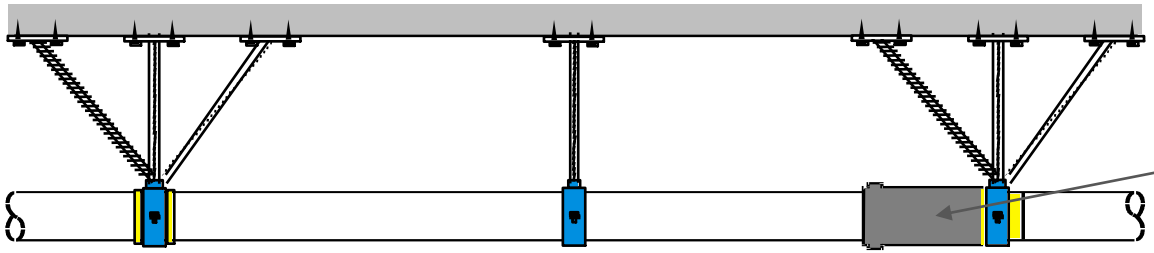
Fixing of the rail system



- Fewer Ceiling Fixing Points
- Quick and Simple Installation

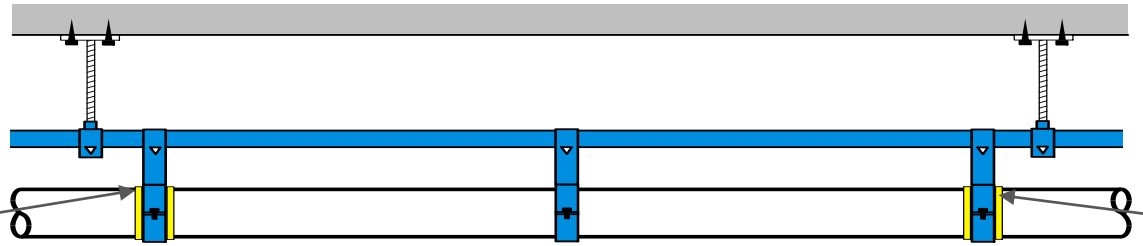
Fixing of the rail system

Conventional Gravity Pipe work Fastening



Direction of expansion

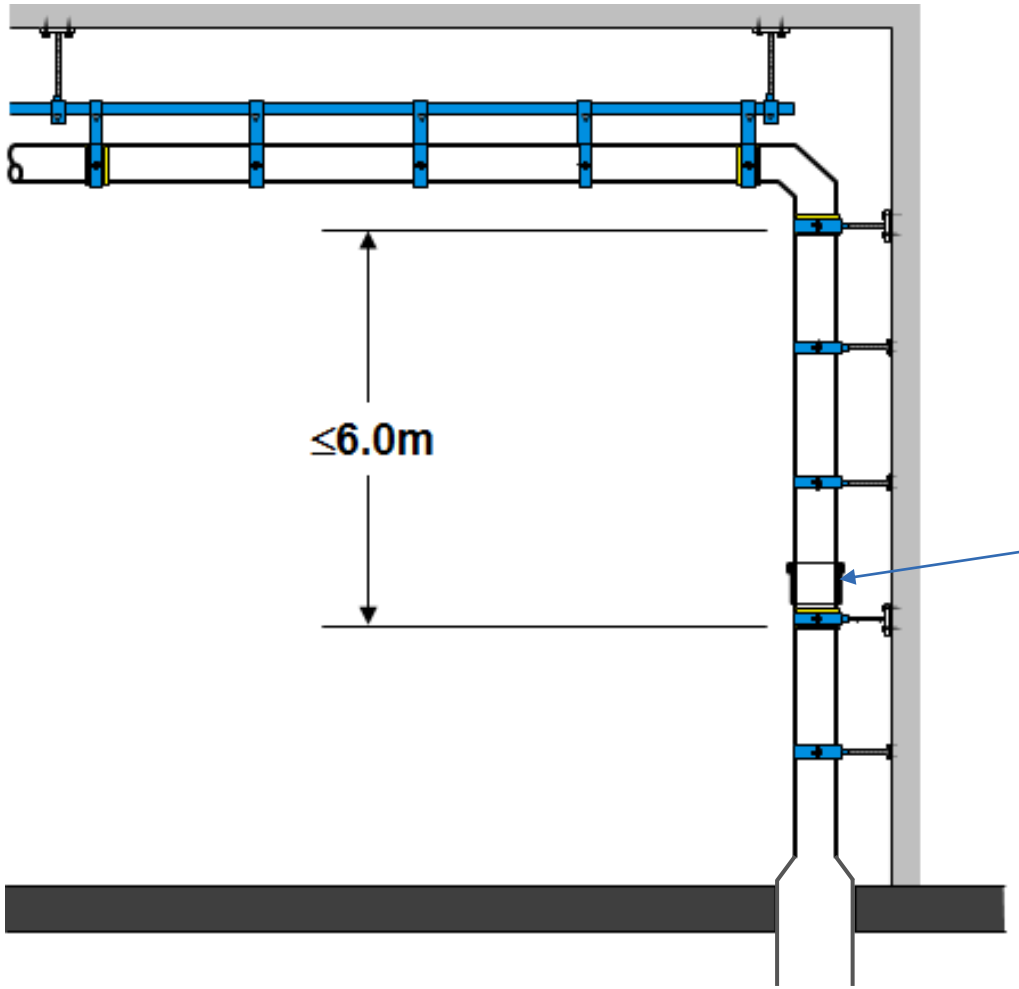
Siphonic Rail fastening system



No horizontal expansion joints used

Fixing of the system

Spacing of brackets and expansion joints on vertical pipework



Design Service

System specific software designed to enable hydraulic calculations for even the most complex roof designs

- Roof layout and other relevant layouts
- Isometric drawings
- Hydraulic calculations
- Full material list including fixings
- Tender documentation including costings

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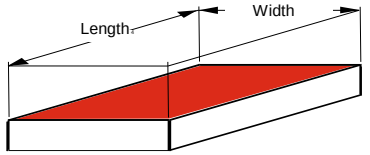
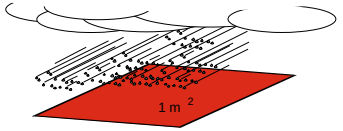
Design overview

1. Calculation of the roof area

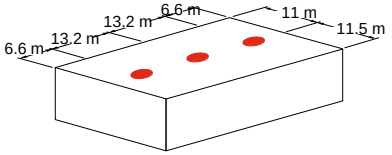


2. Determining the rainfall intensity

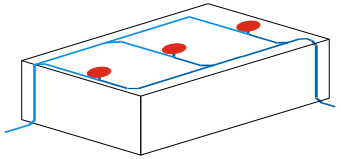


3. Volumetric flow of the roof area

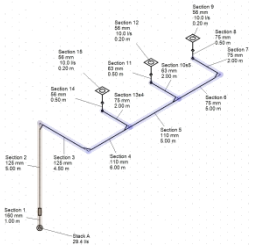
4. Number and position of roof outlets



5. Defining the pipe routing



6. Design software schematic



Prerequisites

Information needed:

Roof plan / layout?

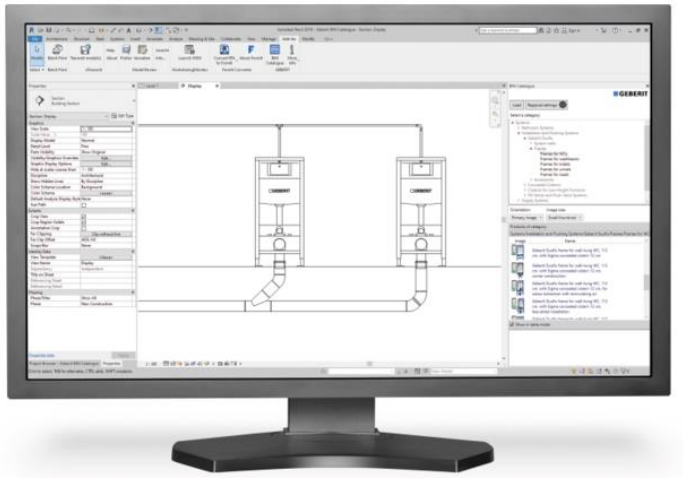
Section drawing?

Core position for the downpipes?

Roof type?

Any “no go” zones within the building?

Areas which might cause obstruction to the pipework



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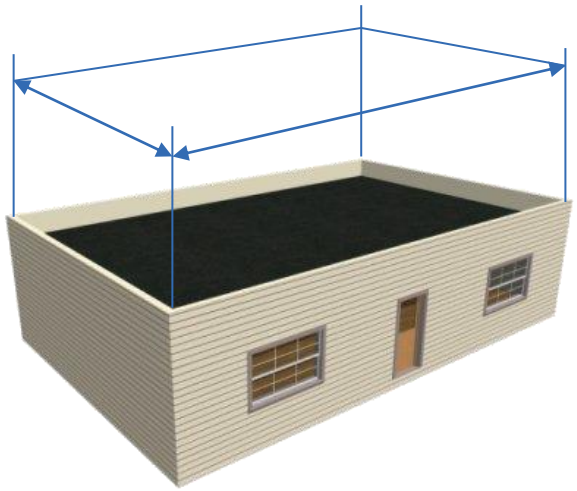
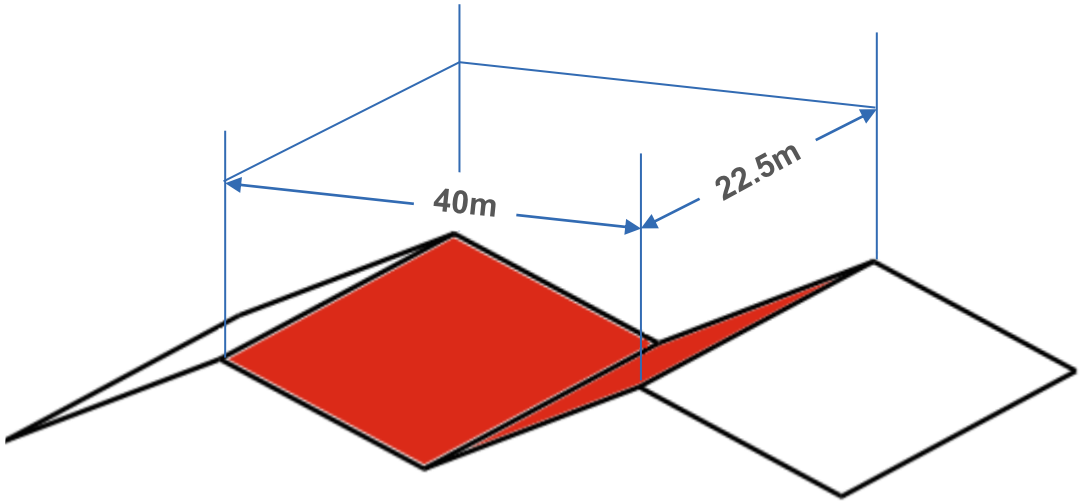


Flat roof



Pitched roof

Formula: Length x Width = Roof Area in m²

40 m x 22.5 m = 900 m²

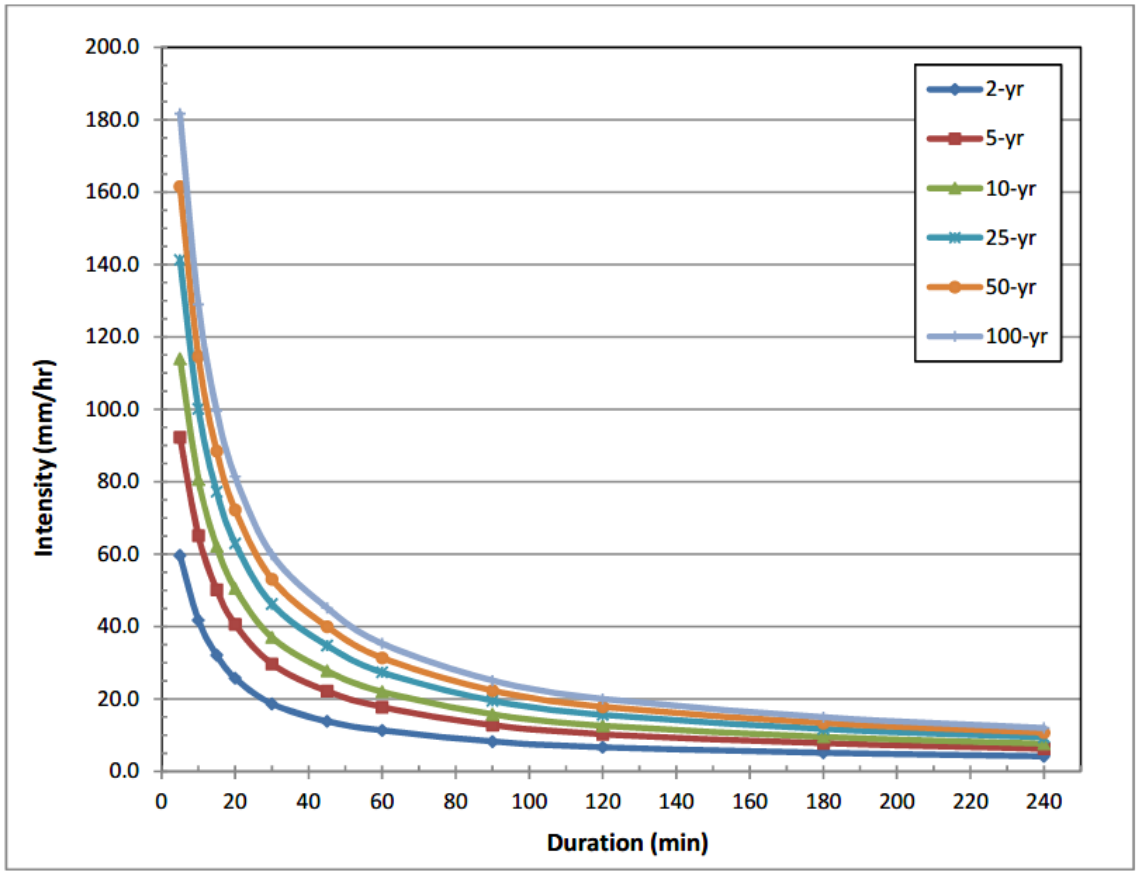
2. Determining the rainfall intensity

If the value for the rainfall is not known, it must be determined with the architect, MEP Consultant and possibly the building insurer. This value is based on the rainfall statistics from the local meteorological institute. The average rainfall per **10 minutes within ten years is recommended.**

Site Class	Note 4	Note 4	Note 4	Note 4	Note 4	Note 4
Precipitation, inches:						
Rainfall, Average Annual	4.3	4.6	3.9	2.8	0.9	3.2
Rainfall Maximum in 24 hours	3.9	2.8	2.0	3.0	0.5	3.1
Rainfall Intensity	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
Isokeraunic Levels (days lightning/year)	24	16	20	11	10	20

See notes at the end of the document.

* Saudi Aramco Engineering Standard



* Dubai Municipality

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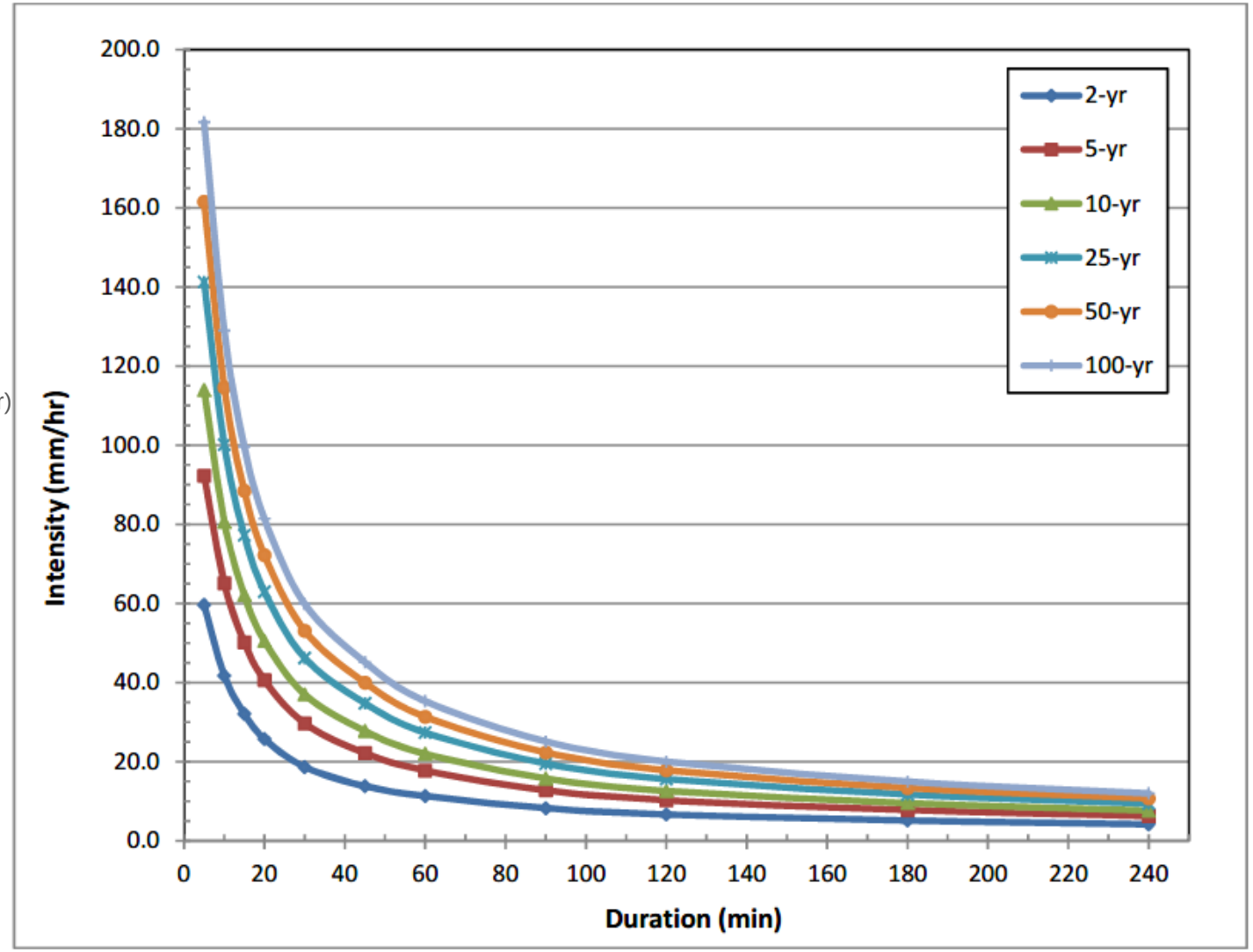
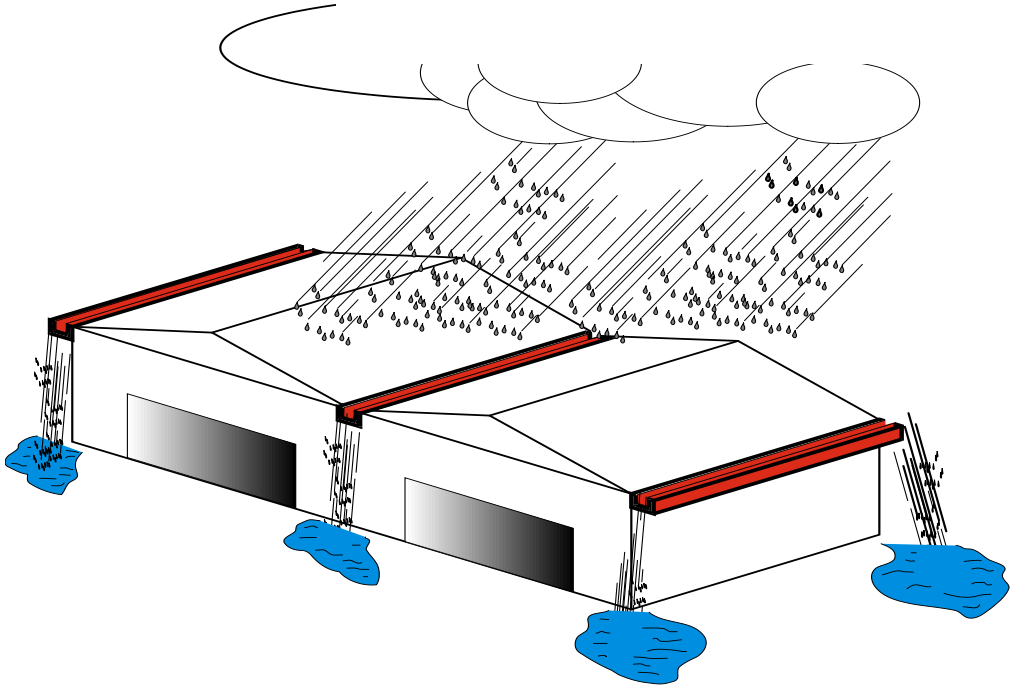
2. Determining the rainfall intensity (Emergency)

$$Q_{NOT} = (r_{(5,100)} - r_{DT} \bullet C) \bullet A / 3600$$

Q_{NO}	Minimum discharge capacity of the emergency
T	Overflows in litres per second
$r_{(5,10)}$	Rainfall in mm per hour and square meter that must be expected once in 100 years
$r_{(D,T)}$	Calculated rainfall in litres per second and square meter (mm/hr)
D	Rainfall duration in minutes
T	Annularity of the rainfall event
C	Capacity factor
A	Effective precipitation area in m2



Geberit recommendation

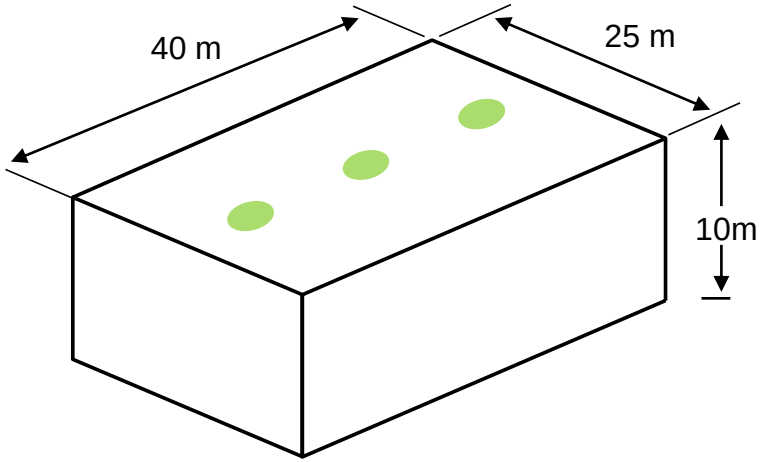


Every roof drainage system can fail under third party influence, so we need an emergency system

Options

1. Oversize the system (not recommended)
2. Provide a secondary siphonic system with adapted outlets
3. Provide an internal gravity overflow system
4. Provide weir overflows through the parapet walls etc.
5. Allow the potential excess to temporarily build up on the roof.

3. Volumetric flow of the roof area



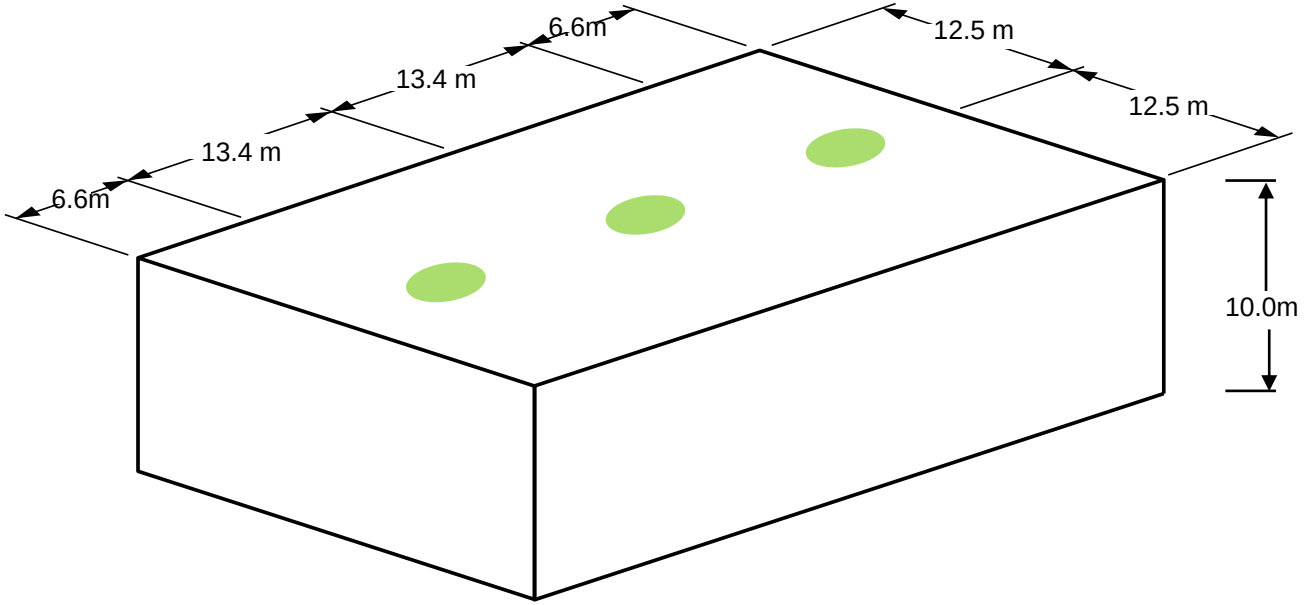
Formula: QR = A x r x C

QR	Rainwater outlet (l/s)
A	Roof area (m^2)
r	Rainfall (l/s x m^2)
C	Capacity factor

Calculation roof area:
40 X 25 = 1000m^2

Calculation Rainwater outlet:
1000m^2 x 0.03 l/s m^2 x 1.0 = 30.0 l/s

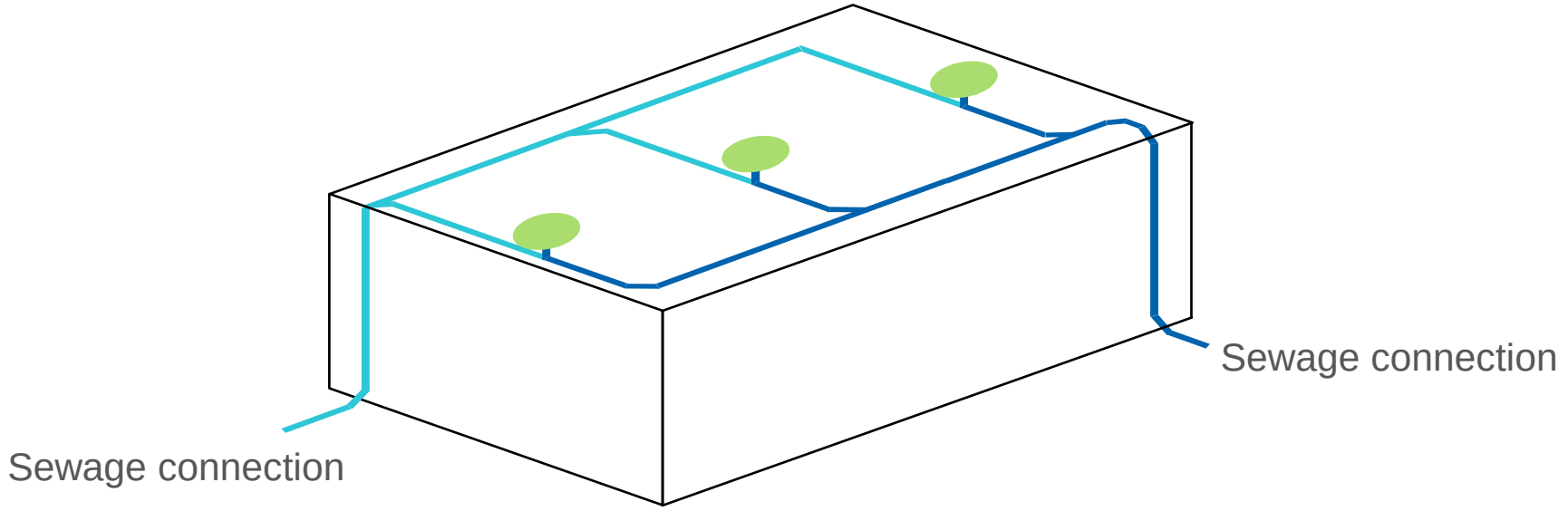
4. Number and position of roof outlets



Formula: $\frac{\text{total amount of rainfall in l/s}}{\text{discharge capacity per outlet l/s}}$ = number of outlets (always rounding up!)

Calculation number of outlets: $\frac{30.0\ \text{l/s}}{12.0\ \text{l/s}}$ = 2.5 => Total 3 outlets of 10.0 l/s

5. Defining the pipe routing



Pipe layout has to be designed in co-ordination with the Architect and MEP Consultant

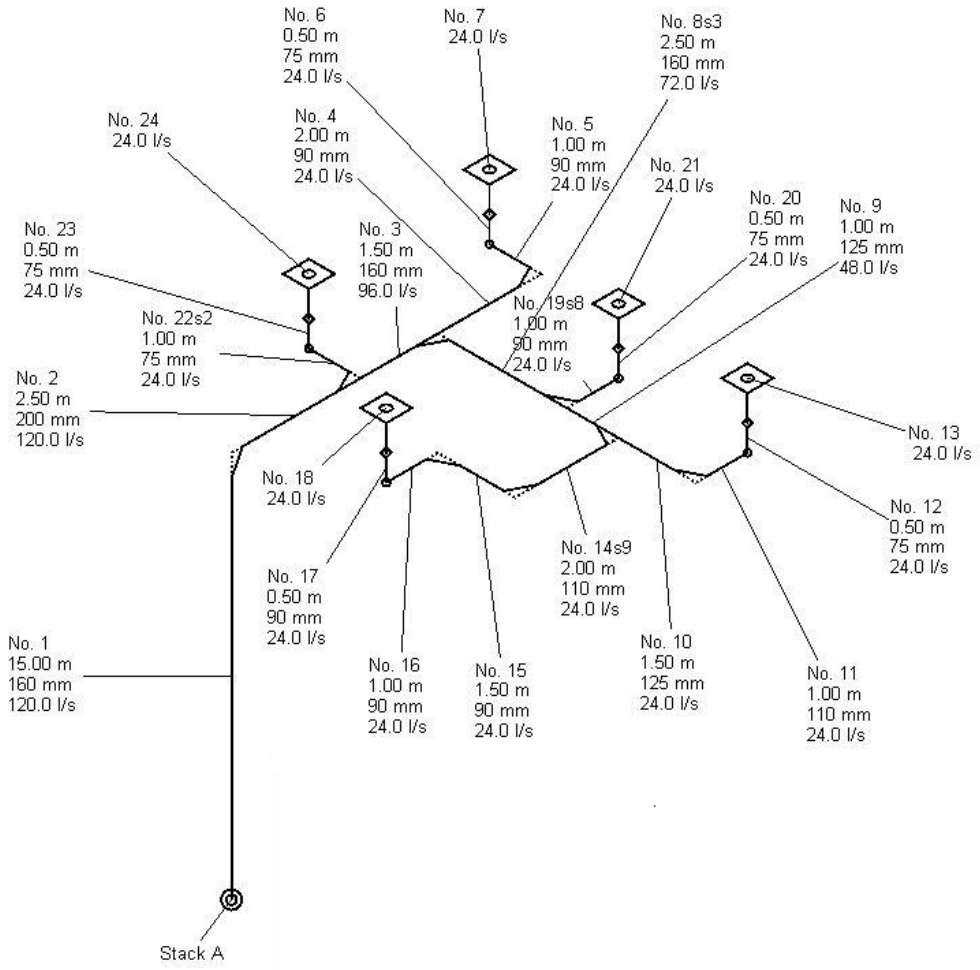
6. Design software schematic

Designer must input:

- Pipe lengths
- Pipe routes
- Flow rate into each outlet

ProPlanner design software will calculate:

- Pipe diameters
- Filling ratio water/air
- Flow velocity and flow rates
- Negative pressures
- System’s capability to operate syphonically



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Summary

1	Siphonic rainwater drainage works differently to conventional
2	Uses negative pressure to operate with full pipework
3	Freedom in design, environmentally friendly, fast installation, self cleansing
4	System of outlets, pipe and bracketry and design software
5	Siphonics use fewer outlets and less pipework
6	Siphonics need careful design to work optimally for the building
7	Siphonic roof drainage is a well-established principle
8	Geberit have over 40 years of experience of siphonic roof drainage

Stay tuned..

- Creating the ideal washroom environment
- Bathroom design behind the wall
- How to make it right – truth or rumour of precision carbon steel?
- **Designing drainage without compromise BS EN 12056**
- Embedding acoustics into design
- **Siphonic rainwater systems**