GF Building Flow Solutions

GF Silenta Premium
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UK Technical information

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How to use this document

Content

Drainage systems are complex services which are essential for a building to be habitable, and are hugely important to ensure the safety and comfort for the building's occupants.

In this document, GF Building Flow Solutions provides the essential information relating to the specification and performance of the Silenta product ranges, as well as the necessary installation requirements in order that each system meets the important standards relating to the planning and installation of gravity drainage systems to safely discharge soil and wastewater within a building's structure.

Throughout this manual we aim to offer useful information to support planners, installers and building operators who have chosen GF Silenta products to protect public health, and to provide decades of trouble-free service.

Information within this document has been written to accompany the published information found within the relevant national and international standards and regulations – BS EN, ISO and Building Regulations.

Detailed instructions for the assembly and operation of Silenta and HT-PP systems can be found in the relevant installation and operating instructions, which are referred to individually later in this manual.

Signs and symbols

Within this manual, distinctive symbols, headlines, and titles are used to highlight particularly important information.

Typographical design elements

Element	Designation	Explanation
☑	Preperation - check point	Condition that must be met before an action, e.g. a planning action, assembly or installation, can be performed.
→	Action, single	Work step, e.g. during component assembly. Several sequential work steps necessary to complete the assembly. Several work steps can also be numbered in ascending order.
↳	Result	Output of a work step or action sequence.
➨	Reference	Reference to another chapter, table, or graphic in this document.
T.1	Title of a table	Tables are numbered this way throughout the document.
G.1	Title of a figure	Pictures, graphics and photos are numbered in this way throughout the document.

This document uses symbols and characters to highlight specific information. The symbols and texts are in shown in boxes highlighted in certain colours.

Symbols

Symbol	Designation	Explanation
i	Information	Highlights information of particular importance.
➨	This symbol refers to chapters in the document or to external sources	Marks references to other book chapters or sources that contain more information.
§	Standards and regulations	Used to identify an excerpt from a regulation, a standard or from useful guidance.
√	Calculation	Calculations (and examples) are marked with this symbol.
⚠	Warning - Personal injury	Used to warn of a hazard that may result in personal injury, e.g. caused by improper use of a tool or incorrect working method.
!	Warning - Damage to property	Used to warn of a hazard that can damage tools, products or objects, e.g. caused by improper use of a tool or incorrect working method.

Polypropylene (PP)

Properties and requirements

The table below shows typical values used to measure the performance characteristics of the material. These values should not be used for calculation purposes but may be applicable to be used as part of a general product specification.

PP (guidelines)

Resin Property	Value	Unit	Method
Melt Index	0.30	g/10min	ASTM D1238
Density	0.89 - 0.91	g/cm³	ASTM D792
Tensile Strength at Yield	320	kg/cm³	ASTM D638
Flexural Modulus	15,000	kg/cm³	ASTM D790
Notched Izod Impact Strength	N.B / 5.0	kg · cm/cm	ASTM D256
Rockwell Hardness	85	R-Scale	ASTM D785
Heat Deflection Temperature	120	°C	ASTM D648
Vicat Softening Point	155	°C	ASTM D1525

General information

Polypropylene (PP) is a versatile, tough, semi-rigid thermoplastic polymer made from propylene, and is one of the world's most common plastics used in everything from car parts, medical devices, and construction products. It's ability to be highly resistant to chemicals and elevated temperatures, whilst being lightweight, strong and flexible, makes it the perfect choice for use in high performance piping systems.

Three different material variants are commonly used to manufacture pipe systems:

- PP homopolymer (PP-H)
- PP block copolymer (PP-B)
- PP random copolymer (PP-R)

Due to the low modulus of elasticity and the high long-term creep strength at high temperatures, PP-R is predominantly used in sanitary products. PP-B is mainly used for sewage systems because of its high impact strength, especially at low temperatures, and PP-H is mainly used for industrial applications.

Resistance to UV and weathering

PP, like most organic materials, will require some general protection from direct UV or prolonged weathering. Although the colour pigments provide some protection, it is not recommended for outdoor use without added measures. It is advisable, when stored in an outdoor location, that the system is protected to prevent any potential damage or contamination from other building products.

For proper protective measures, or for guidance relating to use outdoors, please contact your local office of GF Building Flow Solutions.

Chemical resistance

Whilst PP has excellent resistance to most chemicals, care must be taken when using certain oxidative media to ensure they do not compromise the design life of the product.

At very high concentrations, prolonged exposure to strong disinfectants, such as Chlorine Dioxide or Sodium Hypochlorite, should be avoided. Guidance should be sought from your local office of GF Building Flow Solutions to ensure correct usage of these water treatments.

Limits of use – temperature

The limits of use for the material is based on the embrittlement and softening temperatures as well as the application classes defined within Table 1 - BS EN 1451-1 Plastics piping systems for soil and waste discharge, (low and high temperature) within the building structure — Polypropylene (PP).

For PP Silenta drainage systems, the maximum operating conditions should not exceed –10°C and 95°C.

Fire behaviour

In modern buildings, there are strict regulations governing fire safety and the protection of the building's occupants.

Silenta product ranges have been tested to BS EN 13501-1 - Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests.

Reaction to fire classification:

Silenta Premium: D - s2, d2

Silenta 3A: D - s2, d2

HT-PP: E

Waste Water Pipe System Selection Guide

GF Building Flow Solutions has developed three high performance Polypropylene drainage systems, for use inside a building, intended for the evacuation of wastewater and rainwater.

Selection of the best system for your project is dependent upon the level of priority to be placed on acoustic performance (noise reduction);

Silenta Premium – Maximum acoustic performance

Silenta 3A – Enhanced sound reduction and comfort

HT-PP – Standard applications less sensitive to noise

System Performance Overview

- The acoustic performance is measured in dB(A), representing the noise level transmitted to an adjacent room according to demanding standards (BS EN 14366/BS EN 8233).

System name	Acoustic performance	Key feature
Silenta Premium	12 dB(A) 4l/s	Superior Isolation. The quietest choice, ideal for the most noise-sensitive environments, significantly exceeding the highest comfort classes.
Silenta 3A	15 dB(A) 4l/s	High Performance. Excellent acoustic properties, providing substantial noise reduction and meeting strict comfort standards easily.
HT-PP	Non-Acoustic	Standard performance. An economical drainage system for use where sound transmission will not affect the building's performance.

Comfort Level Classification (BS EN 14366 / VDI 4100)

Drainage system selection depends primarily on the target sound level of the project. Acoustic expectations vary by building type and room function:

- High-End Comfort (SSt III) → ≤20 dB(A) target
- Enhanced Comfort (SSt II) → ≤25 dB(A) target
- Standard Requirement (SSt I / DIN 4109) → ≤30 dB(A) target

GF Building Flow Sloutions wastewater systems are designed to help designers meet these comfort classes depending on the required performance level.

Highest Comfort & Luxury Projects

Target: ≤20 dB(A) (Exceeding BS EN 14366 - VDI 4100 SSt III)

Applications	Recommended System	Requirement Focus
Luxury Apartments, Master Bedrooms, Executive Suites, Hospitals, Premium Residential, High-End Hotels. Hospitals, Libraries, Museums, Quiet Study Areas	Silenta Premium ≤15 dB(A)	Absolute minimum noise transmission. Utilizes the lowest recorded dB(A) level for maximum occupant comfort.
	Silenta 3A	Excellent and reliable performance. Delivers strong sound reduction and fulfils high comfort requirements in most residential and commercial projects

Standard Residential & Commercial Projects

Target: ≤25 dB(A) (BS EN 14366 - VDI 4100 SSt II)

Applications	Recommended System	Requirement Focus
Standard Apartments, Mid-Range Hotel Rooms, General Offices, Dormitories, Retail Stores, School Classrooms and Lecture Halls	Silenta 3A	Guaranteed compliance with high-comfort standards. Provides a noticeable reduction in sound emitted from a drainage system.

Habitable/technical areas where noise can be isolated or is unimportant.

Target: ≤30 dB(A) (DIN 4109/ BS EN 14366 - VDI 4100 SSt I Minimum Legal Standard)

Applications	Recommended System	Requirement Focus
Basements, Parking areas, Storage Rooms, Remote Shafts, Technical Rooms, Workshop areas	HT-PP	Cost-effectiveness. Only suitable when the plumbing noise will not transfer to any adjacent or connected habitable space.

GF Silenta Premium

Additional technical and sales information

More technical information about this system and other ordering information: ➨ website and sales catalogue

System Overview

- GF Silenta Premium is a 3-layer, sound-insulated drainage system, providing the highest level of noise reduction combined with advanced level durability, impact resistance, and easy installation.
- Offering a wide product range, allowing designers and installers complete design freedom, GF Silenta Premium is intended for use for non-pressurised domestic drainage systems designed in accordance with BS EN 12056 parts 1-5, CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage).
- Low friction internal linings reduce the chance of blockages, and due to the light grey internal colouring, GF Silenta Premium makes any internal examination extremely easy.
- GF Silenta Premium is tested by the world renowned Fraunhofer Institute in Stuttgart, Germany.

Benefits

- Highest performance sound insulation ensures ultimate occupant comfort
- Highly resistant to elevated temperatures and chemical attack
- Halogen-free, does not release harmful halogenic gases in the event of fire
- Low-friction internal linings prevents blockages
- Fast installation with no need for specialist tooling
- 100% recyclable and environmentally friendly
- Highly durable and no risk of corrosion
- Wide range of fittings and pipe lengths
- No need for specialist expansion compensation fittings
- Manufactured and tested to BS EN 1451
- BBA (certification pending) and EPD certified.

Fields of Application

GF Silenta Premium is intended for the purposes of evacuating wastewater and rainwater from the following building types;

- High-end residential
- High-rise multi-family residential
- Schools, libraries, hospitals, hotels
- Office buildings, laboratories
- Conference halls and places or worship
- Industrial or commercial buildings
- Sustainable / green buildings

Connected services may include, but are not limited to;

- Domestic sewage water and rainwater
- Domestic wastewater from kitchens, bathrooms, laundry rooms, toilets and similar spaces
- Washing and toilet facilities in commercial or industrial buildings or other facilities that serve other purposes, but are equivalent to domestic wastewater.

Wastewater produced by commerce and industry

When using GF Silenta Premium to discharge untreated industrial or commercial wastewater and effluents which may contain harmful substances, the suitability of the pipe materials, fittings and gaskets must be checked in accordance with the table Chemical Resistance Polypropylene (for Polypropylene, refer to ISO/TR 10358:2021). These resistance lists are to be used as a reference guide only as the Silenta range also utilises materials other than Polypropylene. For complete assurance as to the suitability of the system for use in special applications, please contact your local GF office for advice.

The following information is required for an assessment and decision on suitability:

- Information on the individual substances
- Concentration and pH values
- Information regarding quantities and throughputs
- Temperatures of the wastewater

Installing pipes in concrete or screed within the building

Standard concrete or scred will not damage the materials used to manufacture Silenta Premium.

GF Silenta Premium drainage is suitable for embedding in concrete or screed within the building. However, each installation must fully comply with GF manufacturer's instructions.

Among other things, these requirements include:

- The proper fastening and securing of the connections in order to prevent the pipes and fittings from separating - clamps are the most suitable choice. In particular, this applies in areas where pipes change direction.
- Consideration for the expansion of the pipes under the influence of temperature.
- Once installed, mask the sockets with a suitable adhesive tape in order to prevent concrete from entering the connection and possibly compromising the sealing elements.
- Leak test before pouring the concrete.
- Prior to pouring of the concrete, the system should be filled with water in order to increase its weight, preventing it from floating on top of the concrete during the pour.

Approvals

System approvals

Full information relating to approvals and certifications can be found at www.georgfischer.com/en/our-solutions/gf-building-flow-solutions

Country	Institute
Germany	DiBt, SKZ
Austria	Austrian Standard - Certification Pending
Netherlands	KIWA - Certification Pending
Denmark	ETA-DANAK - Certification Pending
Sweden	KIWA SwedCert - Certification Pending
Norway	Sintef - Certification Pending
Italy	IIC/KIWA IT - Certification Pending
Poland	PZH, ITB
France	CSTB - Certification Pending
Spain	AENOR - Certification Pending
UK	BBA - Certification Pending
Türkiye	TSEK - Certification Pending

System components

GF Silenta Premium pipes are co-extruded using an innovative 3-layer technology. The outer layer made from robust Polypropylene (PP) is impact resistant and protects the system against mechanical damage. The middle layer constructed from a specially formulated, high density, mineral-reinforced polypropylene is designed to absorb all but the highest levels of sound.

Ensuring that noise within a building is controlled and eliminated, is essential to meet the requirements of BS EN 8233 and the Approved Document E (or other relevant UK National Standard).

Finally, the inner layer, which is also manufactured using Polypropylene (PP), has a low-friction, abrasion resistant surface to prevent the build-up of any deposits and encrustations. The robust lining protects against erosion or damage of the pipe by aggressive media.

Pipe layout

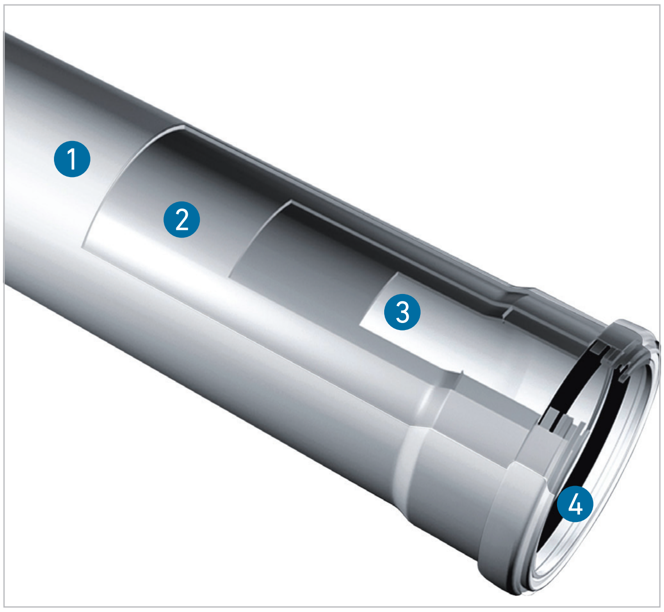
The design of the GF Silenta Premium pipes is characterised as follows:

1 The outer layer is made of PP: Robust and resistant to mechanical
and thermal stress during operation and during processing.

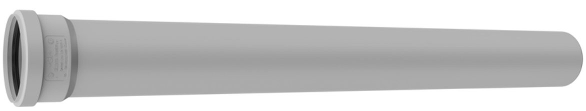
2 The layer in the centre is made of mineral-reinforced PP: The high mass weight ensures sound absorption and reduces the transmission of sound waves.

3 The inner layer is made of PP: Resistant to domestic wastewater. The smooth and abrasion-resistant surface prevents encrustations and ensures perfect and quiet drainage behaviour.

4 Special Gasket System: Guarantees water tightness due to its special gasket structure. The geometric properties of the gasket housing ensures a fast, reliable installation.



Components

Components	Examples of components
Pipes	
Moulded Parts	   
Clamps	 

Technical data

Property	Value
Design	3-layer pipe system (Special PP-Mineral reinforced composite)
Diameters [mm]	d58, d78, d90, d110, d135, d160, d200
Pipe length [mm]	150, 250, 500, 1000, 2000, 3000
Sound transmission	12 dB(A) at 4 l/s (BS EN 14366)
Fire Class	D-s2, d2 according to BS EN 13501-1
Jointing method / Connection	Jointing with Rubber Gasket and Socket (Push-Fit)
Attachment / Clamping	With Silent Clamps (GF or third party)
Color	Light Grey (Halogen-free and Cadmium-free) (RAL 4102)
Installation	Very easy to install thanks to its weight lower than cast-iron pipes, thanks to push fit system, easier installation compared to welded or cemented plastic systems
Thermal expansion coefficient	0.04 mm/(m·K)
Tensile strength	13 N/mm^2
Chemical resistance	Resistant to organic and inorganic chemical environments and to domestic wastewater and industrial wastewater with pH 2 − pH 12 Wherever chemically aggressive wastewater is used (e.g. for industrial applications), it is suitable for pH 2 to pH 12. An individual case assessment can be requested from GF specifying the composition of the respective wastewater and the operating conditions.
Installation temperature	Minimum: -10 °C Maximum: 60 °C
Operating temperature	Minimum: -10 °C Maximum: 97 °C
Application class	B (inside a building)
Ring stiffness	BS EN ISO 9969. The ring stiffness is at least 4.0 kN/m^2 over the entire dimension range: 58 mm to 200 mm
Impact Strength	Complies with TSEK 169
Density	Pipes: 1.66 g/cm; Fittings: 1.68 g/cm^3 (DIN 53479)
Maintenance	Negligible maintenance cost compared to metal based systems
Permissible ambient temperature	Between –20 °C and 60 °C
Permissible wastewater temperature	For domestic wastewater between 0 °C and 90 °C, briefly up to 97 °C

Classification of nominal dimensions

According to BS EN 1451, the nominal size (DN) is a parameter that indicates the diameter of the pipe system used.
GF Silenta Premium is available in the following pipe sizes and wall thicknesses:

Nominal diameter DN [mm]	S Series	Outer diameter d [mm]	Inner diameter d_i [mm]	Wall thickness e [mm]
50	14	58	49.8	4.1
70	14	78	68.8	4.6
90	14	90	80.6	4.7
100	14	110	99.4	5.3
125	14	135	124.4	5.3
150	16	160	149.4	5.3
200	16	200	187.6	6.2

Sound Insulation Performance

Sound insulation is the capability of the system to suppress vibrations that occur within the pipes used to discharge wastewater and rainwater from within the building.

GF Silenta Premium has been specially engineered to include many features to ensure the ultimate performance in relation to sound suppression.

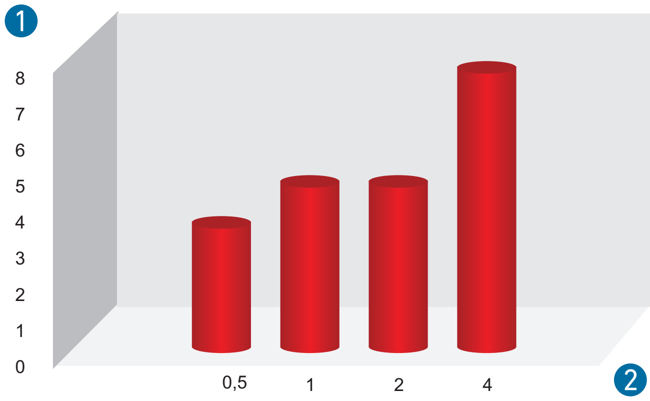
Causes of sound within a drainage system;

- Flushing and discharge from appliances or services
- Flow of water and solids
- Clogging in the direction of flow
- Joints and connections
- Incorrect system design
- Incorrect installation
- Incorrect ventilation

When water is discharged into a drainage system, the sudden flow of water and material can cause turbulence within the system which can result in both negative and positive pressure within the same pipe system. Unless the design has considered all of the dynamics of the air and water flow characteristics, noises may occur that could transmit into the building structure.

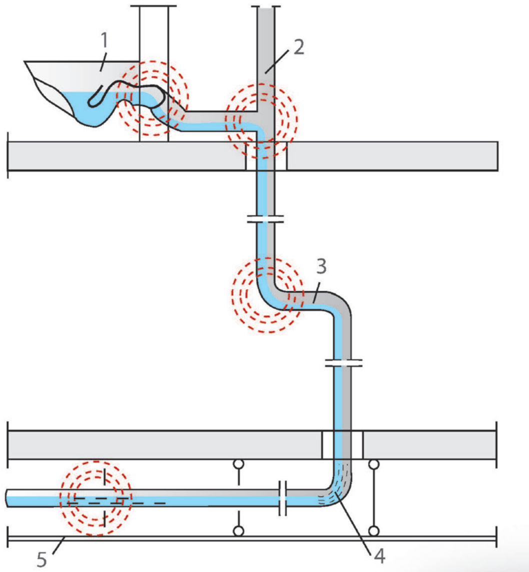
Wherever there is a change of direction of the water flow, special consideration must be made to ensure that these transitions are as gradual as possible to prevent unwanted noise. Water pathways should use long radius bends and the correct sizing of pipes at these points is essential to maintain a healthy system.

Fast 90° bends should be avoided at points within the system that experiences high flow. Off-sets within the stack must be considered, especially when calculating the method of ventilation. Guidance on correct methods of ventilation and sizing should be sought from industry standards such as CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage).



G.3 *Sound performance*

1 Sound performance
2 Water flow velocity (l/s)



G.2 *Source of sound*

Fig. No.	Item	Sound of source	Description
1	Flushing	Discharge of water from sanitary fixtures such as toilets or basins	Sudden water flow and pressure changes at the entry point of the system
2	Joints	Pipe connections	Vibrations and resonance occurring at coupling points
2-3	High water speeds	Excessive water velocity in the system	Increases noise level in vertical stacks and direction changes
3	Discharge	Flow transition in main stacks	Impact noise where vertical stack connects to horizontal branch
4	Clogging of the flowing direction	Partial blockage or restriction in the flow path	Deposits or improper slope causing turbulence and noise in horizontal sections
4-5	Wrong planning	Incorrect layout or slope of the pipeline	Backflow, partial filling, or resonance due to improper installation
5	Faulty design	Insufficient support or poor material choice	Noise transmitted through pipe clamps or building structure

GF Silenta 3A

Additional technical and sales information

More technical information about this system and other ordering information: ➨ website and sales catalogue

System Overview

- GF Silenta 3A, is a 3-layer, sound-insulated drainage system, providing an excellent level of noise reduction combined with advanced level durability, impact resistance, and easy installation.
- Offering a wide range of fittings allowing designers and installers complete design freedom. GF Silenta 3A is intended for use for non-pressurised domestic drainage systems designed in accordance with BS EN 12056 parts 1-5, CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage).
- GF Silenta 3A is intended for use in above ground installations within a building (application area B). It is not intended for use in underground or within a poured concrete surface outside the building.
- Low friction internal linings reduce the chance of blockages, and due to the light coloured internal lining, GF Silenta 3A makes any internal examination very easy.
- GF Silenta 3A is tested by the world renowned Fraunhofer Institute in Stuttgart, Germany in accordance with BS EN 14366.

Benefits
- High performance sound insulation ensures occupant comfort
- Highly resistant to elevated temperatures and chemical attack
- Halogen-free, does not release harmful halogenic gases in the event of fire
- Low-friction internal linings
- Fast installation with no need for specialist tooling
- 100% recyclable and environmentally friendly
- Highly durable and no risk of corrosion
- Wide range of fittings and pipe lengths
- No need for specialist expansion compensation fittings
- Manufactured and tested to BS EN 1451

Fields of Application

GF Silenta 3A is intended for the purposes of evacuating wastewater and rainwater from the following building types;
- High-end residential
- High-rise multi-family residential
- Schools, libraries, hospitals, hotels
- Office buildings, laboratories
- Conference halls and places or worship
- Industrial or commercial buildings
- Sustainable / green buildings

Approvals

System approvals

Full information relating to approvals and certifications can be found at www.georgfischer.com/en/our-solutions/gf-building-flow-solutions

Country	Institute
Germany	DiBt, SKZ - Certification Pending
Austria	Austrian Standard - Certification Pending
Netherlands	KIWA - Certification Pending
Denmark	ETA-DANAK
Sweden	KIWA SwedCert
Norway	Sintef
Italy	IIC/KIWA IT - Certification Pending
Poland	PZH, ITB
France	CSTB - Certification Pending
Spain	AENOR
UK	BBA - Certification Pending
Türkiye	TSEK, EPD - Certification Pending

System components

Pipe layout

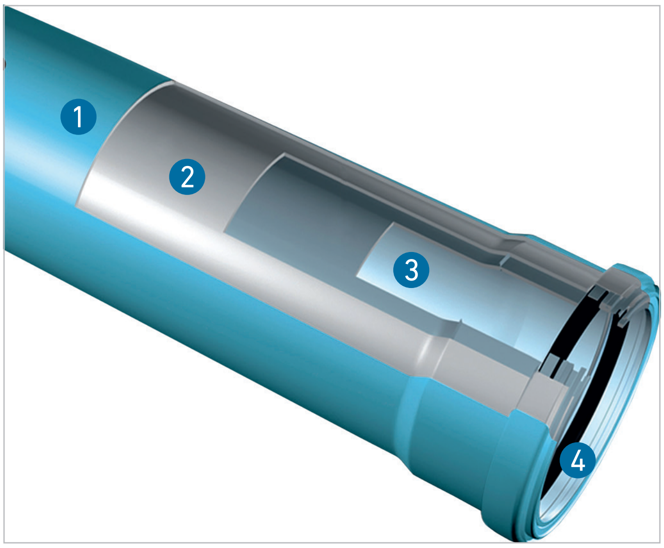
The design of the GF Silenta 3A pipe is characterised as follows:

1 Outer layer: Is resistant to high temperatures and impacts.

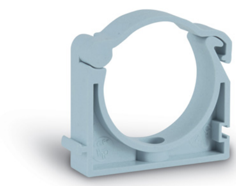
2 Middle layer: With its high density molecular structure and special composite formula, the sound waves are absorbed and prevented.

3 Inner layer: Manufactured using Polypropylene (PP), has a low-friction, abrasion resistant surface to prevent the build-up of any deposits and encrustations. The robust lining protects against the erosion or damage of the pipe by aggressive media.

4 Special Gasket System: Guarantees water tightness with its special gasket structure providing ease of assembly. The geometrical properties of the gasket housing ensures fast and easy installation.



Components

Product group	Examples of components
Pipes	
Moulded Parts	  
Clamps	  

Technical data

Property	Value
Design	3-layer pipe system (Special PP-Mineral reinforced composite)
Diameters [mm]	d32, d40, d50, d75, d110, d125, d160, d200
Pipe length [mm]	150, 250, 500, 1000, 2000, 3000
Sound transmission	15 dB(A) at 4 l/s (BS EN 14366)
Fire Class	D-s2, d2 according to BS EN 13501-1
Jointing method / Connection	Jointing with Rubber Gasket and Socket (Push-Fit)
Attachment / Clamping	With Silent Clamps (GF or third party)
Color	Light Blue (Halogen-free and Cadmium-free)
Installation	Very easy to install thanks to its weight lower than cast-iron pipes, thanks to push fit system, easier installation compared to welded or cemented plastic systems
Thermal expansion coefficient	0.06 mm/(m·K)
Tensile strength	13 N/mm²
Chemical resistance	Resistant to organic and inorganic chemical environments and to domestic wastewater and industrial wastewater with pH 2 − pH 12 Wherever chemically aggressive wastewater is used (e.g. for industrial applications), it is suitable for pH 2 to pH 12. An individual case assessment can be requested from GF specifying the composition of the respective wastewater and the operating conditions.
Installation temperature	Minimum: -10 °C Maximum: 60 °C
Operating temperature	Minimum: -10 °C Maximum: 97 °C
Application class	B (inside a building)
Ring stiffness	BS EN ISO 9969. The ring stiffness is at least 4.0 kN/m² over the entire dimension range DN32 − DN200
Impact Strength	Complies with TSEK / BS EN 1451
Density	Pipes: 1.24 g/cm³; Fitting: 1.34 g/cm³ (DIN 53479)
Maintenance	Negligible maintenance cost compared to metal based systems
Permissible ambient temperature	Between –20 °C and 60 °C
Permissible wastewater temperature	For domestic wastewater between 0 °C and 90 °C, briefly up to 97 °C

Classification of nominal dimensions

According to BS EN 1451, the nominal size (DN) is a parameter that indicates the diameter of the pipe system used. GF Silenta 3A is available in the following pipe sizes and wall thicknesses:

Nominal diameter DN [mm]	S Series	Outer diameter d [mm]	Inside diameter di [mm]	Wall thickness e [mm]
30	16	32	28.0	2.0
40	16	40	36.0	2.0
50	16	50	46.0	2.0
70	16	75	70.0	2.5
90	16	90	84.0	3.0
100	16	110	102.6	3.0
125	20	125	118.2	3.4
150	20	160	151.6	4.2
200	20	200	189.6	5.2

GF HT-PP

Additional technical and sales information

More technical information about this system and other ordering information: ➨ website and sales catalogue

System Overview

GF HT-PP pipes and fittings are made of polypropylene (PP) that guarantees a lightweight system offering high chemical resistance and excellent resistance to mechanical force and abrasion. These characteristics make HT-PP ideal for non-pressurised domestic drainage systems designed in accordance with BS EN 12056 parts 1-5, CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage).

- High Impact Resistance - Due to the flexible molecular structure of its raw material, HT-PP has higher stroke and impact resistance under low temperature conditions than other rigid plastic pipe systems.
- High Temperature Resistance – HT-PP can be used to connect appliance outlets and services where high temperature water discharge is common, such as a washing machine or a dishwasher.
- Smooth inner surface – The low-friction, abrasion resistant surface maintains a smooth flow and prevents the build-up of any deposits and encrustation.
- Halogen-free, does not release any harmful halogenic gases in the event of a fire.
- Easy assembly and Installation - The push-fit system with specially designed gaskets and sockets allows quick and reliable installation without the need for special tools.
- Chemical Resistance - GF HT-PP offers high resistance to chemical agents dissolved in waste waters. Accordingly, GF HT-PP is ideal system where drainage is needed to convey chemical waste. For specialist applications please seek advice from your local GF sales office.
- 100% recyclable and environmentally friendly.
- BBA (Certification Pending) and EPD certified.

Fields of Application

- Office buildings, conference halls etc
- Schools, libraries, hospitals, hotels, houses
- Sustainable / green buildings
- Industrial areas (short and long-term use)

Approvals

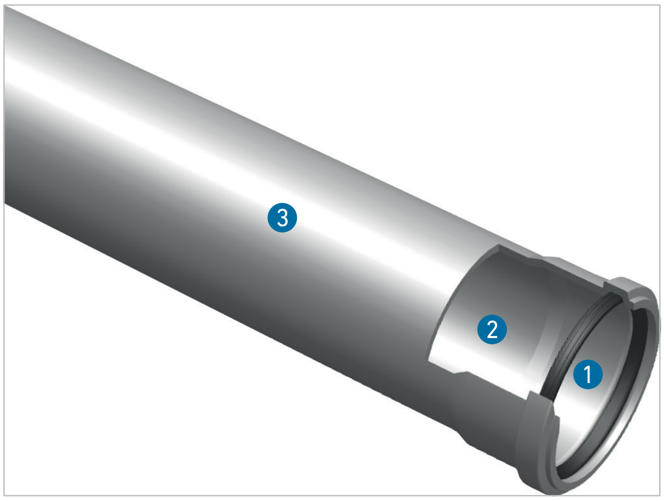
System approvals

Full information relating to approvals and certifications can be found at www.georgfischer.com/en/our-solutions/gf-building-flow-solutions

Country	Institute
Germany	DiBt, SKZ - Certification Pending
Austria	Austrian Standard - Certification Pending
Netherlands	KIWA - Certification Pending
Denmark	ETA-DANAK - Certification Pending
Sweden	KIWA SwedCert - Certification Pending
Norway	Sintef - Certification Pending
Italy	KIWA It - Certification Pending
Poland	ITB - Certification Pending
France	CSTB - Certification Pending
Spain	AENOR - Certification Pending
UK	BBA - Certification Pending
Türkiye	TSEK, EPD - Certification Pending

System components

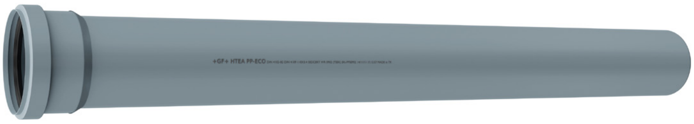
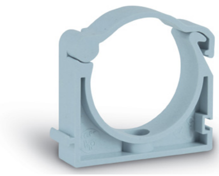
Pipe layout



The design of the GF HT-PP pipe is characterised as follows:

1. **1** Special Gasket System: The push-fit socket with lip seal guarantees water tightness and allows movement of the pipe due to thermal expansion. The geometric characteristics of the socket ensure installation speed and simplicity.
2. **2** Inner Surface: It provides a perfect flow performance with its structure. The superior chemical resistance prevents corrosion and abrasion. It is resistant to high water temperatures.
3. **3** Outer Surface: Resistant against impacts and high temperatures.

Components

Product group	Examples of components		
Pipes			
Moulded Parts			
Clamps			

Technical data

Property	Value
Design	Single-layer structure made of polypropylene. Pipe Classes S16 and S20.
Diameters [mm]	d32, d40, d50, d75, d110, d125, d160
Pipe length [mm]	150, 250, 500, 1000, 2000, 3000
Fire Class	E according to BS EN 13501-1
Jointing method / Connection	Jointing with Rubber Gasket and Socket (Push-Fit)
Attachment / Clamping	With GF Standard Clamps
Color	Dark Grey and White
Installation	Very easy to install thanks to its weight lower than cast-iron pipes, thanks to push fit system, easier installation compared to welded or cemented plastic systems
Chemical resistance	Resistant to organic and inorganic chemical environments and to domestic wastewater and industrial wastewater with pH 2 − pH 12 Wherever chemically aggressive wastewater is used (e.g. for industrial applications), it is suitable for pH 2 to pH 12. An individual case assessment can be requested from GF specifying the composition of the respective wastewater and the operating conditions.
Installation temperature	Minimum: -10 °C Maximum: 60 °C
Operating temperature	Minimum: -10 °C Maximum: 97 °C (in short-term flow conditions)
Application class	B (inside a building)
Impact Strength	Complies with BS EN 1451
Density	Average: 0.92 g/cm^3
Maintenance	Negligible maintenance cost compared to metal based systems
Permissible ambient temperature	Between –20 °C and 60 °C
Permissible wastewater temperature	For domestic wastewater between 0 °C and 90 °C, briefly up to 97 °C

Classification of nominal dimensions

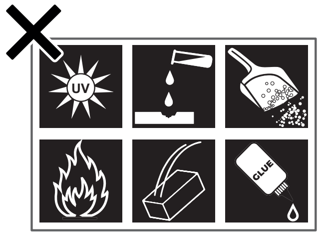
According to BS EN 1451, the nominal size (DN) is a parameter that indicates the diameter of the pipe system used.
GF HT-PP is available in the following pipe sizes and wall thicknesses:

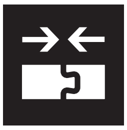
Nominal diameter DN [mm]	GF HT-PP S20			GF HT-PP S16		
	Outer diameter d [mm]	Inside diameter di [mm]	Wall thickness e [mm]	Outer diameter d [mm]	Inside diameter di [mm]	Wall thickness e [mm]
30	32	28.0	2.0	32	28.0	2.0
40	40	36.0	2.0	40	36.0	2.0
50	50	46.0	2.0	50	46.0	2.0
70	75	70.8	2.1	75	70.0	2.5
100	110	104.2	2.9	110	102.6	3.7
125	125	118.2	3.4	125	116.6	4.2
150	160	151.6	4.2	160	149.2	5.4

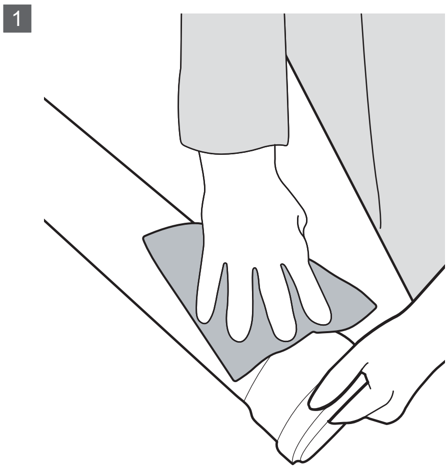
Drainage Systems

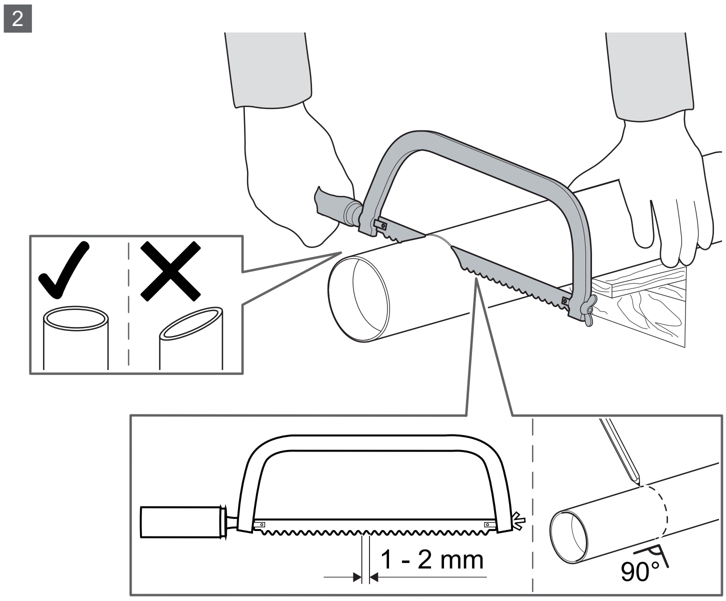
Installation instructions

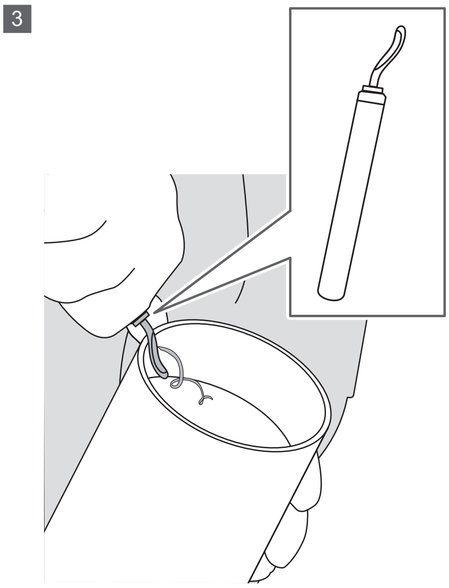
- GF Silenta Premium Sound-Insulated Pipe Systems
- GF Silenta 3A Sound-Insulated Pipe Systems
- GF HT-PP Waste Water Pipe Systems

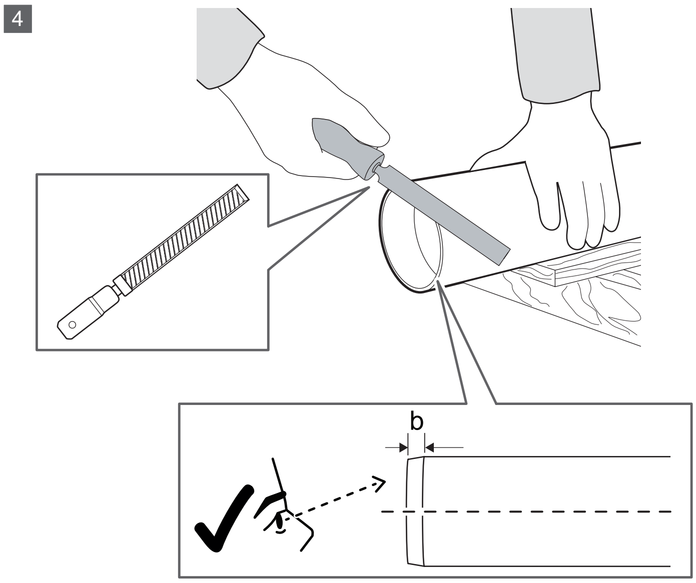






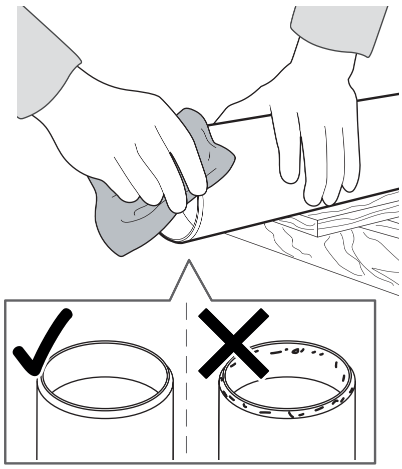






	50 (58)	75 (78)	90	110	135	160	200
b	4	4	5	6	6	7	8

5



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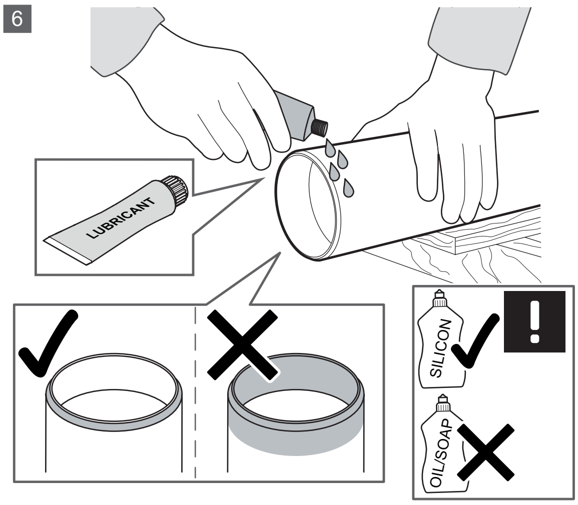

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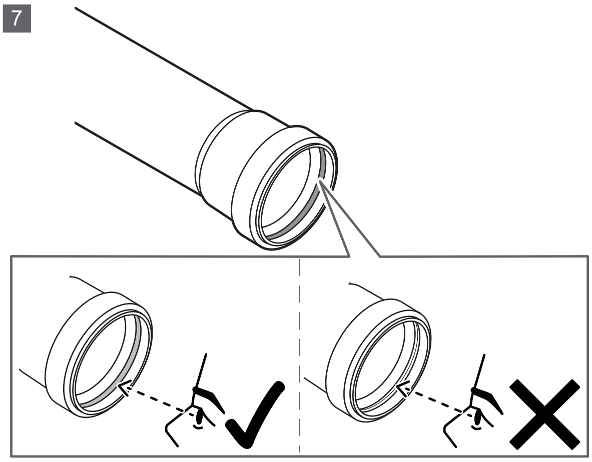

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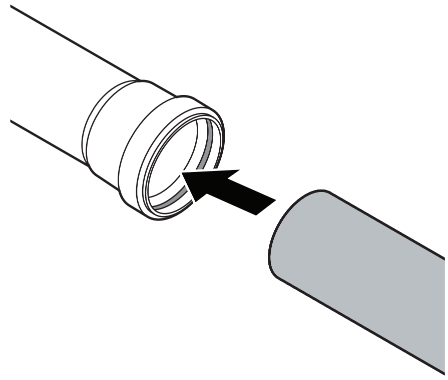
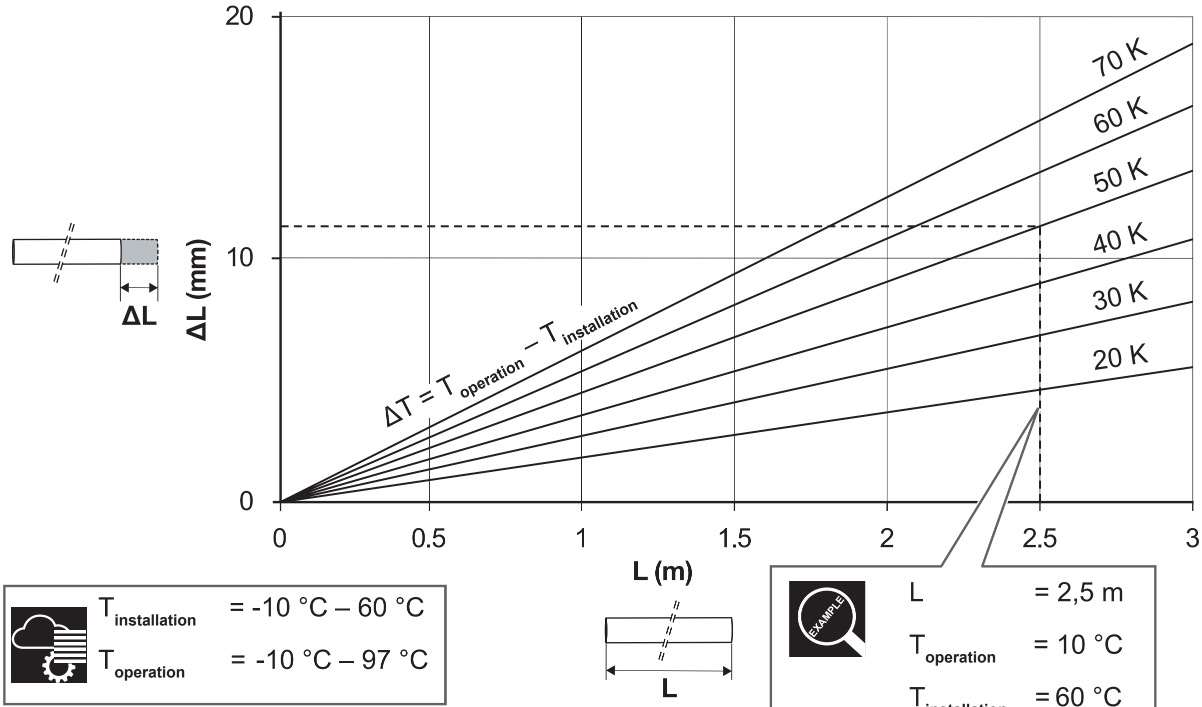


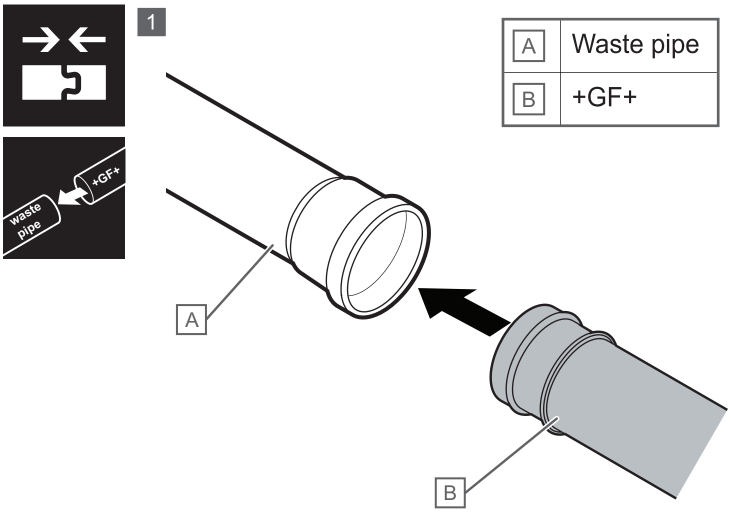


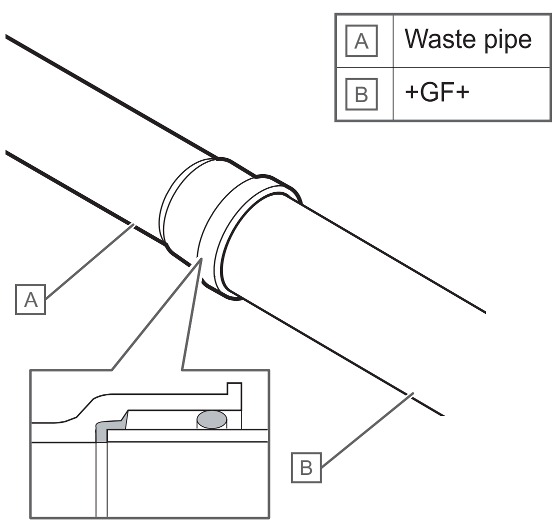
$T_{installation}$ = -10 °C – 60 °C

$T_{operation}$ = -10 °C – 97 °C

EXAMPLE

L	= 2,5 m
$T_{operation}$	= 10 °C
$T_{installation}$	= 60 °C
ΔL	= 11 mm





Rubber O-ring (Push fit) Joints

- The spigot end of the pipe must always be chamfered. Cut pipe ends must be reworked to add the necessary chamfer.
- Check that the sealing gasket is clean and located correctly within the socket profile.
- Before assembly, please ensure that there is no damage (scratches or dents) to the outer surface of the pipe for the entire length that will be inserted into the socket.
- Using a suitable silicon-based product, lubricate the spigot end of the pipe and the O-ring within the socket. DO NOT use liquid soap or oil based greases or oils.
- Align the pipe so it's centre axis is in line with the axis of the socket.
- Gently push the spigot end of the pipe into the socket until fully located.
- While fitting the fixed clamp, please allow 10mm movement to withdraw the spigot from the socket to compensate for expansion.

Pipe Hanging and Clamping

Always use GF silent pipe clamps to minimize the sound caused by vibration. Maximum clamping distances of the pipes should always comply with the values provided in the following table.

- While fixing the pipe with clamps, pay special attention to not cause any tension and stress on pipes.
- Pipe cannot move after tightening the screws of the fixed clamps. For sliding clamps, pipe will continue to move inside the clamp even after tightening the screws.
- For each line longer than 2 m, use 1 fixed clamp immediately after the muff part.
- In vertical lines, always place the fixed clamp on the top point of the pipe and below the socket part.
- While fitting the fixed clamp, pay attention to keep 10 mm distance left on the flat end for expansion.
- Use a fixed clamp after each fitting or fitting group.
- All clamps to be added to the system, apart from the fixed clamps in the horizontal or vertical line, should be a sliding clamp that allows for movement caused by thermal expansion.
- Pipes and fittings should be fixed in short distances so that they do not slide and release.

Attachment

During the installation of wastewater pipe systems, it must be ensured that the pipes are assembled stress-free and that the pipes can elongate if necessary. All downpipes must be installed vertically. At least two attachment points must be provided on each storey (at least one fixed support bracket and one adjustable pipe clip). The spacing between attachments for downpipes must not exceed 2.00 m.

The maximum permissible spacing between attachments of horizontally installed wastewater pipes depends on the respective pipe dimension (see table).

In order to achieve the necessary acoustic performance of the Silenta systems, all pipes must be installed using the Silenta Sound insulated pipe clamps.

T.2 *Spacing between attachments (L) - GF Silenta Premium*

Pipeline DN	58	78	90	110	135	160	200
Spacing between attachments L (max.) [mm], horizontal	750	1125	1350	1500	1625	2000	2150
Spacing between attachments L (max.) [mm], vertical	1500	2000	2000	2000	2000	2000	2000

T.3 *Spacing between attachments (L) - GF Silenta 3A*

Pipeline DN	50	75	90	110	125	160	200
Spacing between attachments L (max.) [mm], horizontal	750	1100	1350	1500	1625	2000	2150
Spacing between attachments L (max.) [mm], vertical	1500	2000	2000	2000	2000	2000	2000

Noise reduction

The proper assembly of the pipes has a considerable influence on the sound reduction as well as the formation of sound waves.

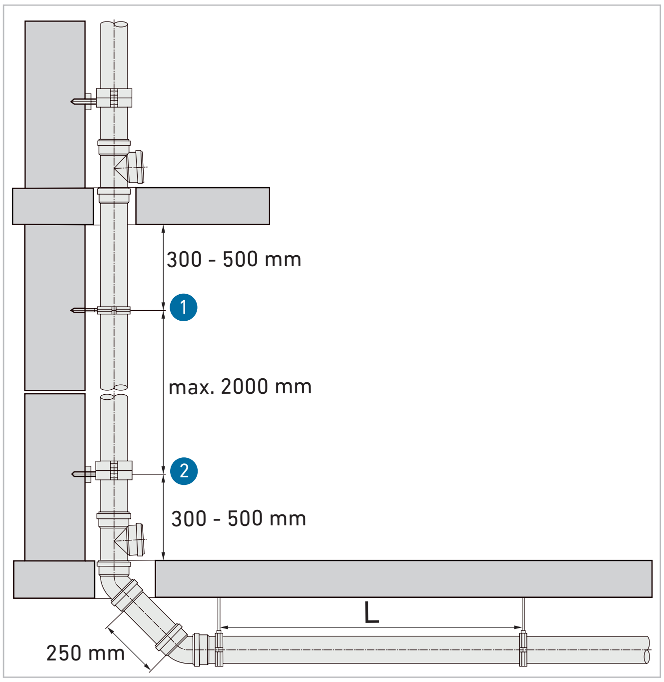
☑ Suitable measures must be taken in order to reduce the flow and sound development in zones where the flow direction changes.

Example

Redirecting the vertical downpipes in a false ceiling area.

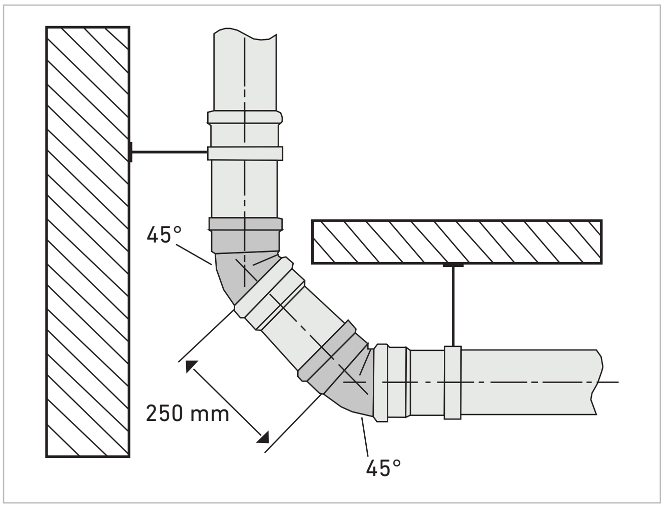
☑ For hydraulic and acoustic reasons, a change in direction by 90°, in which a downpipe enters a horizontal main pipeline, two 45° elbows with an intermediate piece of 250 mm is required.

☑ 87°-elbows must **not** be used when redirecting a downpipe into a horizontal header.



G.5 *Attachment*

1 Guidance clamp, for example, Silent Clamps
2 Downpipe Hakan clamp
L max. spacing between attachments



G.4 *Redirecting a downpipe*

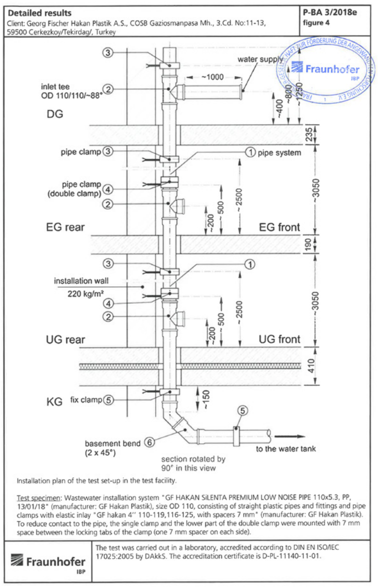
Installation - Silent Pipe Clamp

Silent drainage systems are tested by the German Fraunhofer Building Physics Institute in accordance with BS EN 14366 standard, and the reports regarding sound level are issued by this institute.

In the test equipment used in this institute, sound levels are measured at different flows and different parts of the building.

The test equipment in the institute laboratory is standard and the tests related to all waste water systems are conducted here. As seen in the test equipment below, pipe, fittings, installation wall thickness, water discharge amount as well as silent pipe clamp systems are also significant factors in the test report.

In the vertical lines, one group double and one single clamp should be used on each floor. In the horizontal lines, it is more suitable to use single clamp.



Detailed results
Client: Georg Fischer Hakan Plastik A.S., COSB Gaziosmanpasa Mh., 3.Cd. No:11-13, 59500 Cerkezkoy/Tekirdag/, Turkey

P-BA 3/2018e
figure 4

Installation plan of the test set-up in the test facility.

Test specimen: Wastewater installation system "GF HAKAN SILENTA PREMIUM LOW NOISE PIPE 110x5.3, PP, 13/01/18" (manufacturer: GF Hakan Plastik), size OD 110, consisting of straight plastic pipes and fittings and pipe clamps with elastic inlay "GF hakan 4'' 110-119,116-125, with spacers 7 mm" (manufacturer: GF Hakan Plastik). To reduce contact to the pipe, the single clamp and the lower part of the double clamp were mounted with 7 mm space between the locking tabs of the clamp (one 7 mm spacer on each side).

Fraunhofer IBP — The test was carried out in a laboratory, accredited according to DIN EN ISO/IEC 17025:2005 by DAkkS. The accreditation certificate is D-PL-11140-11-01.

To achieve maximum acoustic performance, the silent pipe clamps used in the test should be used in the installations as well.

Although there are different types of silent pipe clamps, they are available in two kinds - fixed and movable.

The noise created in the waste water systems is transmitted by two methods - airborne and structure borne.

- Sound waves transmitted through contact occur as a result of the waste water and waste moving through the drainage system. Unless controlled, these vibrations can transfer into the building structure via any contact, such as the fixing brackets. The structure borne sound is absorbed by the special molecular structure of Silenta, and the specially-designed GF silent clamps.
- Sound waves transmitted through contact occur as a result of the waste water and waste hitting the pipe wall. These vibrations are transferred on the wall of the installation through contact. The sound created by contact is significantly absorbed by the special molecular structure of Silenta and specially-designed GF silent clamps.

Downpipe support bracket

The downpipe support bracket must support the weight of the vertical pipe length and secure the system to the building structure. Using the special GF Silent clamps, the transmission of structure-borne noise is largely avoided.

An additional advantage of this type of attachment is that it can be mounted at any point of the down pipe (even on smooth pipe).

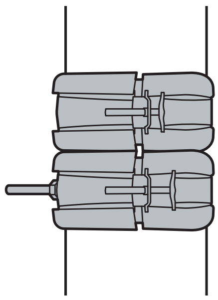
Alternatively, commercially available pipe clips with sound insulation insert can be used as a downpipe support bracket. However, these pipe clips must always be arranged below a pipe sleeve in order to prevent the downpipe from “slipping”.

Guidance clamp (adjustable pipe clip)

The adjustable pipe clip is intended to maintain the axial alignment of the downpipe. This clamp should only have little contact with the pipe and thus allow the longitudinal movement of the downpipe.

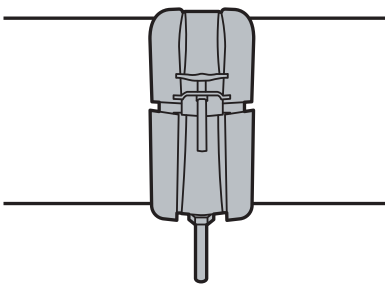
GF silent waste water pipe clamps ensure BS EN 14366 silence norms. In the waste water systems within buildings, cused clamps, their positions and distances are as important as silent pipes and fittings.

For the vertical lines, the pipes should be secured using the double clamp type product. The uppermost clamp on each pipe section must be fully tightened to anchor the pipe to the building structure. The lower clamp could either be a double, or single, clamp type and should only be tightened up to the plastic stop to secure the pipe.



G.6 *Double clamps in vertical lines*

Intermediary clamps between two double clamps, or clamps used in horizontal lines, may use the single clamp type arrangement. To ensure minimal noise transmission through the clamps, the fixing should be tightened up to the plastic wedges and should not be overtightened to the point that the rubber sections become connected.

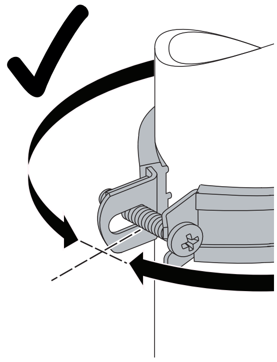
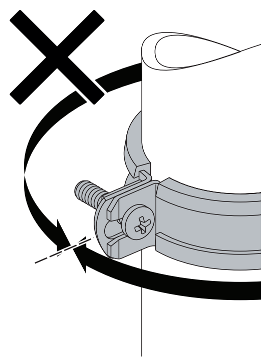


G.7 *Single clamp in horizontal lines*

Proper assembly of pipe clips

In order to reduce the transmission of structure-borne noise, it is important to ensure that the screw plugs are not tightened excessively during the assembly of pipe clips with sound insulation inserts.

→ Observe the manufacturer's information.

Proper assembly	Incorrect assembly
	

Drainage installation

Introduction

The following technical information relating to the design and installation of drainage systems within buildings has been prepared considering the generally accepted guidance found within BS EN 12056 parts 1-5. Additional supporting information can be gained from CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage).

This chapter outlines the technical relationships that must be taken into account when planning and dimensioning the defined area of application for the GF Silenta and GF HT-PP drainage system.

The drainage capacity of the partially filled pipes installed at an incline, was determined using a pipe inner diameter of the GF Silenta Premium drainage system. Filling grades:

$h/d_i = 0.5$ $h/d_i = 0.7$.

These pipes had an operational roughness of $k_b = 1.0$ mm (Prandtl-Colebrook).

The following topics are **not** addressed in these basic principles:

- Drainage systems outside of buildings installed as underground lines
- Rainwater downpipes located outside the building
- Pipelines leading to light liquid separators
- Completely filled rainwater pipes with pressure flow according to schedule

Although this information contains the most important principles for drainage systems inside buildings, it is essential that the full requirements found within Approved Document H are fully observed.

If GF Silenta drainage systems are to be used in areas other than those described within this manual, please seek advice from your local GF office to confirm suitability.

Application technology

The following information applies to systems used for the discharge of ordinary domestic wastewater and rainwater inside all building types.

This guidance only applies to drainage systems operated as gravity-fed drainage with gravity lines. It must be ensured that only the planned wastewater types such as domestic, commercial and industrial wastewater or rainwater are discharged into the drainage points.

Compliance with the following system-specific technical information is mandatory when using GF products.

In the UK, the standard for identifying pipelines and services inside a building is governed by BS 1710, which primarily uses a combination of a basic identification colour, supplementary colours (banding), and text labels to prevent misidentification

- Surface Water – Green with abbreviated - SW
- Foul Water – Green with abbreviated FW

Particularly harmful substances must not be introduced into the drainage system. Permissible building water discharge fed into sewers is guided by UK laws like the Water Industry Act 1991, the Urban Waste Water Treatment Regulations 1994, and the Environment Act 2021.

Labelling and approvals for construction products

In order for designers and installers to be assured of the quality and standard of a product, third party certification is required.

For the Silenta and HT-PP products, GF have undertaken testing and approval to the BBA certification process (approval pending). A BBA Certificate is a UK construction industry quality mark from the British Board of Agrément, proving a building product is tested, reliable, safe, and fit for its intended use. The certificate is recognized by designers, builders, insurers, and government for meeting standards and regulations.

Fire behaviour

In modern buildings, there are strict regulations governing fire safety and the protection of the building's occupants.

It is sometimes necessary for drainage services to pass through fire separating elements within the building. If a fire separating element is to remain effective, every service access point should be adequately protected by sealing with an appropriate fire stopping method.

If deemed suitable by the engineers, fire collars and fire bandages may be applied as long as any methods of attachment or bonding does not compromise the materials of the GF Silenta of HT-PP systems. When deciding on the method of fire-stopping always seek advice from a qualified, competent person.

Silenta product ranges have been tested to BS EN 13501-1 - Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests.

Noise behaviour

When planning and designing a drainage system to suit the requirements of the building use, all noise from each of the installed services must be considered. In order to ensure occupant comfort, guidance should be sought from national standards and the relevant UK building regulations. Ensuring that noise within a building is controlled and eliminated, is essential to meet the requirements of BS EN 8233 and the Approved Document E.

There are several enhanced standards such as VDI 4100 that can guide the control of unwanted noise.

It is highly recommended that all contracted parties, clients, and contractors include in writing the expected level of sound performance, including the specified method of measurement.

Product testing to BS EN 14366 for drainage systems can provide an independent standardised method of reporting installed product performance under controlled conditions.

Wastewater systems

A wastewater drainage system is vital for the safe use of a building. It's purpose is to efficiently and safely remove wastewater and surface water from the property to a civil sewer system or treatment facility. A correctly designed system is critical for safeguarding public health and maintaining a hygienic living environment.

Drainage systems for wastewater should meet the design performance within BS EN 12056 parts 1-5, CIBSE TM70 or CIPHE Design Guide (Sanitary Plumbing & Drainage). The sanitary outlets are linked with partially filled connecting pipelines that have a filling ratio: h / di = 0.5.

Connection pipes within the building will usually flow into collector pipes, which in turn connect to a centralised downpipe. Often drainage systems will require a secondary, or active, ventilation arrangement to compensate for both negative and positive transient pressures within the same system.

The ventilation compensation is vital to ensure that traps maintain an effective standing water seal to block harmful sewer gases, odours, bacteria, and insects from entering buildings while allowing wastewater and solid waste to pass through the drainage system.

To allow greater design capability that does not require compromising the fabric of the building to gain ventilation, approved AAV's (Automatic Air Vents) can be added at the appropriate locations to maintain a healthy and balanced system.

For water-efficient lavatories with flushing water volumes of 4 to 6 litres, nominal diameters smaller than DN100 may be used for connection pipes or downpipes.

If drainage points are removed or taken out of service, the connection points must be sealed to be both airtight and watertight.

Safety and strength

The planning and design of drainage systems inside buildings must consider the following important safety aspects:

- Protection of health, hygiene and the environment
- Preventing the spread of fire
- Preventing leakage of wastewater and sewer gases into the building
- Ensuring backwater flow cannot occur
- Preventing the ingress of rain or surface water through the building's envelope into the building
- Preventing the spread of excessive noise
- Preventing deposits in the pipes and drainage blockages

In order to ensure the permanent stability of drainage systems, compliance with the following requirements and interactions is mandatory:

- Choice of material according to the planned service design lifespan
- Stability of the building
- Fixing the drainage pipes to the structure
- Effects of alternating stress on the pipeline system due to temperature changes and internal pressure fluctuating excessively
- Consideration of mechanical stresses during the installation of the pipeline system until final commissioning
- Preventing electrolytic or chemical reactions
- Corrosion of metal components
- Formation of condensation
- The effects of frost

In order to comply with these requirements, professional planning, design, maintenance and proper operation is required.

Maintaining a sealed system

In order to prevent any escape of water from a drainage system, it is essential to consider the below points;

- Building use and the appropriate loading units (DFU/DF)
- System sizing
- Considered design of ventilation
- Ensure no unapproved harmful media
- Backwater prevention devices
- Accessible access points for rodding and/or internal review
- Careful installation to maintain a smooth water flow.

Frost resistance

GF Silenta and HT-PP systems are unlikely to be installed where the risk of freezing is likely. However, where pipelines may be exposed to freezing, extra measures should be considered to ensure no possible damage to the system.
In exceptional cases, for example in the connection area of roof drains, it may be necessary to add additional thermal insulation, or even self-regulating, electric heating tapes.

In general, ventilated drainage systems inside buildings are considered to be temperature balanced by the warm sewer gases which will compensate for the frost effect.

Traps must not be installed in areas that may be subject to freezing. All water traps must be installed within a protected area inside the building.

In the event that pipes are installed underground (where application area D is permitted), the frost-free depth shall be considered. In most areas, a frost-free installation can be assumed if the pipe is covered with at least 800 mm of soil.

Preventing the discharge of sewer gases

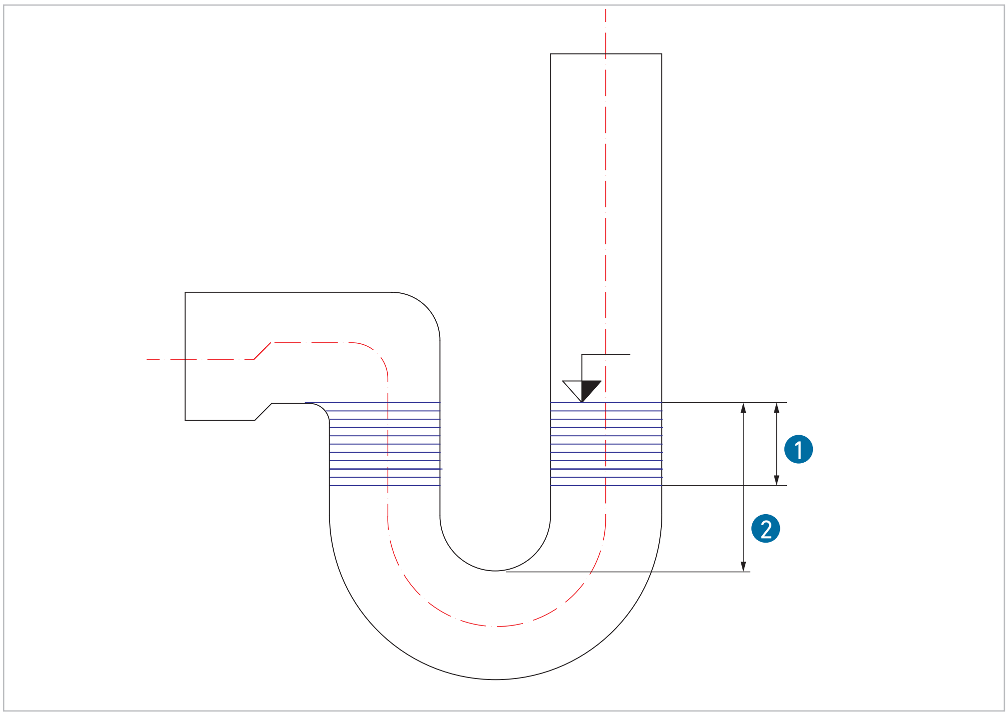
In order to prevent the escape of sewer gases from drainage systems into the building, an odour trap must be incorporated into each drainage point. Several drainage points of the same kind can be directed through a common odour trap.

The water seal head in the odour trap for wastewater drains must be 50 mm. In rainwater drains this water seal head must be 100 mm.

The leakage water loss caused by the drainage process must not reduce the water seal head in the odour trap by more than 25 mm.

This regulation excludes:

- Drain points for rainwater in the separation process
- Runoff points for rainwater in the mixing process, if distances of at least 2.0 m from doors and windows of common rooms are respected
- Floor drains that drain into light liquid separators
- Garages with floor drains, which are connected to mixed water pipes and drained via a central odour trap in a frost-free area



G.8 *Odour trap with water seal head*

1 Permissible water seal head loss <25 mm
2 Water seal head >50 mm

Self-cleaning capability

Drainage systems that are planned, constructed, maintained and operated according to the recognised rules of technology are self-cleaning.

Compliance with following relevant criteria is mandatory:

- proper dimensioning of the pipelines
- adequate and uniform gradient of the pipe invert
- no discharge of hazardous and harmful substances
- no discharge or retention of coarse material and sediments that lead to deposits, growth and blockages
- no waste disposal via the drainage system

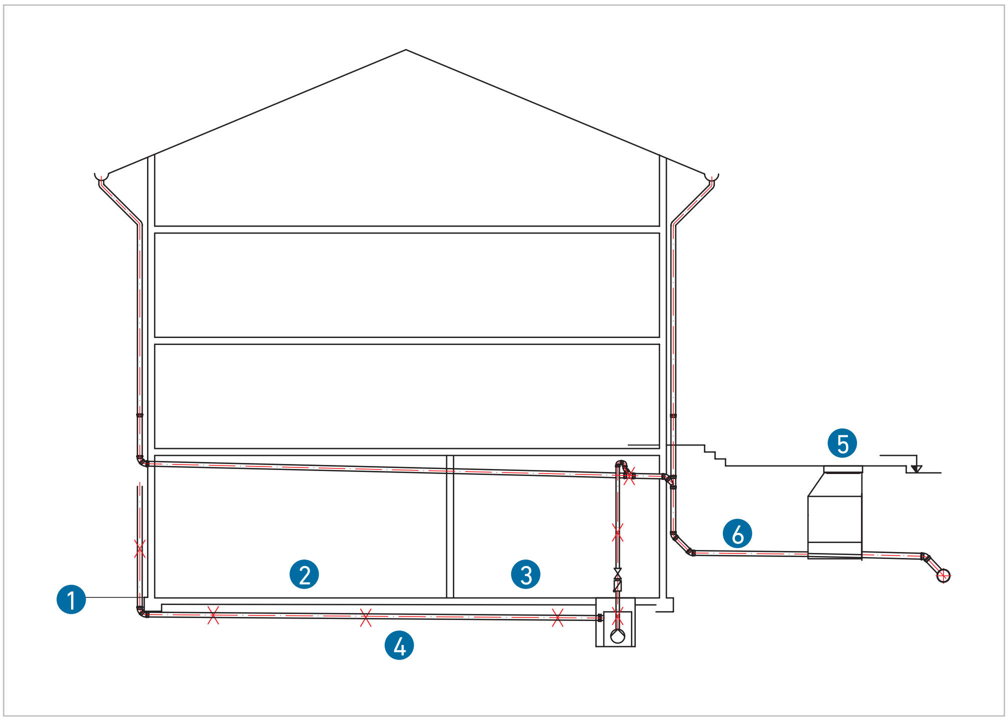
When using pipelines that carry greasy wastewater and if using single and multiple collecting pipes for urinals, special planning principles must be observed to avoid deposits.

Gravity-fed drainage systems/ energy savings

Any wastewater above the backwater level must be drained into the sewage system using gravity. The wastewater must not be routed via lifting systems or a backflow trap (➨ [G.9]).

Drains underneath a water outlet point

There must be a drainage point underneath each water outlet inside the building if the run-off cannot be done across a watertight floor to a suitable drainage point without creating puddles or standing water. This rule excludes tapping points for firefighting purposes and for connection outlets for washing machines and dishwashers.



G.9 *Connection to the sewage system with wastewater above the backwater level*

1 Patio
2 Living quarters
3 Basement
4 Pipelines and sewage lifting units are prohibited
5 Backwater level upper edge of the road in the connecting point
6 Rain water

Protection against backwater

The backwater level in drainage is the maximum height water can rise in a sewer or pipe system due to obstructions, heavy rain, or a connected river causing flow to stop and water to back up, potentially flooding basements and low-lying areas. (➨ [G.10]). Departures from this rule are possible depending on the topography of the surrounding terrain.

Drainage points, in which the water levels inside the trap are below the backflow level, must be drained reliably via sewage lifting units or backflow closures to prevent the backflow of wastewater from the sewer system.

Planning and dimensioning of safety devices to prevent backwater must comply with BS EN 12056-4. When considering specified limiting conditions, sewage lifting units can be used for special purposes when designed to BS EN 12050-3.

Rainwater or greywater discharge (faecal-free wastewater) from areas below the backwater level may only be discharged into the public sewage system if utilising lifting units complying to BS EN 12050-2. The lifting units must be located outside the building and the rainwater must be lifted above the backflow level complying with the conditions of BS EN 12056-4.

Effective drainage surfaces below the backwater level must be kept as small as possible and evidence that flooding is prevented must be provided.

If buildings or property are at risk, the sewage lifting units must be designed for a once-in-a-century rain event r(5.100.

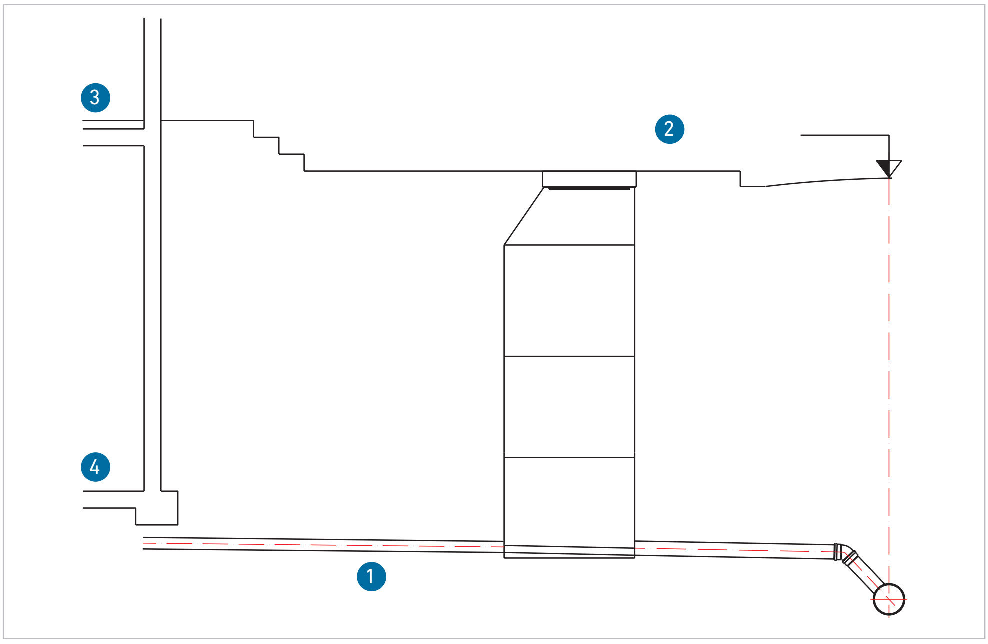
In exceptional cases, for example on abutting properties or in underground car park entrances, the lifting system should be equipped with a double pump. The installation of the lifting unit is also possible within the building, however, the building must be protected using suitable measures in order to prevent flooding.

Rainwater from small areas – up to 5 m2 – of areas such as basement entrances, can seep away in compliance with the specifications of DIN 1986-100, 13.1.3.

Pressure pipelines from sewage lifting units must be connected to ventilated collecting or underground pipelines. Connection to a downpipe is not permitted.

Anti-flooding devices, such as a non-return valve, must comply with BS EN 13564-1 and must only be used if:

- there is an incline to the sewer system
- the rooms are of ancillary importance; that is to say, any material assets stored here, or the health of the residents, are not adversely affected if the rooms are flooded
- the user group is small and if a toilet is available to this group above the backwater level
- in case of backwater, the use of the drainage point can be omitted.

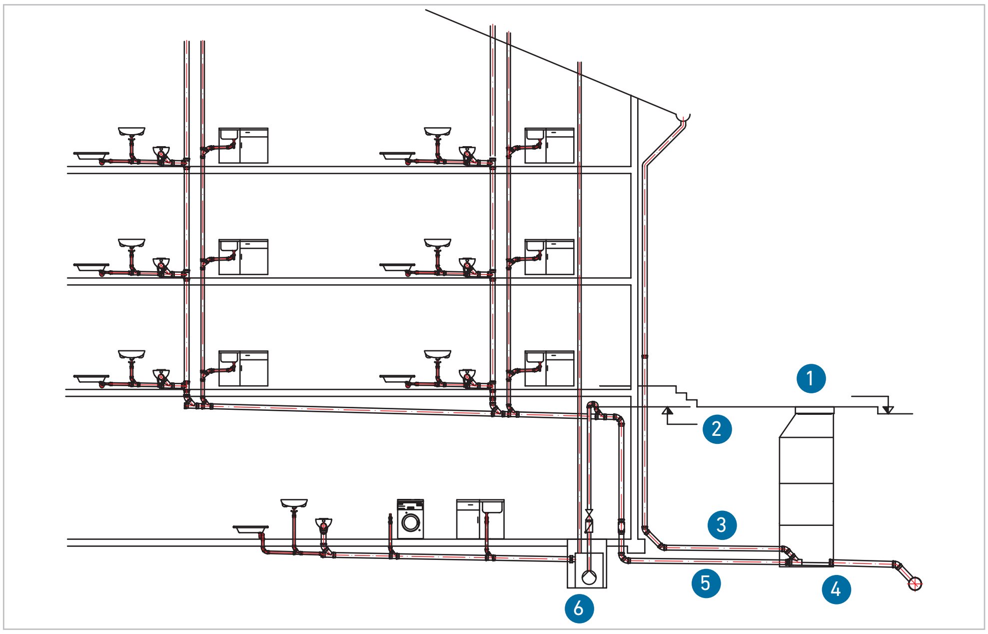


G.10 *Backwater level upper edge of the road*

1 Wastewater
2 Backwater level upper edge of the road in the connecting point
3 Ground floor
4 Basement

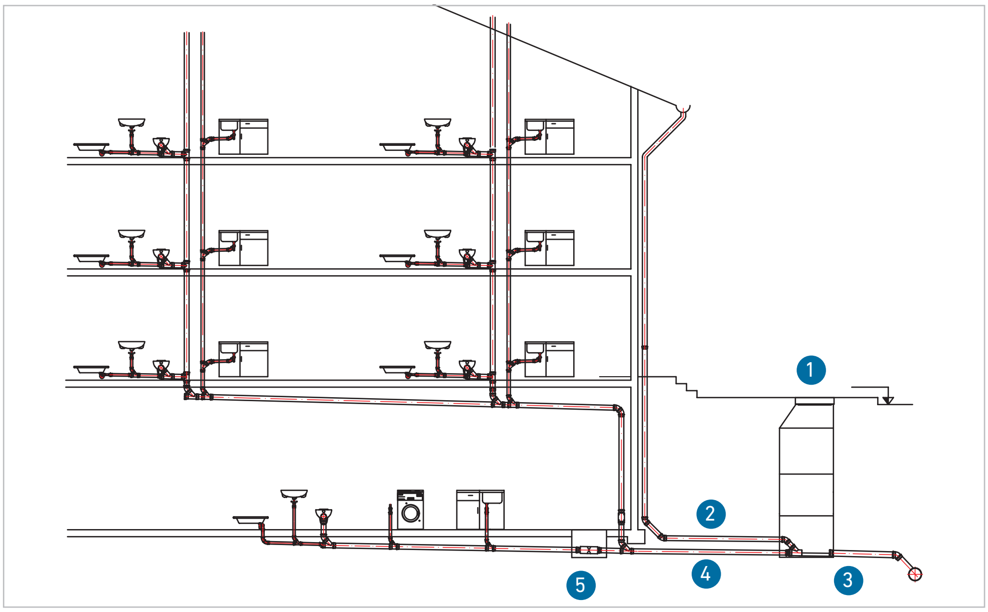
According to BS EN 13564-1, the following types of antiflooding devices are permitted according to the stated application:

- Types 2, 3 and 5 for wastewater not containing faeces
- Type 3 with labelling "F" for wastewater containing faeces
- Types 0, 1, and 2 for earth tanks used in rainwater harvesting systems, if their overflows are connected exclusively to rainwater channels
- The specifications for the operation, inspection and maintenance of sewage lifting units are provided in DIN 1986-3.



G.11 *Active backwater safety devices with sewage lifting units*

1 Backwater level upper edge of the road in the connecting point
2 The pipe invert of the backwater loop must be above the backwater level
3 Rain water
4 Mixed waster
5 Wastewater
6 Sewage lifting unit for wastewater containing faeces



G.12 *Passive anti-flooding device with central backwater stop*

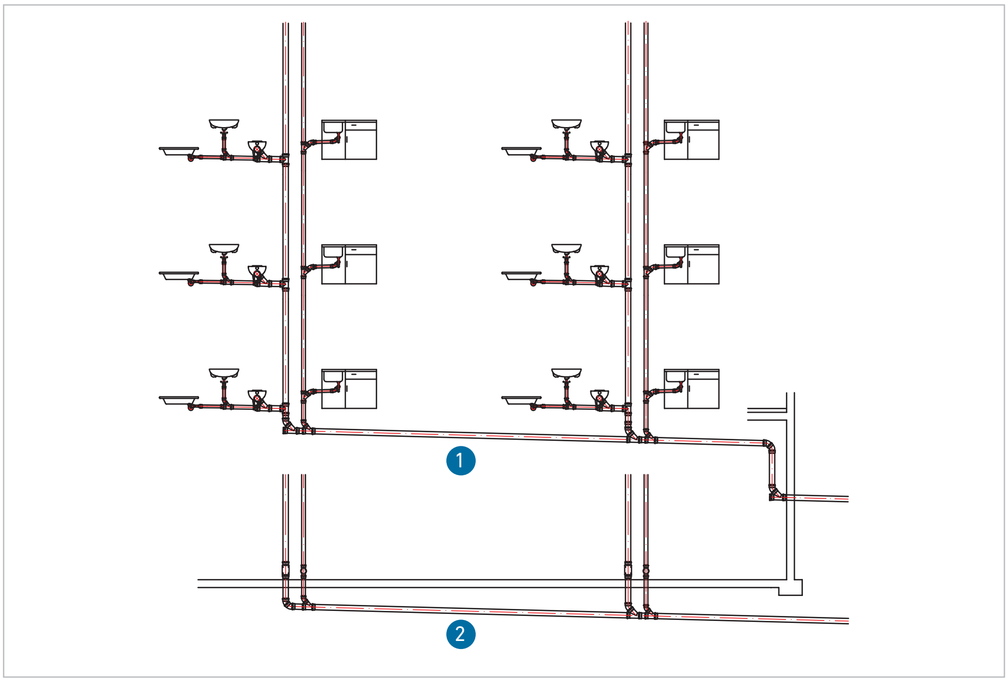
1 Backwater level upper edge of the road in the connecting point
2 Rain water
3 Mixed waster
4 Wastewater
5 Central anti-flooding device, type 3 with marking "FW" for wastewater containing faeces

Pipeline installation

Omitting underground pipelines

In order to make inspections easier and providing simpler rehabilitation option, water collection pipelines should be installed under the floor slab of buildings and not underground (➨ [G.13]).

In buildings without basements or where drainage systems are located below the backwater level, underground pipes should be routed out of the building and kept as short and straight as possible.



G.13 *Collection pipelines instead of underground pipelines*

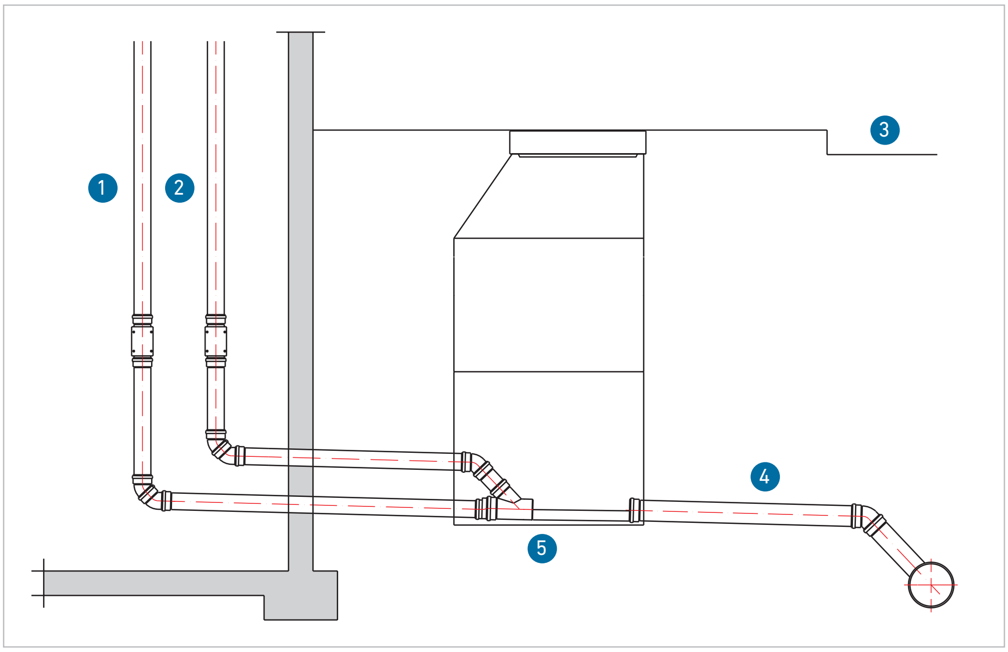
1 Headers
2 Underground pipelines

Discharge of various types of wastewater

Inside buildings, rainwater and wastewater pipes must be routed separately (separation system), and for hydraulic reasons, may only be brought together outside the building (outside the overload area) in an inspection chamber with an open-flow, if possible.

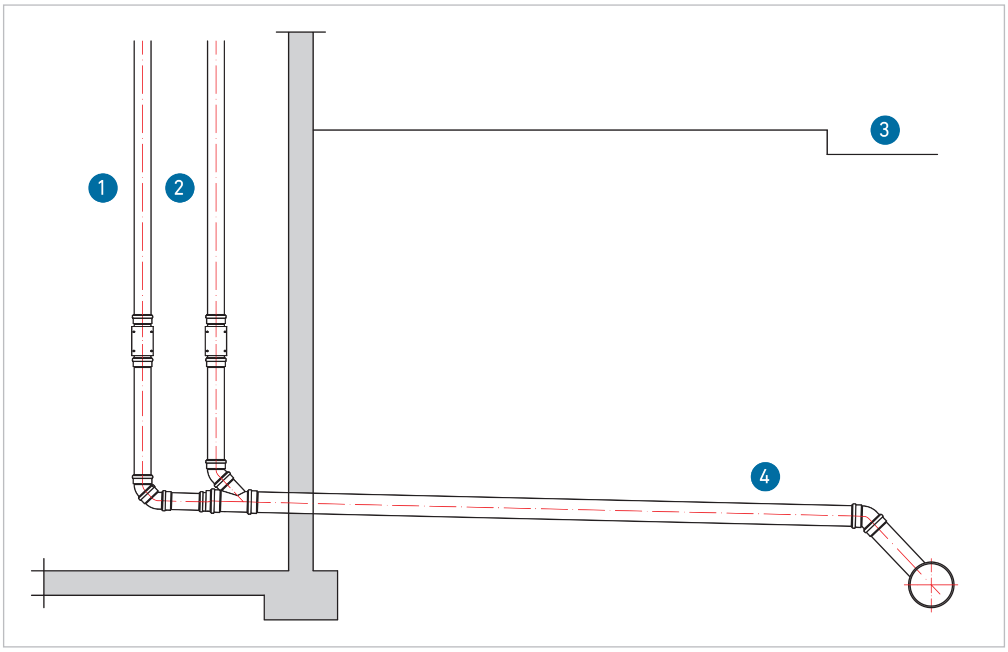
An exception exisist where properties are abutting; here, the wastewater and rainwater pipes may be brought together within the building, however, they must be routed directly along the building's outer wall.

On abutting properties, underground rainwater pipelines or headers with nominal diameters ≥DN 150, should be connected to the public mixed water sewer using their own connecting line.



G.14 *Merging pipes outside the building (normal case)*

1 Rain water
2 Wastewater
3 Street
4 Mixed waster
5 Inspection chamber with an open-flow



G.15 *Merging pipes inside the building (with the exception of abutting properties)*

1 Rain water
2 Wastewater
3 Street
4 Mixed waster

Proof of seal tightness of pipelines inside or outside of buildings

For drainage pipes and their connections, both inside or outside buildings, the following applies: Whatever the environment, each connection must be permanently sealed at an internal or external pressure of not less than 0.5bar.

Buried sewers must be tested to an approved national standard such as BS EN 1610 or BS 8000, either using procedures "W" for water or "L" for leaks.

Drains that are difficult to access, such as pipes laid in concrete or pipelines that are installed in inaccessible floor ducts, manholes or intermediate floors should be tested immediately after installation for leaks – similar to the procedure for underground lines.

Drainage pipes such as a single collecting pipes, downpipes, or headers, which are installed above ground or are concealed within buildings - for example behind false walls, in pre-fab wall installations, within brick partition walls, wall slits or suspended ceilings, must be tested for leaks according to the procedures within Approved Document H or BS EN 12056-5.

The prerequisite for the above is:

- Only pipes, fittings, gaskets, etc., which comply with the generally recognised codes of practice (standards or test guidelines) and are labelled accordingly, shall be used.
- Only competent personnel shall be permitted to install the pipeline, and the workmanship must be undertaken meet to the requirements of BS 8000 Workmanship on Building Sites Part 13 Code of Practice for Above Ground Drainage
- In contrast to buried pipelines, leaks can be detected.
- A repair is possible, even if it means an on-site effort (forcefully open suspended ceilings or false walls, etc.).

In order to prepare for a leak test, all bypasses and end plugs at drainage points must be secured in order to prevent the pipes from slipping apart due to the static overpressure expected in the pipeline.

Protection for high pressure areas

Drainage connections that are not braced in the longitudinal direction using clamps must be secured in order to prevent their separation, and/or causing the misalignment of their mutual axes. In particular, this applies to fittings installed in areas where the internal design pressure may be exceeded, or where excessive pressure may result due to overload; for example - rainwater downpipes, lines in the backwater area, or pressure lines of lifting units.

Securing the connection can be guaranteed by selecting the proper attachment, using pipe clips and brackets, or by adding special measures such as safety over-clamps (claw fasteners).

The spacing between pipe fittings must be observed according to the installation instructions for the GF Silenta and HT-PP pipe systems. The same applies to the additional methods intended to prevent the connections from separating and/or causing the misalignment of their mutual axes.

Directional changes

Directional changes and branching of underground pipelines and headers may only be carried out with ≤45° elbows and branches. This requirement is to ensure the hydraulic performance and ventilation of the drainage system, as well as the use of cleaning equipment and the control of sewer television cameras.

Reductions and transitions to other nominal diameters

Nominal diameter changes and transitions to other materials must be made with transition fittings or transition seals. Fittings and gaskets must be tested and approved in order to ensure a permanently sealed connection.

It is not permitted to reduce the nominal diameters of sewer pipelines in the direction of flow, neither inside nor outside buildings.

Mixed water pipelines may have different pipe cross-sections for the main pipe and the connecting pipe due to the different design regulation for private and public rainwater pipes required for private the property and for the public sewage system. In this exceptional case, the pipe's cross-section change outside the building should lead into an inspection chamber with an open-flow close to the property boundary.

This exeption also applies to rainwater pipelines which are operated fully filled and according to schedule.

Preventing flushing of external matter

Collecting pipelines

When merging horizontal pipelines, a bend of at least 15° must be incorporated at the junction. This improves flow and results in less deposits of solids at the branch. Therefore, double branch pipes must not be incorporated into horizontal pipelines (G.17).

If the nominal diameters in collecting pipes, headers and underground pipelines must change, eccentric reducers must be used.

In collecting pipes and headers, the eccentric reducers must be installed at the same angle; this ensures better ventilation. At the same time, flushing external matter into the smaller nominal diameter pipes is prevented.

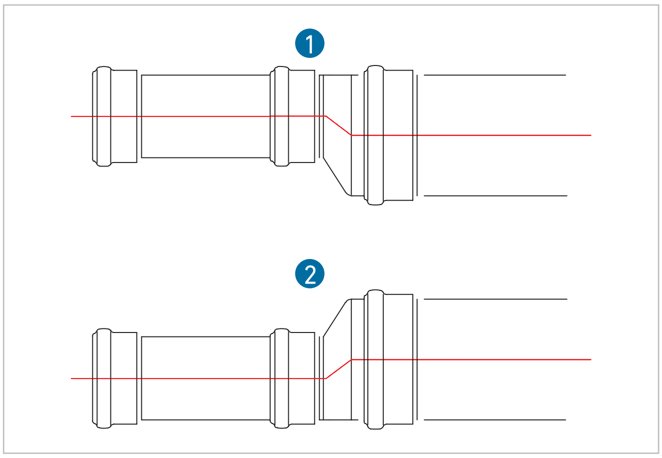
If the nominal diameter of an underground pipeline must be change, it is preferred that this change takes place at the same pipe invert level. This will make cleaning and inspection tasks much easier (e.g. with sewer television systems).

Downpipes

If the geometry of downpipe connections is not fully considered, wastewater can be flushed from one individual or collecting pipe into another pipeline. Fig. [G.19] illustrates how wastewater from the connecting pipe of a higher-level drain can be flushed into the water seal head of a toilet bowl.
If discharge is incorrectly considered, when flushing the toilet, foul water could enter into, and contaminate, the water seal head of the floor drain.

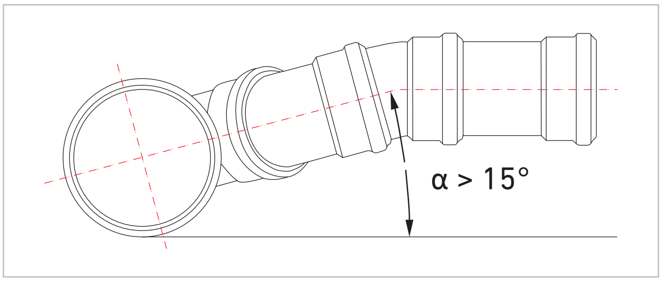
Therefore, the connections of collecting pipes and single connection lines to the downpipe must be designed such as to avoid the flushing of wastewater – in particular foul wastewater – into other single or collection pipelines.
The following design principles must be taken into account:

- The minimum height difference "h" required between the water level in the odour trap and the bottom of the connection line at the downpipe branch (➨ Fig. [G.21]) must be greater than the nominal diameter of the collection or single connection line (h ≥ DN).
- Compliance with the height difference and/or the spread angle as seen in Fig. [G.23] is mandatory.
- For individual connecting pipes of toilets that are linked to the downpipe using an 87° double branch, the height distances shown in Fig. [G.22] should be taken into account.
- When installing single or multiple collecting pipes which carry sewage-free and foul wastewater and are connected to the downpipe with a double branch having an inner radius or 45° inlet angle of the same diameter, the height distance shown in Fig. [G.24] must be maintained.

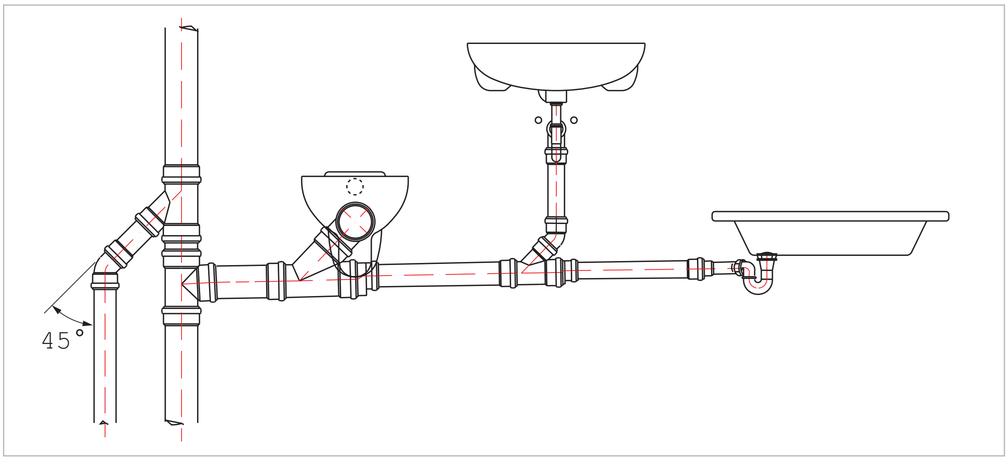


G.16 *Alignment of branches connecting to underground pipes and headers*

1 Pipe crowns at same level
2 Pipe inverts at same level

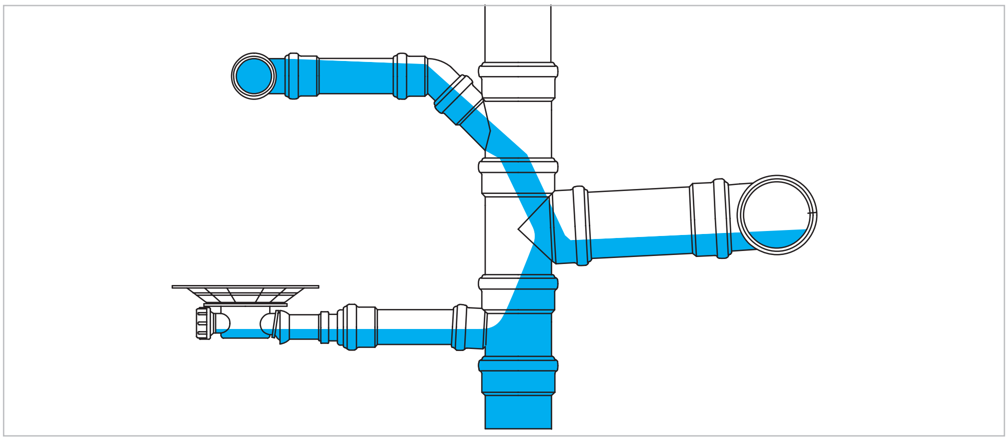


G.17 *Design of transitions in horizontal pipelines*



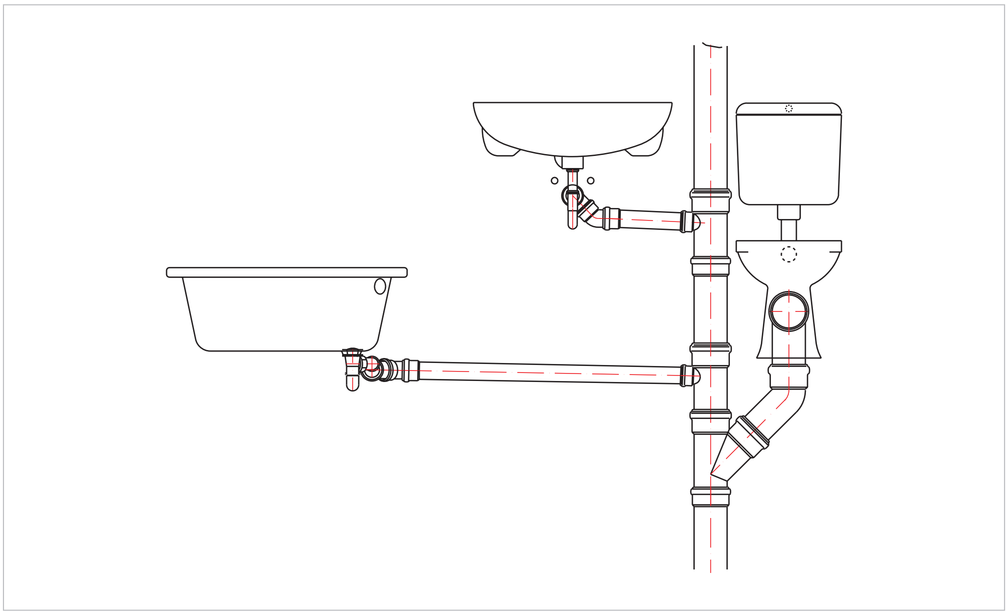
G.18 *Overflow-proof collecting pipes*

... ensuring the crowns of the eccentric reductions are at the same level



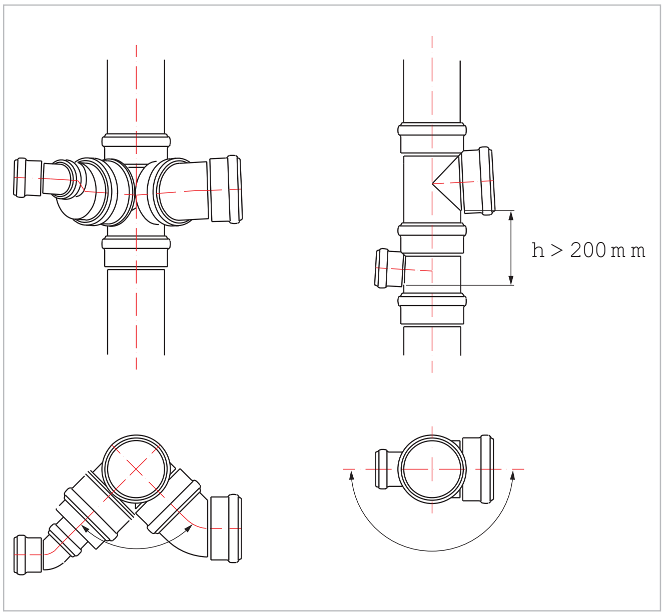
G.19 *External flushing into single connection lines*

... if the geometry of downpipe connections is unfavourable



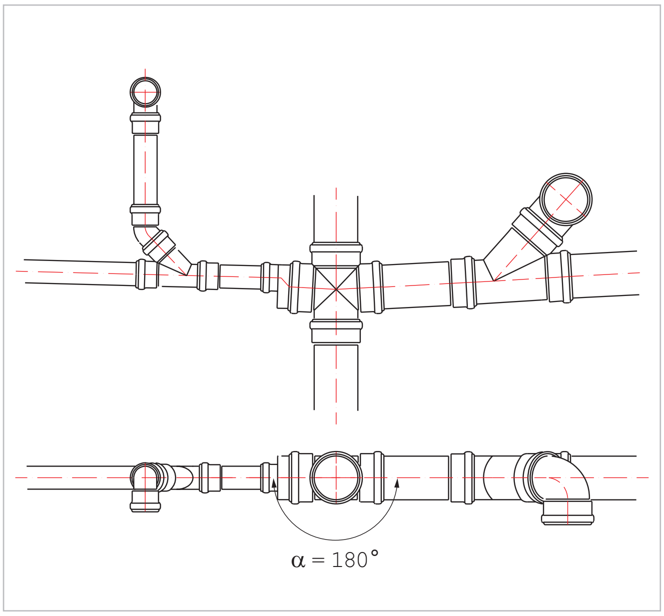
G.20 *Overflow-proof connections of individual connection pipelines to the downpipe*

... by adhering to minimum required distances required



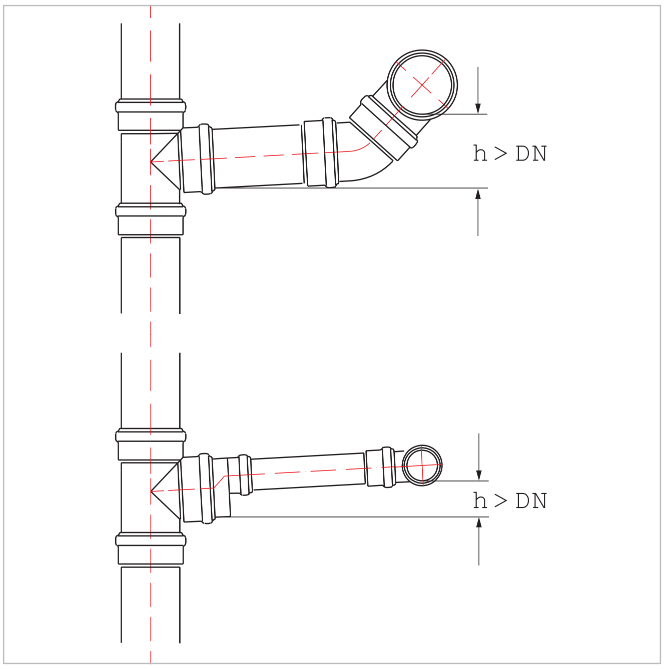
G.21 *Minimum height difference "h" required*

... between the water level in the odour trap and the invert of the connection line at the downpipe branch



G.23 *Overflow-proof connection*

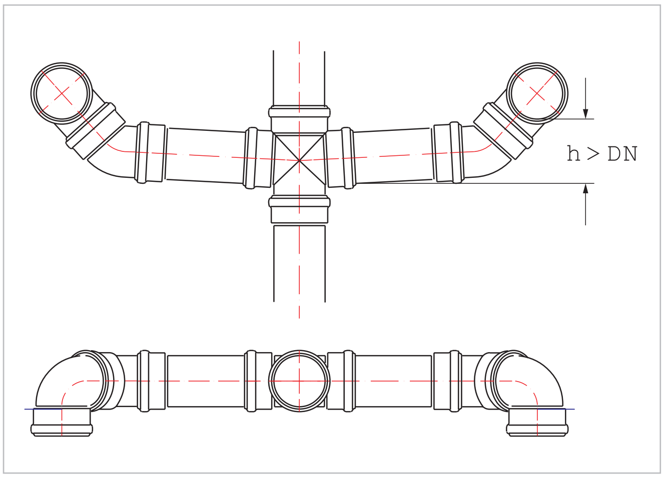
... when using double branches of the same diameter with an inside radius or 45° inlet angle



G.22 *Overflow-proof connections to the downpipe*

... if the pipe invert connection and the pipe diameter are the same

... by off-setting the inlet flows by 90° in a corner branch (right picture) and in connections on the opposite side by observing a minimum required distance (left picture)



G.24 *Connecting pipelines from toilets located opposite to each other*

Wastewater downpipes

In order to keep the water seal inside the odour traps, pressure fluctuations caused by drainage processes in the system must be limited. The expected pressure fluctuations are greatest in the area of the downpipes, as drainage flows are greatly accelerated or decelerated. The resulting low pressure or excessive pressure must be compensated or reduced by the unobstructed air flows in the entire drainage system.

The extent of the pressure fluctuations within any system is strongly influenced by the resistance, which opposes the flowing air in the drainage system. Every design for a wastewater system must consider all elements of the scheme to ensure faultless equalisation of transient pressures.

Considerations relating to flow, stack height, off sets within the downpipes, and diversity of use must be calculated to ensure the correct method of ventilation is adopted to maintain a healthy system. Transitions in flow should be handled by installing at least 2x 45° elbows. The flow resistances in the downpipe are of particular importance for the functionality of the discharging unit. Downpipes and the associated main ventilation pipes should therefore be routed as straight as possible through the floors and extending above the roof. A constriction of the air flow by introducing cross-sectional reductions in the ventilation pipe, or at the end of the ventilation stack, is not permitted.

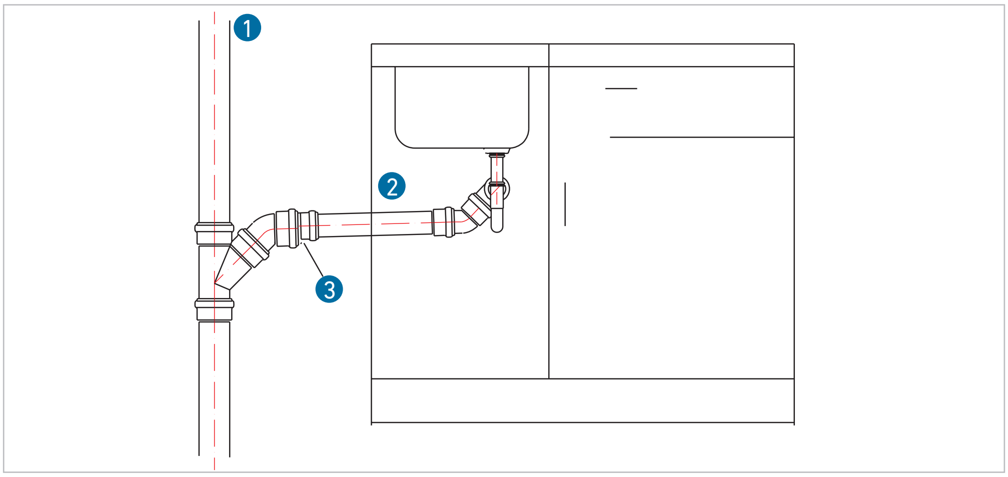
Adjacent flats may only be connected to a downpipe if noise and fire safety requirements are met.

The geometric shape of the branch, with which single or collecting pipes are connected to the downpipe, has an influence on the pressure conditions in both the connection line and the downpipe. Connections to downpipes ≤DN70 must therefore be made with branches having a connection pitch of 88° ± 2° (➨ [G.25]).

If only kitchen drains are connected to what is referred to as “kitchen waste pipes”, an exception to this basic rule is permitted for reasons of better cleaning options. Taking into account all aspects, in this case, connection branches with a slope of less than 45° are more suitable (➨ [G.25]).

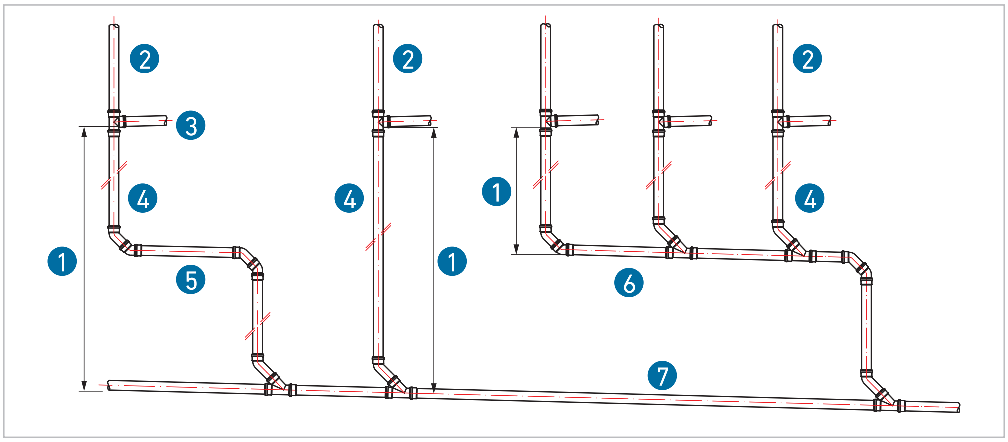
If the nominal diameter of the downpipe and the connecting line are the same, 45° branches or 88.5° branches with inner radius should be preferred. This ensures that the pressure fluctuations in the downpipes are reduced to a minimum.

If a downpipe flow is diverted into a header, an underground pipeline or in the area of a downpipe offset, special, design measures must be taken into account, depending on the length of the downpipe. The definate length of the downpipe must be determined using the rules illustrated in Fig. [G.26].



G.25 *Connection of a single kitchen connection DN50 to a downpipe DN70*

1 DN70
2 DN50
3 Excentric reduction DN70 / DN50

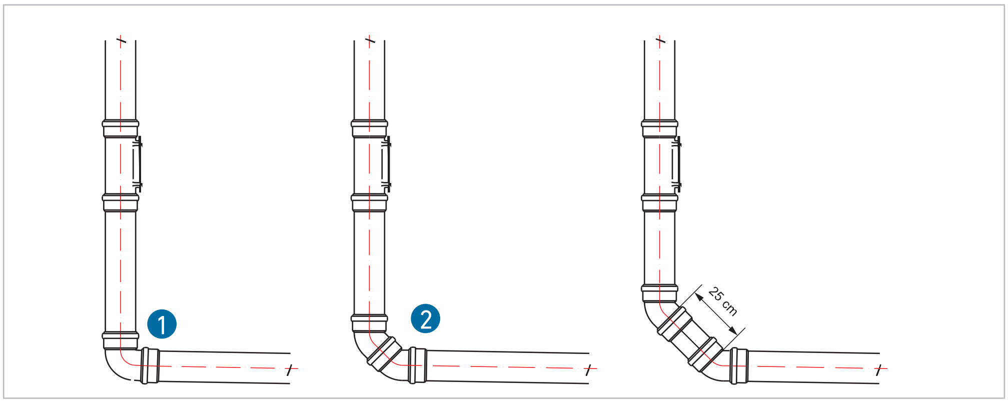


G.26 *Determining the length of the downpipe*

1 Length of the downpipe
2 Main ventilation pipe
3 Collecting pipe
4 Downpipe
5 Downpipe off-set
6 Header pipes vented by adding more downpipes
7 Underground pipeline

Downpipes up to 10 m long

Downpipes up to 10 m long may be connected to horizontal pipelines using 88° elbows. The variants using 2x 45° elbows or 2x 45° elbows with a 25 cm long intermediate piece are hydraulically more favorable, reduce the impact noise and thus improve the sound insulation (➨ [G.27]).



G.27 *Design types of deflections of horizontal downpipes*

1 87° elbow
2 2x 45° elbows

Downpipes longer than 10 m up to 22 m long

When using downpipes longer than 10 m and up to 22 m long, the installation of an 87° elbow for the deflection is no longer permitted. The variants with 2x 45° elbows or 2x 45° elbows with 25 cm long intermediate piece must be used (➨ [G.27]).

If the downpipe offset requires directional changes that exceed 45° and which are located in an area subject to critical excessive pressure, connections to the downpipe up to a height of at least 2.00 m are not permitted any more(➨ [G.28] and ➨ [G.29]).

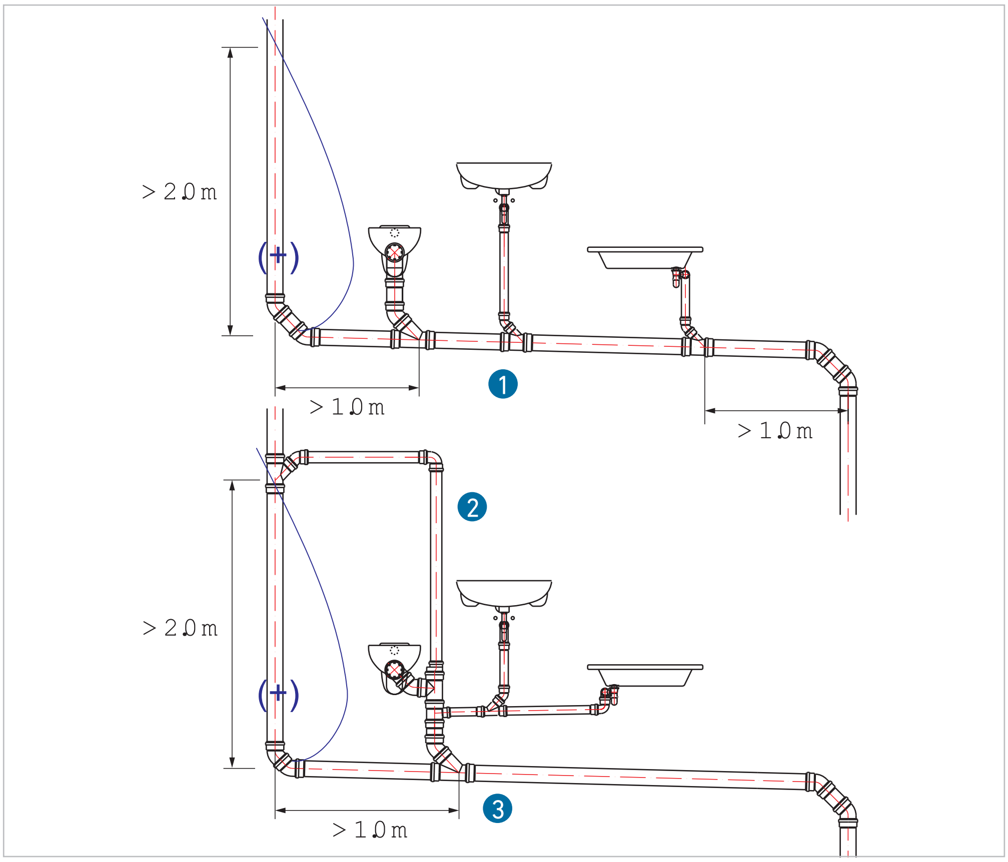
Single and collecting pipes must be connected to the horizontal line in the off-set, taking into account a minimum distance of 1.0 m downstrean of the inflow side elbow and 1 m upstream of the drain side elbow (➨ [G.28]).

In a downpipe off-set, the elbows on the inlet and outlet side must be equipped with an additional adaptor measuring 25 cm long between the 45° elbows. When using bypass lines, this additional adaptor can be omitted (➨ [G.28] and ➨ [G.29]).

However, if the downpipe off-set is shorter than 2.0 m, a bypass must be provided. Single and collecting pipes must be connected to the bypass pipeline. The bypass must be connected at least 2.0 m above the inlet side and 1.0 m below the elbow of the outlet side (➨ [G.29]).

Downpipes exceeding a length of 22 m

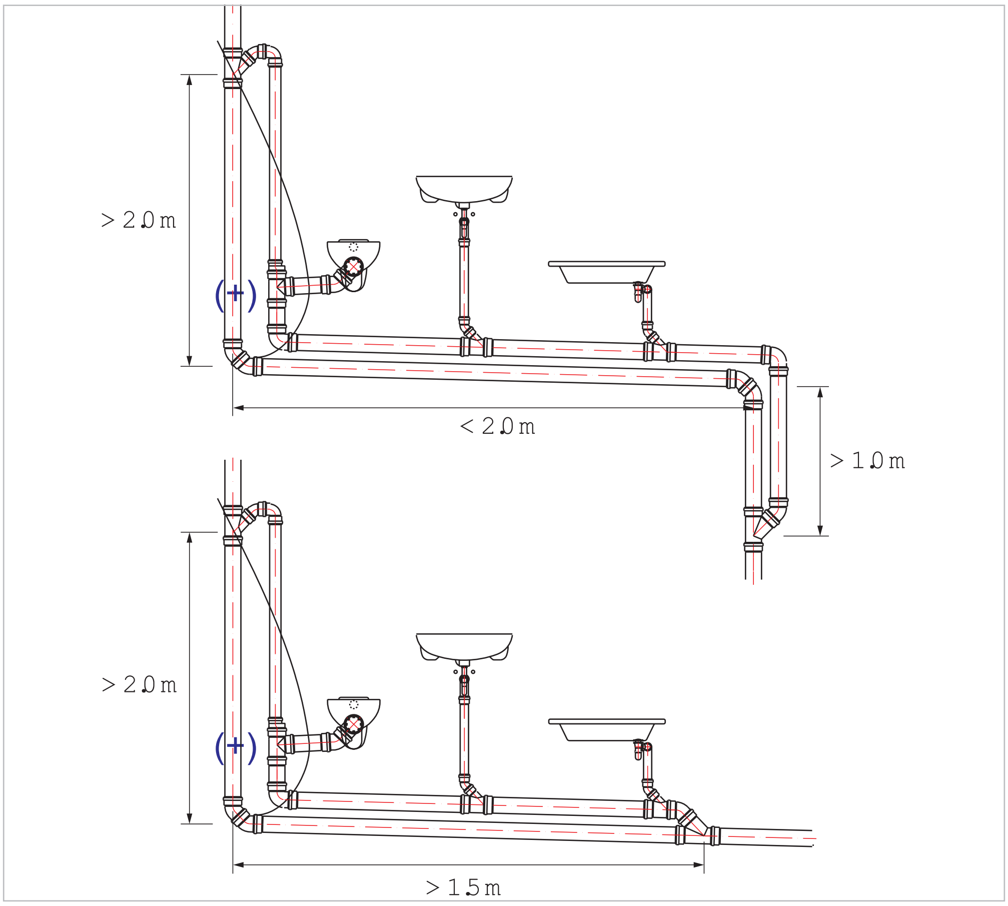
If the length of a downpipe exceeds 22 m, connections in an area subject to critical excessive pressure are only permitted on bypass lines (➨ [G.28] and ➨ [G.29]).



G.28 *Connections in an area subject to critical excessive pressure*

... taking into account distances or using a ventilation pipe

1 Downpipe off-set
2 Ventilation pipe
3 Downpipe off-set



G.29 *Connections in an area subject to critical excessive pressure or off-sets with bypass lines*

Ventilation

Ventilation of the drainage system

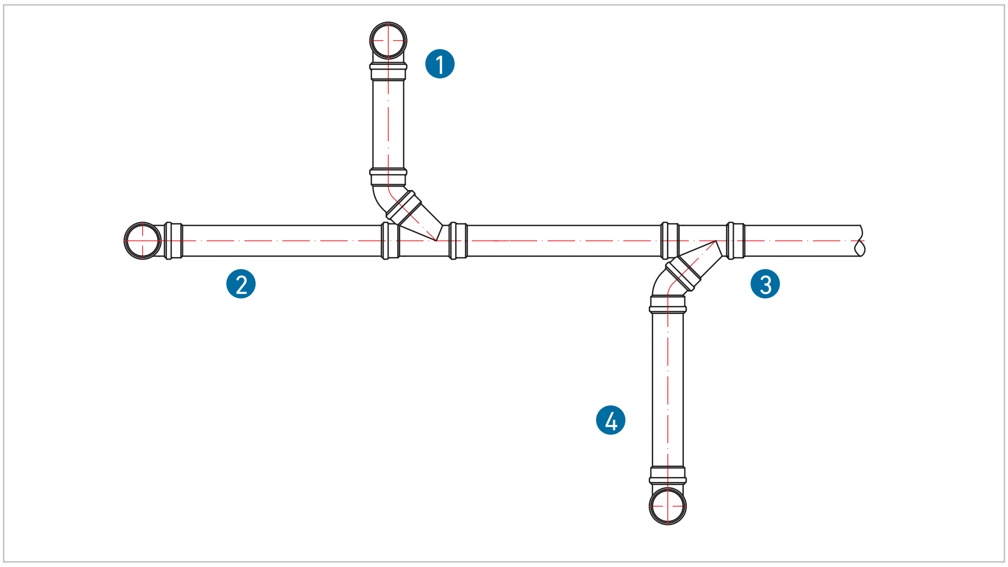
The relationship between the property's drainage system and the public sewer system, requires that sufficient ventilation for the internal drainage capacity is considered within the internal drainage system. Reasons for this are:

- The ventilation openings in the manhole covers are not sufficient to dissipate the sewer and digester gases of the public sewer system and thus to ensure safe operation
- Pressure fluctuations resulting from acceleration or deceleration processes of the wastewater flow can only be kept within acceptable limits by providing adequate ventilation of the entire drainage system

In order for the ventilation to function safely, sharing the use of the drainage pipes for room ventilation is not permitted.

Ventilation through the roof must not be interrupted by other installations, for example, odour traps.

In drainage systems without downpipes, at least one ventilation pipe with a nominal diameter of DN70 must be routed through a suitable open vent pipe extending above the roofline, or via an Air Admittance Valve (AAV) meeting the standards of BS EN 12380:2002 for ventilation. In this case, compliance with the requirements for the design principles of single and multiple collecting pipes (➨ Chapter 'Dimensioning') is mandatory.



G.30 *Ventilation methods for drainage systems without downpipes*

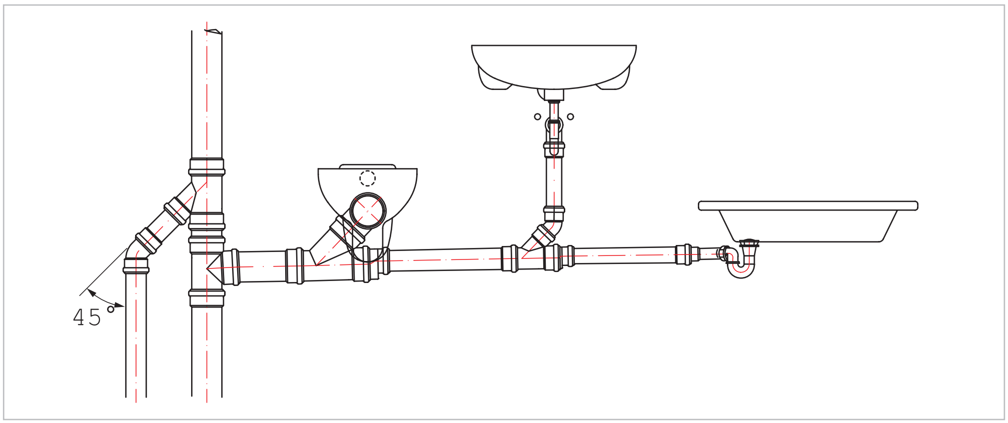
1 Ventilation through the roof must be at least DN70
2 Collecting pipe
3 Headers
4 Collecting pipe

Merging ventilation pipes

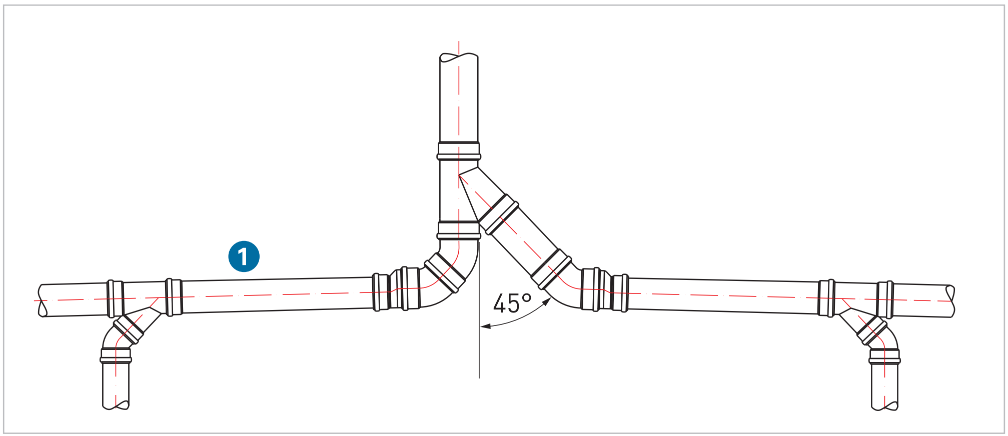
For architectural or structural reasons, the merging of ventilation pipes may be required. Collecting ventilation pipes must be dimensioned according to the nominal widths (➨ Chapter 'Nominal diameters of ventilation pipes').

Merged ventilation pipes must only be installed at an angle of 45°, and above the highest connecting pipeline. The cross-sections of the common nominal diameter must be made in accordance with the design principles (➨ Chapter 'Nominal diameters of ventilation pipes').

In order for the natural air flow – caused by the air density differences in the horizontally installed ventilation pipes, the horizontal off-sets of the ventilation pipes must have a slope of about 2.0 cm/m and the deflections in the elbows and branches must be at an angle of 45° (➨ [G.32]).



G.31 *Merging ventilation pipes*



G.32 *Merging main ventilation pipes into collecting ventilation pipes*

1 Slope J > 2 cm/m

Ventilation valves

Ventilation valves must comply with BS EN 12380. They may only be installed in special situations in a drainage system that is otherwise ventilated with at least one main ventilation pipe above the roof.

Ventilation valves can only counteract the formation of vacuum in a drainage system. The installation of ventilation valves in an area subject to critical excessive pressure, for example in the redirectional area of downpipes, is not permitted. Therefore, the use of these valves is limited to the following applications:

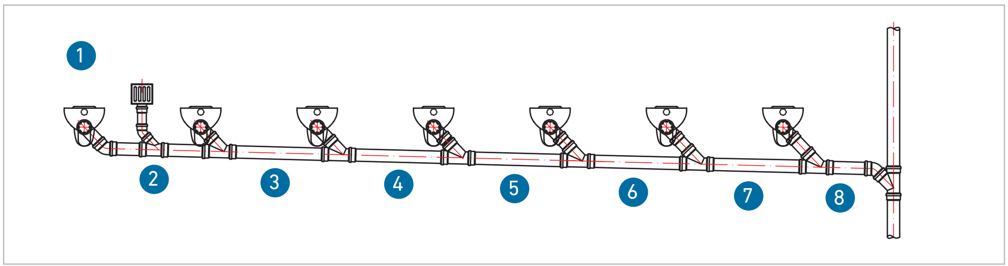
- For the ventilation of single or collecting pipes, if the maximum permissible lengths from Table [T.5] and Table [T.6] are exceeded
- For semi-detached dwelling and duplexes or comparable units these valves can be used as a replacement for additional main ventilation ducts, if at least one downpipe is equipped with a main ventilation pipe
- In existing systems for the subsequent ventilation of single and collecting pipes, for example, as a measure to prevent the odour traps from being sucked empty or to avoid gurgling noises in the pipe
- Replacement for indirect secondary ventilation and ventilation lines, which are intended to counteract the formation of a vacuum (➨ [G.34] and ➨ [G.33]).

Ventilation valves must be installed so that sufficient air can be supplied and maintenance or replacement is possible.

Because of the risk of wastewater discharge, ventilation valves must not be installed below the backwater level.

At the top end of the ventilation pipe, a stack vent protrudes above the roof. This vent opening must meet the following requirements:

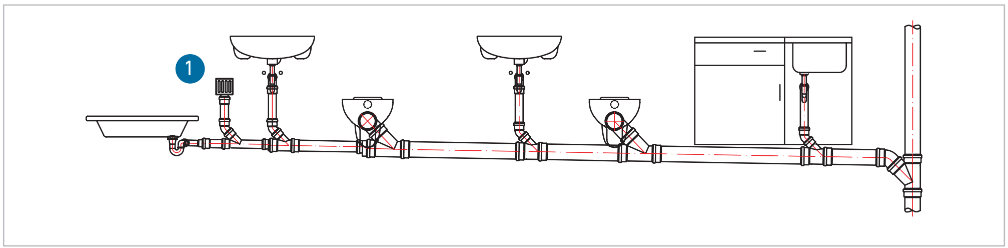
- The stack vent must leave the roof at a perpendicular angle.
- Preferably, the stack vent is open on top. Covers or hoods on the stack vent should be omitted for aerodynamic reasons.
- If covers are used, the air flow must not be deviated by more than 90°.
- The outlet cross-section must be at least 1.5 times the cross-section of the ventilation pipe.
- The vertical distance from the upper edge of the vent opening to the roof surface must be at least 15 cm.
- If the opening of a ventilation pipe is near common rooms, the minimum height of 1.0 m above the window lintel and a minimum lateral distance of 2.0 m from the window opening must be maintained.
- Compliance with these minimum distances is also mandatory in the suction area of ventilation intake points, refrigeration and air conditioning systems and must be coordinated with the manufacturer.
- Roof penetrations must be connected watertight and must comply with the heat protection and airtightness of the functional layers.



G.34 *Ventilation valve as a replacement for an indirect secondary line or ventilation line*

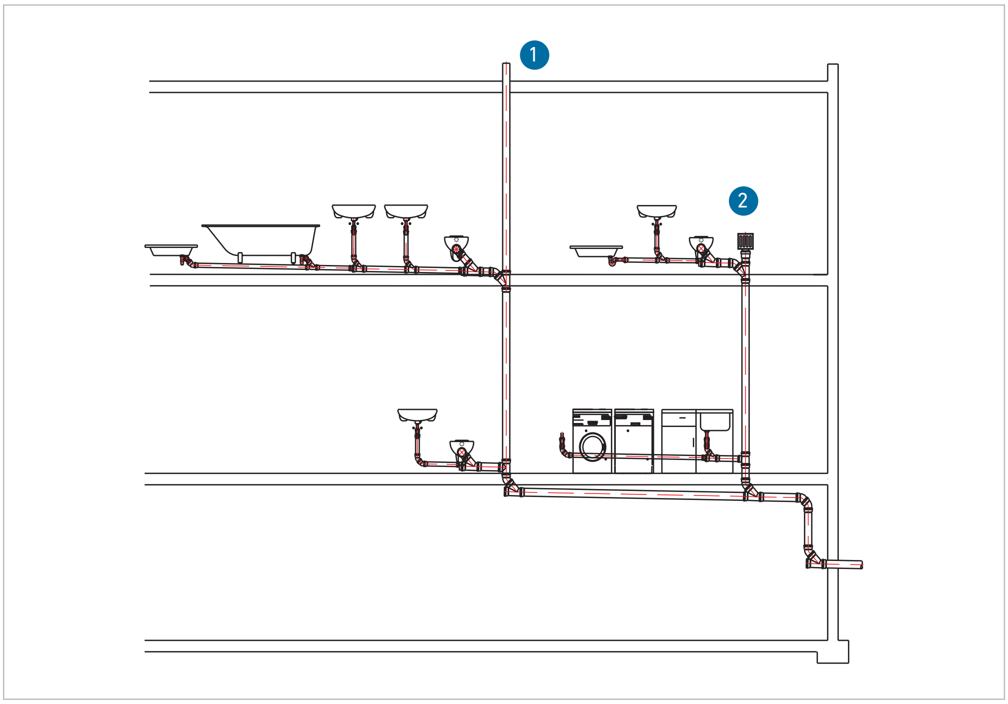
... in a heavily loaded collecting pipe (in-line toilet system)

1 Ventilation valve
2 TS 1
3 TS 2
4 TS 3
5 TS 4
6 TS 5
7 TS 6
8 TS 7



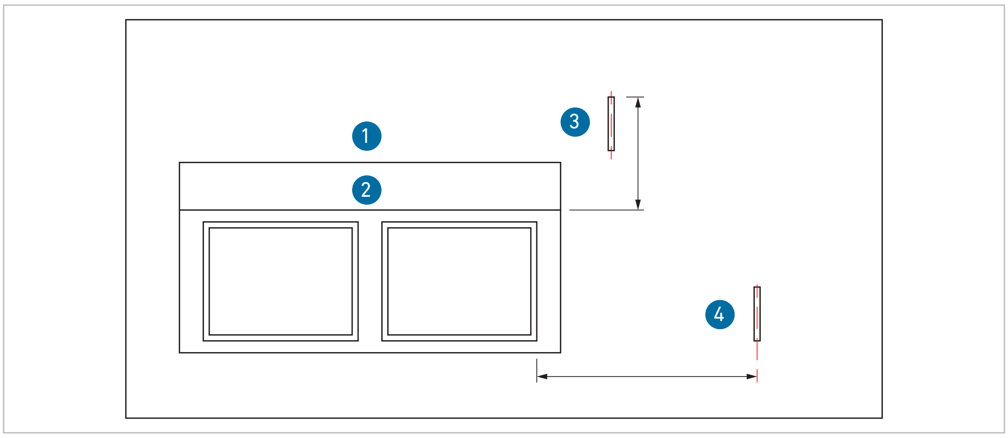
G.33 *Ventilation valve for longer single or multiple collecting pipes*

1 Ventilation valve



G.35 *Use of ventilation valves in semi-detached dwelling and duplexes*

1 At least one main ventilation pipe above the roof
2 Ventilation valve



G.36 *Minimum clearances of the endpipes from ventilation pipes to windows of common rooms*

1 Gable roof
2 Window lintel
3 End of ventilation pipe (h ≥ 1,0 m)
4 End of ventilation pipe (l ≥ 2,0 m)

Ventilation of sewage lifting units

Preventing Vacuum: As wastewater or other fluids are pumped out of the wet well (the chamber where the liquid collects), it creates a negative pressure or vacuum inside the sealed chamber. A vent pipe allows atmospheric air to enter the wet well, equalising the pressure and preventing the formation of a vacuum. Without it, the pump would struggle to draw liquid, or the wet well could even collapse under external atmospheric pressure.

Preventing Overpressure: Conversely, when liquid flows into the wet well, or during certain operational conditions, air can become trapped and compressed. The vent pipe provides an escape route for this excess air, preventing overpressure that could damage the wet well structure or internal components.

Sewage lifting units conforming to BS EN 12050-1 must always be ventilated with a separate ventilation pipe above the roof. The connection of a container ventilation line to a collective ventilation line is permitted and must be installed at an angle of 45°. The collective ventilation line must be dimensioned according to the regulations (➨ Chapter 'Nominal diameters of ventilation pipes').

If the pump shaft of a sewage lifting unit for grey wastewater is closed odour-tight, the same requirements for the container ventilation apply.

Connecting a container ventilation line to a downpipe is not permitted. Do not use a vent valve to replace the container ventilation pipe above the roof.

Single, collecting and headers that lead to a sewage lifting unit, as described in Chapter ventilation of the drainage system') are aerated and vented.

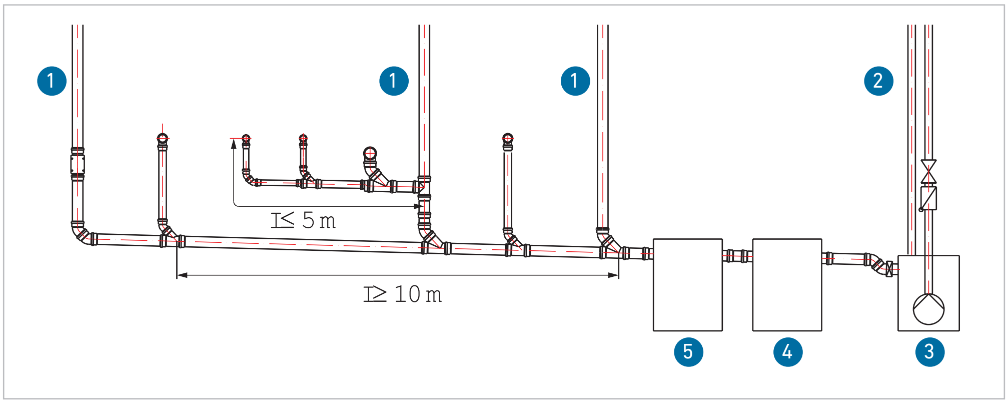
Ventilation of the pipelines to the dirt separator

Both the inlet and outlet pipe of your trap should be vented, ensuring there is air flow available on entry and exit – this allows the device to maintain pressure equilibrium and stops vacuums forming inside the pipes. Ventilation pipes should terminate above the roof in accordance with BS EN 1825-2. If the inlet pipe is longer than 10 m, an additional ventilation pipe must be connected directly in front of the grease separator (➨ [G.37]).

Single and collecting pipes, longer than 5.0 m must be ventilated separately.

The ventilation pipes of the drainage system in front of the grease separator (intake lines) and, if necessary, the grease separator can be combined into a collective ventilation line.

Ventilation pipes of wastewater pipes and of sewage lifting unit must not be connected to the ventilation pipe of the grease separator.



G.37 *Requirements for the ventilation of grease separator systems*

1 Ventilation pipe
2 Ventilation pipe must penetrate the roof separately
3 Sewage lifting unit
4 Grease separator
5 Sludge trap

Dimensioning

Wastewater pipelines

A self-cleaning system with and adequate pressure equalisation through ventilation are among the most important objectives in the design and dimensioning of a wastewater drainage system.

In a drainage pipeline, wastewater and air for pressure equalisation must be able to flow together, but independent of each other. Therefore, the lines for the wastewater transport are only partially utilised (partial filling). The cross-section not used by the wastewater is available to the air flow. The pipes must not be allowed to seep with sewage during normal operation of the drainage system at any time. Even a brief interruption of the air flow caused by the full filling of the pipe, results in pressure fluctuations that jeopardise the trap water seals in the odour traps. During such operating conditions, water seal head can be completely depleted or pushed back into the drainage pipes. Such operations are accompanied by unpleasant gurgling noises.

In a partially filled pipeline, the wastewater is transported only by the effects of gravity and due to the difference in the water level. The water level difference is generated by installing the pipe angle at a slope.

Conveying the wastewater using external energy is limited to a few exceptional cases. A hydraulically perfect function in partially filled drainage pipelines can be expected if – with the occurrence of the total water discharge (Q_{tot}) – a flow with a suitable degree of filling (h/d_i) and suitable flow velocity (v_{min}) is set in such a way that suspended matter and sediment can be transported and washed out (self-cleaning ability).

An optimal flow condition is characterised by a parallel course of the waterline with the angle of the pipe, which is installed along the gradient line.

By adapting the normative specifications for a maximum permissible degree of filling (h/d_i), a minimum required pipe angle (J_{min}) and minimum required or maximum permissible flow velocities (v), this optimum flow state becomes the basis of the design.

Drainage systems are designed along the flow path. The design usually starts with the longest flow path. All flow paths must be divided into pipe segments. Within the pipe segments, the total discharge of water (Q_{tot}), the pipe angle (J) and the permissible degree of filling (h/d_i) must not change. The designations of the pipe segments must be chosen without ambiguity and used both in the engineering drawings of the drainage system and in the documentation containing the results of the calculation.

The results of the design must be documented in what is referred to as hydraulic lists.

Total wastewater discharge

The total wastewater that drains into a pipe segment of the drainage system (Q_{tot}) consists of the expected runoff at peak times from the connected sanitary drainage objects (Q_{WW}) and, if applicable, the drainage objects with continuous runoff (Q_C) and the pump flow rates of sewage lifting units (Q_P). Permanent drainages and pump delivery flows must be added to the wastewater drain without deduction.

FI.1 *Formula 1*

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

Q_{tot} Total wastewater discharge in L/s
Q_{ww} Wastewater discharge, in L/s
Q_c Continuous discharge in L/s
Q_p Pump delivery rate in L/s
Q_{ww} Wastewater discharge into a pipe segment in L/s

FI.2 *Formula 2*

$$Q_{ww} = K \cdot \sqrt{\sum(DU)}$$

Q_{ww} Wastewater discharge in L/s
K Discharge indicator
$\sum(DU)$ Sum of the connection values

T.4 *Discharge indicator K*
... depending on the type of building and usage

Building type and usage	K
Irregular use, for example in a block of flats, nursing homes, bed & breakfasts, offices	0.5
Regular use, in hospitals, schools, restaurants, hotels	0.7
Frequent use, for example in public toilet facilities and/or showers	1.0

If drainages from areas with different uses overlap in one pipe segment, Q_{WW} should be calculated with approximately the same amount of wastewater drainage with the respective larger discharge code (K).

Nominal diameters of drainage pipes

Single collection lines, not vented and vented

Single connection pipes that are not vented, must be dimensioned according to the table, depending on the type of drainage object and the assigned connection value (DU).

In addition, compliance with the following requirements is mandatory:

- Minimum slope J_{min} = 1 cm/m
- Maximum length l_{max} = 4 m
- a maximum of three 90° elbows (without connecting elbow) in the flow path
- maximum permissible height difference between a connection to a drainage object and the pipe invert in the connection branch to the downpipe $\Delta h_{max} \leq 1$ m

If one of the above conditions cannot be met, the single connection pipeline must be ventilated.

Ventilated single connection lines must be dimensioned depending on the type of drainage object and the assigned connection value (DU) (➨ [T.5]).

Compliance with the following requirements is mandatory:

- Minimum slope J_{min} = 0.5 cm/m
- Maximum length l_{max} = 10 m
- Maximum permissible height difference between a connection to a drainage object and the pipe invert in the connection branch to the downpipe $\Delta h_{max} \leq 3$ m

T.5 *Connection values (DU) and nominal diameter of the single connection line of drainage objects*

Drainage object	Connection value DU [l/s]	Nominal diameter of single connection pipelines DN
Washbasin, bidet	0.5	40
Shower without plug	0.6	50
Shower with plug	0.8	50
Single urinal with cistern	0.8	50
Single urinal with flush valve	0.5	50
Free standing urinal	0.2	50
Urinal without flushing unit	0.1	50
Bathtub	0.8	50
Kitchen sink and dishwasher	0.8	50
Kitchen sink	0.8	50
Dishwasher	0.8	50
Washing machine up to 6 kg	0.8	50
Washing machine up to 12 kg	1.5	56/60
WC with 4.0/4.5 litre cistern	1.8	80/90
WC with 6.0 litre cistern/flush valve	2.0	80 ... 100
WC with 9.0 litre cistern/flush valve	2.5	100
Floor drain DN50	0.8	50
Floor drain DN70	1.5	70
Floor drain DN100	2.0	100
Note: For lavatory systems with flush valves, the same connection values can be used as for systems with cisterns.		

Collecting pipes

Collecting pipes that are not ventilated. must be dimensioned depending on the discharge code. the sum of the connected values ∑(DU) and the length.

Compliance with the following requirements is mandatory (➨ [T.6]):

- Minimum slope Jmin = 1 cm/m
- Maximum permissible length (lmax) according to the table
- A collecting pipe that is not ventilated. must comply with the specifications applicable to single connection pipelines

If one of the application limits cannot be met. it is considered a header which must be ventilated and dimensioned accordingly (➨ Chapter 'Header and underground pipelines inside the building').

Dimensioning example of a semi-detached dwelling

The design of the colleting pipeline illustrated above takes into account the specifications listed in Table [T.7].

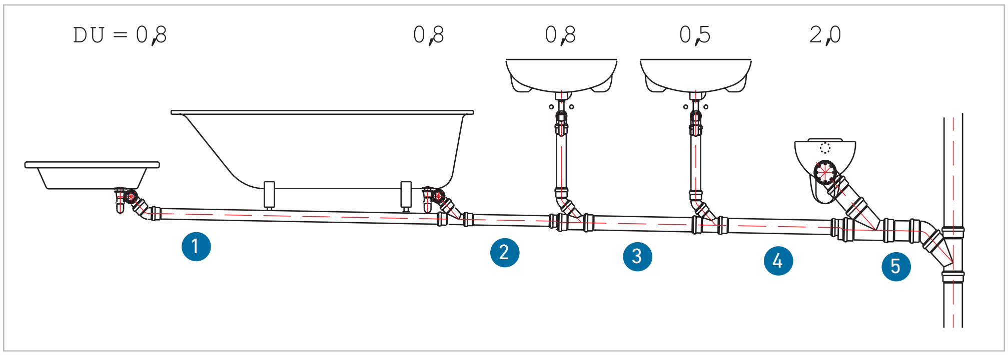
In the first step. the longest flow path in the collecting pipe must be determined and subdivided into pipe segments. The length of the respective pipe segment and the sum of the connection values are also required for design purposes. With this output data. the required diameters can be determined with Table [T.6]. Subsequently. the maximum permissible length of the collecting pipe must be checked. Here. knowing the connection diameter to the downpipe is critical. When using a nominal diameter DN90 (d_i = 80.6 mm). the maximum permissible length of the pipe is 10.0 m. Since in this specific example the collecting pipe is only 5.5 m long. the design can be completed successfully.

T.6 *Permissible load and maximum permissible length of collecting pipes that are not ventilated*

DN	$d_{i,min}$ [mm]	Discharge indicator K K = 0.5 ∑(DU) [l/s]	K = 0.7 ∑(DU) [l/s]	K = 1.0 ∑(DU) [l/s]	Maximum permissible length l_{max} [m]
50	44	1.0	1.0	0.8	4.0
56/60	49/56	2.0	2.0	1.0	4.0
70 [a)]	68	9.0	4.6	2.2	4.0
80	75	13.0 [b)]	8.0 [b)]	4.0	10.0
90	79	13.0 [b)]	10.0 [b)]	5.0	10.0
100	96	16.0	12.0	6.4	10.0

a) No toilets

b) Maximum number of toilets



G.38 *Drainage capacity of downpipes*

... depending on the diameter and the inlet geometry of the branch

1 TS 1
2 TS 2
3 TS 3
4 TS 4
5 TS 5

T.7 *Collecting pipes*

TS	Length [m]	∑(DU) [l/s]	K	Q_{ww} [l/s]	Q_P [l/s]	Q_C [l/s]	Q_{tot} [l/s]	d_i [mm]	J [cm/m]	h/d_i	Q_{zul} [l/s]	v [m/s]
1	1.5	0.8						49.6	1.0			
2	1.0	1.6						49.6	1.0			
3	1.0	2.1						68.8	1.0			
4	1.0	2.6						68.8	1.0			
5	1.0	4.6						68.8	1.0			
Sum:	5.5											

Downpipes with main ventilation

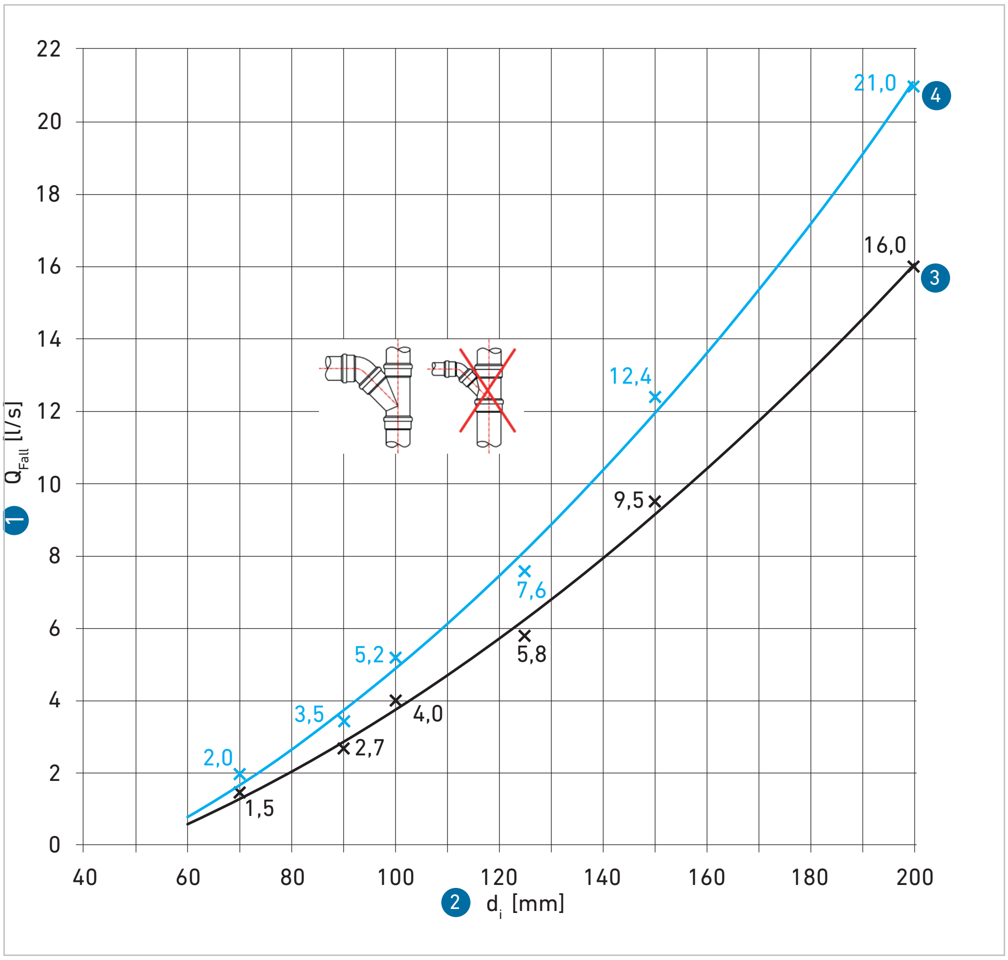
Downpipes with main ventilation must be dimensioned depending on the total wastewater drainage and the geometry of the branch linking the downpipe with the connection or collecting pipeline (➨ [T.8]).

The geometry of the branch affects the drainage capacity of the downpipe. If the wastewater is discharged at an angle below 45° or through an 87° branch with inner radius, the downpipe can be stressed higher than a sharp-angled inlet at approx. 90° into a branch without inner radius.

T.8 *Drainage capacity of a downpipe with main ventilation*

DN	Branches without inner radius Q_{max} [L/s]	Branches with inner radius Q_{max} [L/s]
70	1.5	2.0
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

When using lavatory systems with a volume of 4.0 L to 6.0 L flushing water, the nominal diameter for downpipes in system I must be at least DN80.



G.39 *Drainage capacity of downpipes*

...depending on the diameter and the inlet geometry of the branch

1 Drainage capacity of a downpipe
2 Internal diameter of the downpipe
3 Branches without inner radius
4 Branches with inner radius

Dimensioning example of a semi-detached dwelling

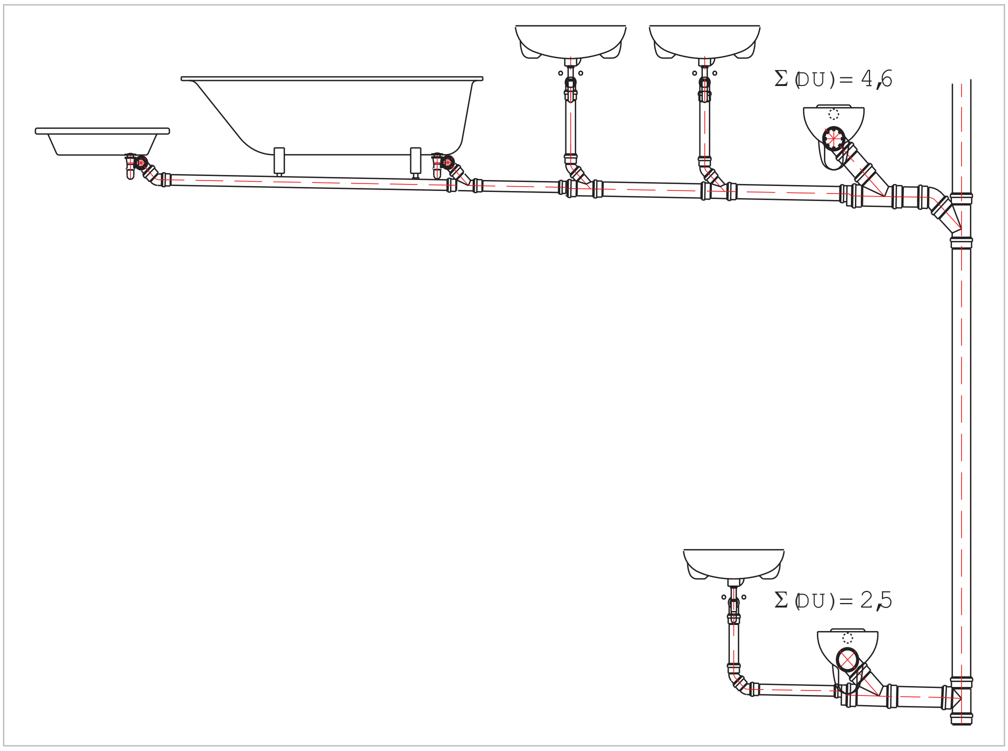
The following information must be available for the dimensioning of a downpipe:

- Principle of downpipe ventilation (main ventilation, auxilliary ventilation, secondary ventilation)
- Geometry of the connection branch to the downpipe (with or without inner radius)
- The sum of the load values ∑(DU) for the pipe segment at the end of the downpipe and the resulting total discharge Q_{tot}
- The connected value DU of the largest connected drainage object

In this dimensioning example, the connection value DU of the toilet is 2.0 L/s larger than the calculated peak discharge Q_{WW} mit 1.4 L/s. The downpipe must be dimensioned for the larger value (Q_{tot} = 2.0 L/s). The downpipe with main ventilation and connection branches with inner radius (45° branch) can be designed with a nominal diameter of DN90 (d_i = 80.6 mm). The maximum permissible drainage in a downpipe of this nominal diameter is 3.5 L/s (➨ [T.8] and [G.66]).

T.9 *Downpipe*

TS	Length [m]	∑(DU) [l/s]	K	Q_{ww} [l/s]	Q_P [l/s]	Q_C [l/s]	Q_{tot} [l/s]	d_i [mm]	J [cm/m]	h/d_i	Q_{zul} [l/s]	v [m/s]
6	2.8	7.1	0.5	1.3			2.0	80.6			3.5	



G.40 *Design of a downpipe in a semi-detached dwelling*

Header and underground pipelines inside the building

Headers and underground pipes within the building must be dimensioned for the total wastewater discharge (Q_{tot}) in the respective pipe segments (➨ [T.11] and ➨ [T.12]).

Compliance with the following requirements is mandatory:

- Maximum permissible degree of filling $h/d_i = 0.5$
- Maximum permissible degree of filling $h/d_i = 0.7$ (only for pipe segments downstream of a pump flow from a sewage lifting units)
- Minimum slope $J_{min} = 0.5$ cm/m
- Minimum flow rate $v_{min} = 0.5$ m/s

In order to ensure self-cleaning capability, header pipes and underground pipelines must not be designed larger than the calculation procedure specifies.

Header pipes and underground pipelines must always be dimensioned for an even gradient of the pipe invert throughout the entire flow path.

Example applicable to Table [T.11]:
The total wastewater flow of $Q_{tot} = 4.0$ L/s across a pipe segment of a drainage systemis musy be drained. The pipe invert J = 1.0 cm/m and a maximum permissible degree of filling is $h / d_i = 0.5$.

The required nominal diameter is determined using DN125 (d_i = 124.6 mm) from Table [T.10]. The maximum drainage capacity of this nominal diameter for a given gradient and degree of filling is Q = 5.0 L/s at a flow velocity of v = 0.8 m/s and is therefore greater than the required 4.0 L/s. Corresponding results are usually recorded in hydraulic lists (➨ [T.10]).

T.10 *Hydraulic list with results for the design of a collecting or underground pipeline*

	Calculation of peak discharge							Drainage capacity of the selected pipeline				
TS	Length	∑(DU)	K	Q_{ww}	Q_P	Q_C	Q_{tot}	d_i	J	h/d_i	Q_{zul}	v
	[m]	[l/s]		[l/s]	[l/s]	[l/s]	[l/s]	[mm]	[cm/m]		[l/s]	[m/s]
							4.0	124.6	1.0	0.50	5.0	0.82

T.11 *Drainage capacity of partially filled GF Silenta Premium pipelines (h/d_i = 0.5)*

J	DN56		DN70		DN90		DN100		DN125		DN150		DN200	
[cm/m]	d_i = 49,6		d_i = 68,8		d_i = 80,6		d_i = 99		d_i = 124,6		d_i = 149,6		d_i = 189,6	
	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	V [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]
0.5							1.9	0.5	3.5	0.6	5.8	0.7	10.8	0.8
0.6					1.2	0.5	2.1	0.5	3.9	0.6	6.3	0.7	11.9	0.8
0.7			0.9	0.5	1.3	0.5	2.3	0.6	4.2	0.7	6.8	0.8	12.8	0.9
0.8			0.9	0.5	1.4	0.5	2.4	0.6	4.5	0.7	7.3	0.8	13.7	1.0
1.0			1.0	0.5	1.6	0.6	2.7	0.7	5.0	0.8	8.2	0.9	15.4	1.1
1.2	0.5	0.5	1.1	0.6	1.7	0.7	3.0	0.8	5.5	0.9	9.0	1.0	16.8	1.2
1.4	0.5	0.5	1.2	0.7	1.9	0.7	3.2	0.8	5.9	1.0	9.7	1.1	18.2	1.3
1.6	0.5	0.6	1.3	0.7	2.0	0.8	3.4	0.9	6.4	1.0	10.4	1.2	19.5	1.4
1.8	0.6	0.6	1.4	0.7	2.1	0.8	3.7	0.9	6.8	1.1	11.0	1.3	20.7	1.5
2.0	0.6	0.6	1.5	0.8	2.2	0.9	3.9	1.0	7.1	1.2	11.6	1.3	21.8	1.5
2.5	0.7	0.7	1.6	0.9	2.5	1.0	4.3	1.1	8.0	1.3	13.0	1.5	24.4	1.7
3.0	0.7	0.8	1.8	1.0	2.7	1.1	4.7	1.2	8.7	1.4	14.2	1.6	26.7	1.9
3.5	0.8	0.8	1.9	1.0	2.9	1.2	5.1	1.3	9.4	1.5	15.4	1.7	28.9	2.0
4.0	0.9	0.9	2.1	1.1	3.2	1.2	5.5	1.4	10.1	1.7	16.4	1.9	30.9	2.2
4.5	0.9	0.9	2.2	1.2	3.3	1.3	5.8	1.5	10.7	1.8	17.4	2.0	32.7	2.3
5.0	1.0	1.0	2.3	1.2	3.5	1.4	6.1	1.6	11.3	1.9	18.4	2.1	34.5	2.4

T.12 *Drainage capacity of partially filled GF Silenta Premium pipelines (h/d_i = 0.7)*

J	DN56		DN70		DN90		DN100		DN125		DN150		DN200	
[cm/m]	d_i = 49,6		d_i = 68,8		d_i = 80,6		d_i = 99		d_i = 124,6		d_i = 149,6		d_i = 189,6	
	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]	Q [l/s]	V [m/s]	Q [l/s]	v [m/s]	Q [l/s]	v [m/s]
0.5					1.8	0.5	3.2	0.6	5.9	0.6	9.6	0.7	18.1	0.9
0.6			1.3	0.5	2.0	0.5	3.5	0.6	6.5	0.7	10.6	0.8	19.8	0.9
0.7			1.4	0.5	2.2	0.6	3.8	0.7	7.0	0.8	11.4	0.9	21.4	1.0
0.8			1.5	0.6	2.3	0.6	4.1	0.7	7.5	0.8	12.2	0.9	22.9	1.1
1.0	0.7	0.5	1.7	0.6	2.6	0.7	4.5	0.8	8.4	0.9	13.7	1.0	25.7	1.2
1.2	0.8	0.5	1.9	0.7	2.9	0.8	5.0	0.9	9.2	1.0	15.0	1.1	28.1	1.3
1.4	0.8	0.6	2.0	0.7	3.1	0.8	5.4	0.9	10.0	1.1	16.2	1.2	30.4	1.4
1.6	0.9	0.6	2.2	0.8	3.3	0.9	5.8	1.0	10.7	1.2	17.3	1.3	32.5	1.5
1.8	1.0	0.7	2.3	0.8	3.5	0.9	6.1	1.1	11.3	1.2	18.4	1.4	34.5	1.6
2.0	1.0	0.7	2.4	0.9	3.7	1.0	6.5	1.1	11.9	1.3	19.4	1.5	36.4	1.7
2.5	1.1	0.8	2.7	1.0	4.2	1.1	7.2	1.3	13.3	1.5	21.7	1.7	40.7	1.9
3.0	1.2	0.9	3.0	1.1	4.6	1.2	7.9	1.4	14.6	1.6	23.8	1.8	44.6	2.1
3.5	1.3	0.9	3.2	1.2	4.9	1.3	8.6	1.5	15.8	1.7	25.7	2.0	48.2	2.3
4.0	1.4	1.0	3.5	1.2	5.3	1.4	9.2	1.6	16.9	1.9	27.5	2.1	51.6	2.4
4.5	1.5	1.1	3.7	1.3	5.6	1.5	9.7	1.7	17.9	2.0	29.2	2.2	54.7	2.6
5.0	1.6	1.1	3.9	1.4	5.9	1.6	10.2	1.8	18.9	2.1	30.8	2.3	57.7	2.7

Dimensioning example of a header (semi-detached dwelling)

The following information must be available when dimensioning a pipe segment in a header or underground pipeline:

- Discharge code (K) for the building type and usage
- The sum of the load values (∑(DU)) for the pipe segment that must be dimensioned
- Flow rate of a sewage lifting unit (Q_P) in the pipe segment
- Connection value (DU) of the largest connected drainage object
- Total wastewater discharge (Q_{tot})
- uniform pipe slope (J)
- maximum permissible degree of filling in the ppe segment (h/d_i)

In the pipe segment TS 7, the connection value DU of a lavatory is 2.0 L/s is greater than the calculated peak drainage Q_{WW} of 1.3 L/s. The calculation must continue, using the larger value (DU = 2.0 L/s). The pipe segment TS 7 must be dimensioned taking into account the maximum permissible degree of filling h/d_i = 0.5. The pipe invert is initially specified as J = 1.0 cm/m and is applicable to all pipe segment.

In pipe segment TS 9, the pump delivery flow from a sewage lifting unit with Q_P = 3.5 L/s is fed into the pipeline. Starting with this pipe segment, the maximum permissible degree of filling can be increased to h/d_i = 0.7 (➨ [T.12]).

Due to the flow rate of the sewage lifting unit, a nominal pipe diameter DN125 (d_i = 124.4 mm) must be installed when using a pipe invert of J = 1 cm/m in the pipe segments TS 9 – TS 11.

The continuous use of the nominal diameter DN100 (d_i = 99 mm) is only possible when installing the header at a point where the pipe invert gradient is equal to J = 1.5 cm/m (➨ [T.13] and [T.14]).

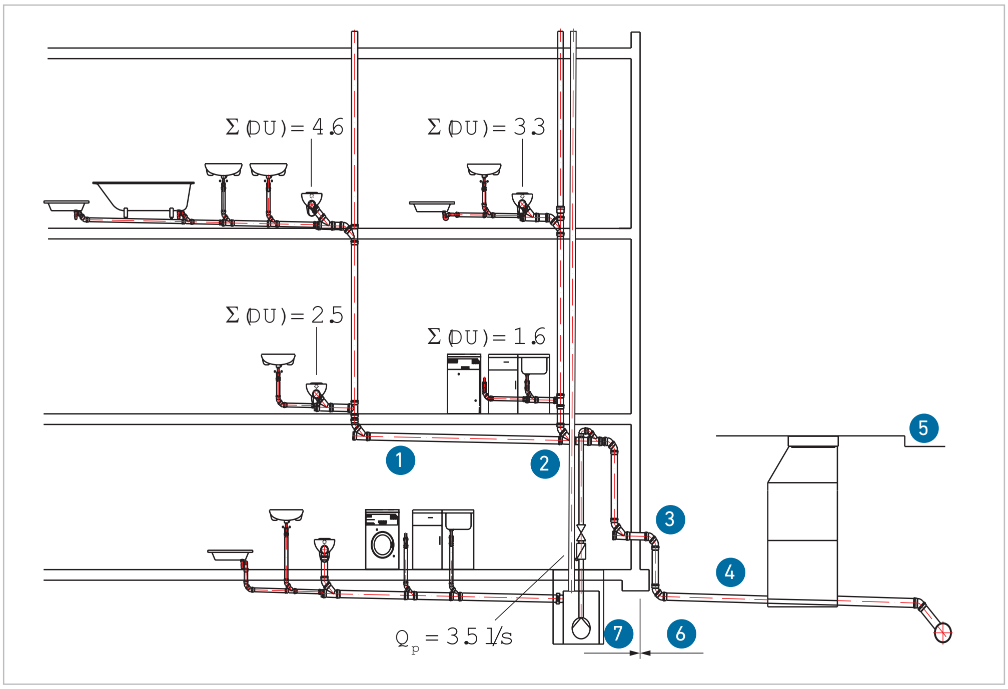
Dimensioning example for a heavily loaded collecting/ header (series toilet system)

In this case, the design does not succeed as a collecting pipeline (➨ [T.9]). When considering the public use of a series toilet system (K = 1.0), the admissible sum of the connected values (∑(DU) = 6.4) – which is used as a prerequisite for the use of the design table – is significantly exceeded when using ∑(DU) = 14.0 in the example.

If one of the application limits in Table [T.9] cannot be met, it must be considered a header from a calculation point of view. This implies that the header must be ventilated at the end. In this scenario, a vent valve is used for the ventilation; however, this could also be ensured by recirculating the air or using an indirect secondary ventilation pipe. This header must be dimensioned using Table [T.11] (results: ➨ [T.15]). Verification of the hydraulic capacity for the continuous use of the nominal diameter DN100 (d_i = 99.0 mm) is only possible, if the header is installed on a pipe invert slope of J = 2.0 cm/m.

Dimensioning example for headers in a block of flats

The downpipe with main ventilation and connection branches without inner radius (87° branch) can be designed with a nominal diameter of DN90 (d_i = 80.6 mm). The maximum permissible discharge under the given conditions is 2.7 L/s (➨ [T.10] and ➨ [G.66]). By contrast, the associated header (TS 1) must already be designed using DN100 (d_i = 99.0 mm) with a specified pipe invert slope of J = 1.0 cm/m.



G.41 *Design of a header in a semi-detached dwelling*

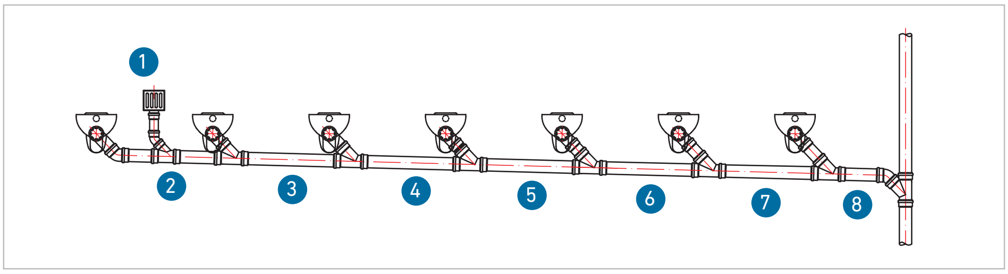
1 TS 7
2 TS 8 / TS 9
3 TS 10
4 TS 11
5 Street
6 Outside the building
7 Inside the building

T.13 *Calculation for gradient J = 1.0 cm/m*

		Calculation of peak discharge						Drainage capacity of the selected pipeline				
TS	**Length**	**∑(DU)**	**K**	**Q_{ww}**	**Q_P**	**Q_C**	**Q_{tot}**	**d_i**	**J**	**h/d_i**	**Q_{zul}**	**v**
	[m]	**[l/s]**		**[l/s]**	**[l/s]**	**[l/s]**	**[l/s]**	**[mm]**	**[cm/m]**		**[l/s]**	**[m/s]**
7		7.1	0.5	1.3	0.0	0.0	2.0	99.0	1.0	0.50	2.7	0.7
8		11.9	0.5	1.7	0.0	0.0	2.0	124.6	1.0	0.50	5.0	0.82
9		11.9	0.5	1.7	3.5	0.0	5.5	124.6	1.0	0.70	8.4	0.92
10		11.9	0.5	1.7	3.5	0.0	5.5	124.6	1.0	0.70	8.4	0.92
11		11.9	1.5	5.2	3.5	0.0	5.5	124.6	1.0	0.70	8.4	0.92

T.14 *Calculation for gradient J = 1.5 cm/m*

		Calculation of peak discharge						Drainage capacity of the selected pipeline				
TS	**Length**	**∑(DU)**	**K**	**Q_{ww}**	**Q_P**	**Q_C**	**Q_{tot}**	**d_i**	**J**	**h/d_i**	**Q_{zul}**	**v**
	[m]	**[l/s]**		**[l/s]**	**[l/s]**	**[l/s]**	**[l/s]**	**[mm]**	**[cm/m]**		**[l/s]**	**[m/s]**
7		7.1	0.5	1.3	0.0	0.0	2.0	99.0	1.5	0.50	3.3	0.87
8		11.9	0.5	1.7	0.0	0.0	2.0	99.0	1.5	0.50	3.3	0.87
9		11.9	0.5	1.7	3.5	0.0	5.5	99.0	1.5	0.70	5.6	0.97
10		11.9	0.5	1.7	3.5	0.0	5.5	99.0	1.5	0.70	5.6	0.97
11		11.9	1.5	5.2	3.5	0.0	5.5	99.0	1.5	0.70	5.6	0.97

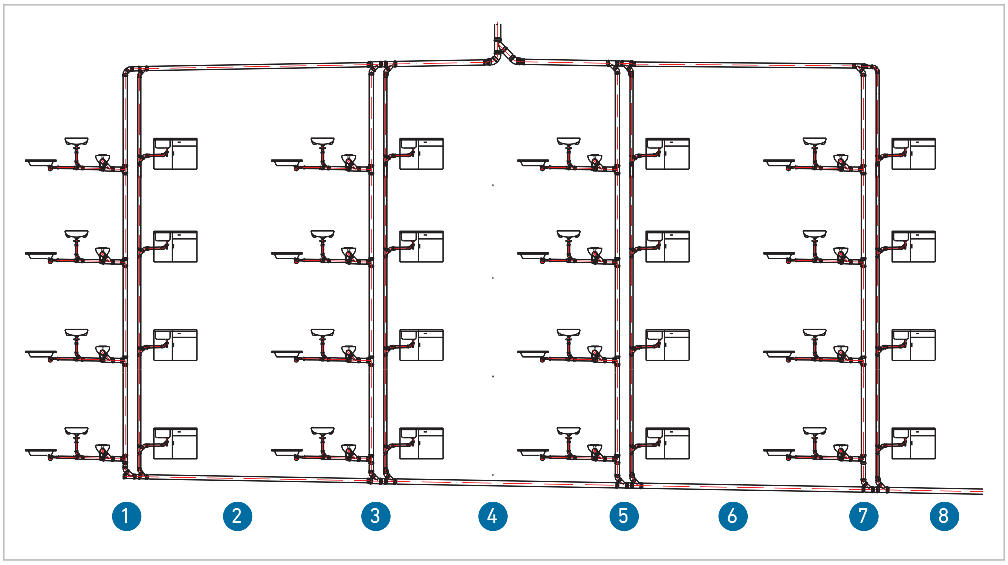


G.42 *Collecting pipelines/header pipes subject to excessive loads (in-line lavatory) used in public facilities*

1 Ventilation valve
2 TS 1
3 TS 2
4 TS 3
5 TS 4
6 TS 5
7 TS 6
8 TS 7

T.15 *Design of headers for a series toilet system for public use*

	Calculation of peak discharge							Drainage capacity of the selected pipeline				
TS	Length [m]	∑(DU) [l/s]	K	Q_{ww} [l/s]	Q_P [l/s]	Q_C [l/s]	Q_{tot} [l/s]	d_i [mm]	J [cm/m]	h/d_i	Q_{zul} [l/s]	v [m/s]
1	1.2	2.0	1.0	1.4	0.0	0.0	2.0	99.0	2.0	0.50	3.9	1.00
2	1.2	4.0	1.0	2.0	0.0	0.0	2.0	99.0	2.0	0.50	3.9	1.00
3	1.2	6.0	1.0	2.4	0.0	0.0	2.4	99.0	2.0	0.50	3.9	1.00
4	1.2	8.0	1.0	2.8	0.0	0.0	2.8	99.0	2.0	0.50	3.9	1.00
5	1.2	10.0	1.0	3.2	0.0	0.0	3.2	99.0	2.0	0.50	3.9	1.00
6	1.2	12.0	1.0	3.5	0.0	0.0	3.5	99.0	2.0	0.50	3.9	1.00
7	1.2	14.0	1.0	3.7	0.0	0.0	3.7	99.0	2.0	0.50	3.9	1.00
Sum:	8.4											



G.43 *Headers in a block of flats*

1 to **8**: TS1 to TS8

T.16 *Design of headers in a block of flats*

	Calculation of peak discharge							Drainage capacity of the selected pipeline				
TS	Length [m]	∑(DU) [l/s]	K	Q_{ww} [l/s]	Q_P [l/s]	Q_C [l/s]	Q_{tot} [l/s]	d_i [mm]	J [cm/m]	h/d_i	Q_{zul} [l/s]	v [m/s]
1		13.2	0.5	1.8	0.0	0.0	2.0	99.0	1.0	0.50	2.7	0.70
2		16.4	0.5	2.0	0.0	0.0	2.0	99.0	1.0	0.50	2.7	0.70
3		29.6	0.5	2.7	0.0	0.0	2.7	99.0	1.0	0.50	2.7	0.70
4		32.8	0.5	2.9	0.0	0.0	2.9	124.6	1.0	0.50	5.0	0.82
5		46.0	0.5	3.4	0.0	0.0	3.4	124.6	1.0	0.50	5.0	0.82
6		49.2	0.5	3.5	0.0	0.0	3.5	124.6	1.0	0.50	5.0	0.82
7		62.4	0.5	3.9	0.0	0.0	3.9	124.6	1.0	0.50	5.0	0.82
8		65.6	0.5	4.0	0.0	0.0	4.0	124.6	1.0	0.50	5.0	0.82

Nominal diameters of ventilation pipes

Main ventilation pipes

Main ventilation pipes must have the same cross-sectional areas as the applicable downpipes.

T.17 *Cross-sections of ventilation pipes (GF Silenta Premium)*

DN	d_i [mm]	A_{HL} [cm²]
56	49.6	19.3
70	68.8	37.2
90	80.6	51.0
100	99.0	77.0
125	124.6	121.9
150	149.6	175.8
200	189.6	282.3

Collecting main ventilation pipes

The cross-section of a collecting main ventilation pipe (A_{SHL}) must be at least as large as half the sum of the cross-sectional areas of the individual main ventilation pipes (A_{HL}).

FI.3 *Formula 6*

$$A_{SHL} \geq \frac{\sum(A_{HL})}{2}$$

The nominal diameter of the collecting main ventilation pipe must be at least one nominal size larger than the largest nominal diameter of the applicable main ventilation pipe.

Dimensioning example: Collecting main ventilation pipes for block of flats

T.18 *Dimensioning collecting main ventilation pipes for block of flats*

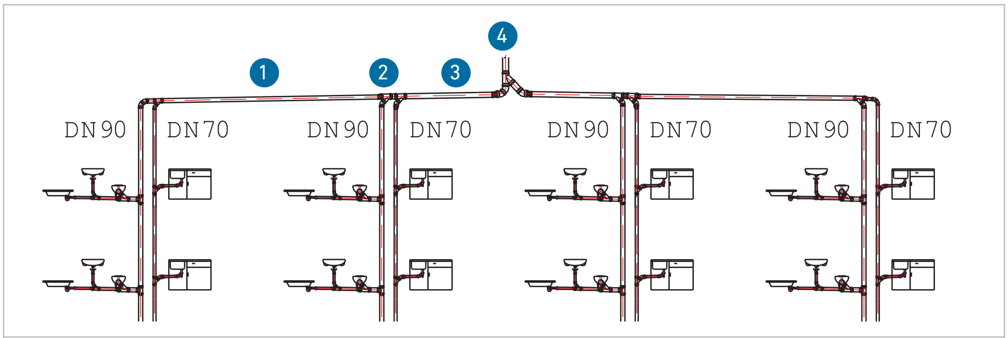
TS	$\sum(A_{HL})$ [cm²]	A_{SHL} [cm²]	$d_{i,min}$ [mm]	d_i [mm]	DN
1	88.2	44.1	74.9	99.0	**100**
2	139.2	69.6	94.1	99.0	**100**
3	176.4	88.2	106.0	124.6	**125**
4	352.8	176.4	149.9	149.9	**150**

For segment TS 1, formula [FI.3] results in a minimum internal diameter of $d_{i,\,min}$ = 74.9 mm (➨ [T.18]). However, since the nominal diameter of the collective main ventilation must be at least one nominal size larger than the largest nominal diameter of the associated main ventilation (DN90), this pipe segment of the collective main ventilation must be dimensioned as DN100. The collecting main ventilation must be routed vertically above the roof, using an end pipe of nominal diameter DN150 (TS 4).

Bypass and ventilation pipes

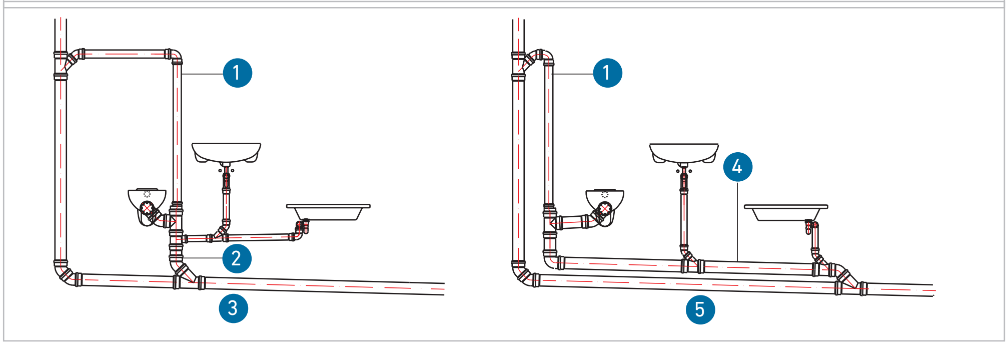
The nominal diameter of a bypass shall be the same as the downpipe, however, it must not exceed DN100.

Where a ventilation pipe merges into a downpipe, downpipe off-set or header pipe, the ventilation pipe shall be designed having the same nominal diameter as the header it is intended to ventilate, however, a DN70 is sufficient.



G.44 *Dimensioning example*

1 to **4**: TS1 to TS4



G.45 *Dimensioning bypass and ventilation pipes*

- **1** Ventilation pipe ≥DN70
- **2** Collecting pipe
- **3** Downpipe off-set
- **4** Bypass ≤DN100
- **5** Header

Cleaning

Cleaning openings

Regulations and guidance in the UK, primarily found in Approved Document H of the Building Regulations and standards like BS EN 12056-2:2000, mandate that drainage systems must have adequate, permanent access for inspection and rodding. Internal drainage pipes can be fitted with cleaning fittings having rectangular, round or oval openings as well as pipe end closures.

Key areas for access should include;

- At the head of a drain run.
- At changes in direction (bends over 45 degrees are generally avoided; shallower bends may require access nearby).
- Where branch drains join a main pipe (unless an inspection chamber is at the junction).
- At changes in pipe size or gradient.
- At regular intervals along straight runs (typically every 22 metres for underground drains).

Access points (rodding eyes, inspection chambers, manholes) must be accessible at all times and must not be built over, covered by permanent finishes, or blocked by landscaping. Rodding points should be positioned to avoid internal flooding if a cap is removed, ideally in external locations or service voids.

In headers, cleaning and pipe end closures must be used.

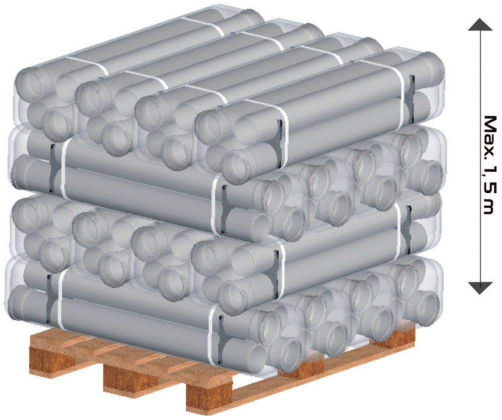
Downpipes must be provided with a cleaning pipe immediately upstream of the transition to a collecting or underground pipeline.

Inspection and maintenance

Regulations for building drainage maintenance focus on safety, efficiency, and compliance, primarily guided by UK Building Regulations Part H (or equivalent national standard) - supported by BS EN 12056, BS EN 752, BS 8000-13 requires systems to be accessible and to undergo documented cleaning and regular inspections to ensure the system is fail-safe.

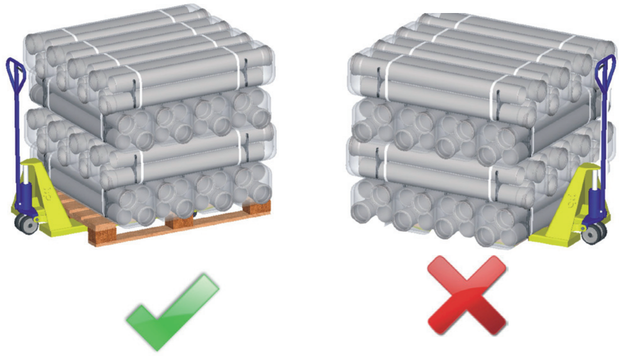
The owner or authorised user (operator) shall be responsible for the appropriate inspections and any regular maintenance. All maintenance shall be undertaken by a competent person using appropriate tooling and materials.

Storage



Correct methods of storage should be used to provide a stable assembly of several layers of pipe. Correct methods of storage will prevent any damage or deformation to the pipes. Pipes should not be stacked above 1,5 m.
Pipes should be safe against sliding.

Pipes packed in the factory might be stacked on wooden frames. Appropriate packaging such as pallet etc. must be used to prevent any damage to the pipes, especially the socket ends of the pipes. The use of correct packaging pallets also makes it easier to lift the pipes from the floor.



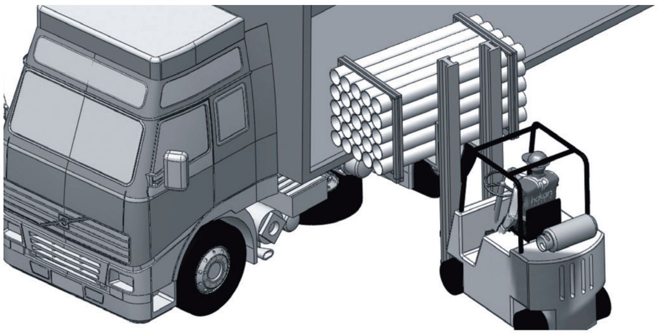
GF Silenta and HT-PP products are not resistant to prolonged exposure to UV. Stored product should be protected from direct sunlight.

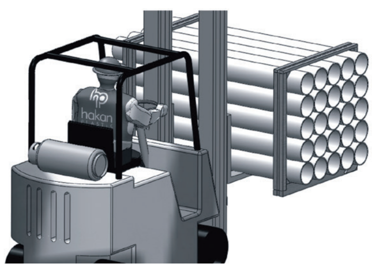
Pipes and fittings packed in carton boxes should be protected against moisture.

Carton boxes should be sealed and stored in a dry area.

Transportation

Pipes should be carefully transported to prevent any damages. Pipes and fittings should ideally be stored away from direct sunlight, dirt and free from risk of accidental damage. Ensure that pipes and fittings are handled carefully, and pipes should never be slid or dragged on a floor or hard surface. Loading and unloading and packing of pipes in a block should be carried out by means of a suitable forklift having flat threads and extensions.





Directories

Glossary

The terms are listed in accordance with the standards BS EN 752, BS EN 12056 and DIN 1986.

General information

Backwater level – The highest level up to which water inside the drainage system can rise.

Domestic wastewater – Wastewater originating from sanitary equipment and areas such as kitchens, laundry rooms, bathrooms, toilets or similar locations and flows into the drainage system.

Drainage system – A system that is installed comprising drainage objects, pipelines and other components that collect wastewater and uses gravity to drain it.

Industrial wastewater – Wastewater that is modified and contaminated by industrial or commercial use.

Odour trap – A device that prevents seepage of sewer gases from draining through a water trap.

Mixing system – Drainage system for the common discharge of dirty water an precipitation in the same pipeline or duct system

Rainwater – Water from natural precipitation that has not been contaminated by use is also referred to as rainwater.

Self-cleaning capability – Ability of the drainage pipes to recover themselves from impurities by natural processes and to avoid blockages when used as intended.

Separation system – Drainage systems consist of two piping or sewer systems for the separate discharge of precepitation and rainwater

Wastewater – Wastewater is domestic effluence.

Waste water – Water that flows during use into the drainage system, such as domestic sewage water, commercial and industrial wastewater and rainwater.

Pipelines

Bypass – A line receiving connecting lines in an area of a downpipe offset where water accumulates, or in the area of a transition of a downpipe feeding into a collecting or underground pipeline.

Collecting pipe – This pipeline receives the wastewater from several individual connecting pipes, conveying it to a secondary pipeline or to a lifting system.

Connecting duct – Channel between the public sewer and the boundary of the property or the first cleaning opening, e.g. entrance shaft on the property.

Header – A horizontal pipe holding the wastewater from the down, collection and single connection pipes. A header is not installed in the ground or in the concrete slab.

Rainwater discharge pipe – Internal or external, vertical pipe, if necessary, with an offset for the discharge of rainwater from roof areas, balconies and loggias.

Sewer mains – An inaccessible pipeline, installed under ground or in the concrete slab, and commonly conveying the wastewater to the sewer.

Single connection line – Line from the odour trap of a drainage object to a secondary pipeline.

Wastewater down pipe – A vertical pipe, possibly with offsets, which leads through one or more storeys, is ventilated through the roof and supplies the wastewater to a sewer main or collective pipe.

Ventilation systems

Main ventilation – Ventilation of single or multiple combined downpipes up to and above the roof.

Recirculating ventilation – Ventilation of a connecting pipeline or a bypass line by returning to the applicable downpipe.

Ventilation valves – Valve that introduces air into the drainage system, but not out again in order to limit pressure fluctuations within the drainage system.

Dimensioning

Calculation rainfall intensity – Use local IDF curves or data from official meteorological sources (such as the Flood Estimation Handbook (FEH) data in the UK)

Connection load – Average value of wastewater drainage in l/s from a sanitary drainage object.

Continuous runoff – Continuous runoff in l/s of all constant drainages, e.g. runoffs from equipment, machinery or cooling water.

Discharge coefficient – The discharge coefficient indicates the ratio of the rainwater entering the drainage system to the surface condition of the rain catchment area and relative to the total rainwater in the applicable rainfall area.

Discharge indicator – Code indicating how frequently sanitary drainage objects in different types of buildings are used.

Effective drainage area – The roof area projected from the floor plan or the property area shown in the outdoor facility digram.

Emergency drainage – Additional rain drainage down emergency drains or emergency overflows with unrestricted discharge to the property. **Pump delivery flow** – Waste water discharge in l/s from sewage pumps.

Total wastewater drainage – Total wastewater drainage in l/s is the sum of wastewater drainage, continuous drain and pump flow rate.

Wastewater drainage – Total drainage water in l/s from sanitary drainage objects in a drainage system.

Literature - Standards

Wastewater installation - International standards

BS EN 752	Drain and sewer systems outside buildings
BS EN 1253-1	Gullies for buildings – Part 1: Requirements
BS EN 1451	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Polypropylene (PP) - Part 1: Specifications for pipes, fittings and the system
BS EN 1610	Construction and testing of drains and sewers
BS EN 1825-2	Grease separators – Part 2: Selection of nominal size, installation, operation and maintenance
BS EN 12050-1	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 1: Faecal matter lifting plants
BS EN 12050-2	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 2: Lifting plants for wastewater containing faecal matter
BS EN 12050-3	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 3: Lifting plants for limited applications
BS EN 12056-1	Gravity drainage systems inside buildings – Part 1: General and performance requirements
BS EN 12056-2	Gravity drainage systems inside buildings – Part 2: Sanitary pipework, layout and calculation
BS EN 12056-3	Gravity drainage systems inside buildings – Part 3: Roof drainage, layout and calculation
BS EN 12056-4	Gravity drainage systems inside buildings – Part 4: Wastewater lifting plants, layout and calculation
BS EN 12056-5	Gravity drainage systems inside buildings – Part 5: Installation and testing, instructions for operation, maintenance and use
BS EN 12380	Air admittance valves for drainage systems – Requirements, test methods and evaluation of conformity
BS EN ISO 9969	Thermoplastics pipes - Determination of ring stiffness
BS EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
BS EN 14366	Laboratory measurement of noise from waste water installations
ISO 178	Plastics — Determination of flexural properties

Wastewater installation - German DIN standards

DIN 1986-3	Drainage systems on private ground – Part 3: Specifications for service and maintenance
DIN 1986-4	Drainage systems on private ground – Part 4: Fields of application of sewage pipes and fittings of different materials
DIN 1986-30	Drainage systems on private ground – Part 30: Maintenance
DIN 2425-4	Plans for public utilities, water resources and long-distance lines; sewer network drawings of public sewerage systems
DIN 4040-100	Grease separators – Part 100: Application provisions for grease separators in accordance with DIN EN 1825-2
DIN 4102	Fire behaviour of building materials and building components
DIN 4109	Sound insulation in buildings (all parts)
DIN 4124	Excavations and trenches – Slopes, planking and strutting breadths of working spaces DIN 1986-100 Drainage systems on private ground – Part 100: Specifications in relation to: DIN EN 752 and DIN EN 12056
DIN 18195	Waterproofing of buildings (all parts)
DIN 18381	German construction contract procedures (VOB) – Part C: General technical specifications in construction contracts (ATV) – Installation of gas, water and drainage pipework inside buildings
DIN 53479	Testing of Plastics and Elastomers; Determination of Density
VDI 4100	Sound insulation between rooms in buildings – Dwellings – Assessment and proposals for enhanced sound insulation between rooms

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1187891 v2_01_2026_UK
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