GF Building Flow Solutions

GF Silenta Premium
GF Silenta 3A
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EN Technical information

Silenta Premium

Silenta 3A

HT-PP

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How to use this document

Content

In this document, GF Building Flow Solutions provides an essential, in-depth and a diversified look at the required work equipment, as well as the range of piping system services and solutions that will help to safely and reliably convey fluids and gases.

The document describes and explains the essential basics for planning and product selection, processing and operation of piping systems in building technology. It is suitable as a reference work as well as a document for training and further education or to support during a consultation meeting.

When selecting and assessing a specific subject-matter, we focus on explaining the planning and installation relevant areas.

All information is based on the applicable international ISO and EN standards, on various national standards, directives and additional data from raw material manufacturers. In addition, results from extensive, internal studies have been incorporated. This should help the sales consultant, the system designer, the engineer and the installer to better understand the complex systems incorporated in building technology and to plan and design the system correctly.

Detailed instructions for the systems and products can be found in the applicable installation and operating instructions, which are referred to individually.

Signs and symbols

In this document, distinctive fonts, headlines and titles are used to highlight certain information.

Typographical design elements

Element	Designation	Explanation
☑	Prerequisite, 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 the assembly of a component. Several work steps in a row result in an action sequence that is completed with a result. Several work steps can also be numbered in ascending order.
↳	Resultat	Result of a work step or action sequence
➨	Reference	Reference to another book 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. The Roman numeral refers to the book part, the Arabic numerals form the consecutive numbering in the book part

Symbols

Symbol	Designation	Explanation
	Information	This symbol highlights information of particular importance.
	This symbol refers to chapters in the document or to external sources	This symbol marks references to other book chapters or sources that contain more information.
	Reference to a standard, law or regulation	This symbol is used to identify a text excerpt from a standard, a statute or similar regulations. It refers to detailed information about a statement in standards and sections of laws, or legal notices.
	Calculation	Calculations (and examples) are marked with this symbol.
	Warning sign (Personal injury)	This warning symbol is 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 during assembly.
	Warning sign (Damage to property)	This warning symbol is 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 during assembly.

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

Polypropylene (PP)

Properties and requirements

The table shows typical characteristic values measured on the material. These values should not be used for calculation purposes.

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

The values listed above are typical values for reference purpose only and shall not be construed as specifications.

General information

Polypropylene (PP) is a thermoplastic belonging to the group of polyolefins and thus is a semi-crystalline material. The density is lower than that of other known thermoplastics. The mechanical properties, the chemical resistance and in particular the heat resistance have made polypropylene an important material in piping system construction as well. PP is formed by the polymerisation of propylene (C_3H_6) using, for example, Ziegler-Natta catalysts.

Three different material variants are common in piping system construction:

- 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 the sanitary sector. PP-B is mainly used for sewage systems because of its high impact strength, especially at low temperatures, and the comparatively low temperature resistance. PP-H is mainly used for industrial applications.

UV-repellent and resistance to atmospheric conditions

PP, like most organic materials, is inherently not UV- and weather-resistant. In favour of drinking water, an additional UV protection was not used, although the colour pigments provide some protection. However, unprotected storage or outdoor use is not recommended. For proper protective measures and the use outdoors, please contact the appropriate branch office at GF Building Flow Solutions.

Chemical resistance

As with all polyolefins, there is a certain sensitivity to oxidative media, to which disinfectants from the field of water treatment and disinfection, such as chlorine dioxide and sodium hypochlorite belong. When used, compliance with certain rules and limits is mandatory to in order to prevent damage to the system. For specific information on the durability of your application, please contact your local GF Building Flow Solutions branch office.

Limits of use

The limits of use of the material are based on the embrittlement and softening temperatures as well as the application classes defined in the relevant standards and regulations.
For PP, these limits are between –10°C and 95°C. Details can be found in the applicable pressure-temperature diagrams for the respective system.

Fire behaviour

PP is one of the flammable plastics. The oxygen index is 19% (below 21%, the plastic is considered flammable). When the flame is extinguished, PP continues to drip and burn without giving off sooty smoke. All combustion processes produce toxic substances, carbon monoxide usually plays a major role. Combustion of PP produces primarily carbondioxide, carbonmonoxide and water.

Suitable extinguishing agents are water, foam and carbondioxide. Pipes made of PP are currently classified according to EN 13501-1.

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 offers three polypropylene-based wastewater systems – Silenta Premium, Silenta 3A and HT-PP – which can all be used in standard indoor drainage applications.

All three systems are suitable for indoor wastewater installations. The choice depends on acoustic expectations and project comfort levels rather than installation limitations:

→ Choose Silenta Premium for maximum acoustic performance.
→ Choose Silenta 3A for enhanced comfort and sound reduction.
→ Choose HT-PP for standard, economical solutions.

System Performance Overview

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

System name	Acoustic performance	Key feature
Silenta Premium	12 dB(A) according to EN14366/ VDI4100	Superior Isolation. The quietest choice, ideal for the most noise-sensitive environments, significantly exceeding the highest comfort classes.
	15.5 dB(A) according to DIN4109	
Silenta 3A	15 dB(A) according to EN14366/ VDI4100	High Performance. Excellent acoustic properties, providing substantial noise reduction and meeting strict comfort standards easily.
	18 dB(A) according to DIN4109	
HT-PP	Non-Acoustic	Economical Standard. A basic drainage pipe offering no dedicated acoustic insulation; suitable only where noise is not a concern.

Comfort Level Classification (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 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) (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 plumbing noise.

Non-Habitable/Technical Areas

Target: ≤30 dB(A) (DIN 4109/ 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

- The GF Silenta Premium, a sound-insulated pipe system, provides a complete solution with advanced level durability, impact resistance, low sound level and easy installation features have considerably wide product range.
- GF Silenta Premium is a sound-insulating 3-layered sewer pipe system made of PP material which is specially formulated and reinforced for non-pressurized domestic drainage in accordance with system standards of EN 1451, DIN 4109 and DIN 4102.
- Due to the light grey colouring, the wastewater system GF Silenta Premium is easy to inspect.
- GF Silenta Premium is currently being tested by the German Fraunhofer Institute.

Benefits

- provides excellent sound insulation, creates ideal conditions for buildings and contributes to an increase in the property value along with the quality of life. Reduces the vibrations and unfamiliar sounds coming from the plumbing system
- is suitable for hot/cold water and acidic liquid transfers.
- is an alternative to cast iron pipes
- does not contain halogen and does not release halogenic toxic gases in case of fire
- 100% recyclable and environmentally friendly
- No corrosion, durable
- HOCH (fire performance), EPD (environmental declaration), Fraunhofer certificates available for all countries.

Fields of Application

GF Silenta Premium is intended and suitable for the following types of wastewater and areas of use.

- Office buildings, conference halls etc
- Schools, libraries, hospitals, hotels, houses
- Sustainable / green buildings
- Industrial areas (short and long-term use)
- Domestic sewage water and rainwater
- Domestic wastewater from kitchens, laundry rooms, bathrooms, toilets and similar spaces; however, mainly from households or similar facilities, such as hotels, retirement homes, hospitals, office and administrative buildings, sports facilities, 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 discharging untreated wastewaters of commercial or industrial origin and effluents with comparable harmful substances, the usability of the pipe materials, fittings and gaskets must be checked in accordance with the table Chemical Resistance Polypropylene (resistance list) for the GF Silenta Premium drainage system. Because these resistance lists are only a guide to users, the manufacturer should be involved in deciding whether or not to use them.

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

The GF Silenta Premium drainage system is suitable for embedding in concrete, however, compliance with the assembly instructions of the manufacturer is mandatory. Among other things, this includes:

- The proper fastening and securing of the pipes in order to prevent the pipes from slipping apart, claws are most suitable choice. This applies in particular in areas where pipes change direction.
- Consideration of the expansion of the pipes under the influence of temperature.
- Masking the sleeves with adhesive tape in order to prevent concrete from entering through the pipe's gap and into the sleeve.
- Leak test before pouring the concrete.
- Filling the pipe with water in order to increase its own weight and prevent it from floating on top of the concrete while pouring it.

Approvals

System approvals

Up-to-date information on system approvals is available from Technical Support.

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 coextruded in an innovative 3-layer technology made from polypropylene (PP). The outer layer is impact resistant and protects against mechanical damage. The middle layer is made of mineral-reinforced polypropylene and absorbs sound in a reliable manner. This ensures, pursuant to DIN 4109, GF Silenta Premium can be safely used in buildings with sound insulation requirements. The smooth and abrasion-resistant inner surface prevents incrustations and deposits and protects against corrosion, for example, if aggressive household chemicals are used.

Pipe layout

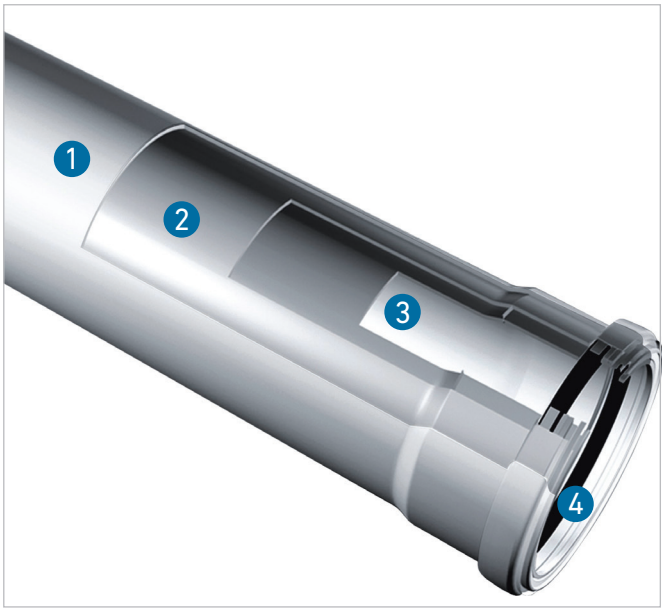
The design of the GF Silenta Premium pipes is characterised as follows:

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 propagation 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: It guarantees water tightness with its special gasket structure providing ease of montage. The geometrical properties of the gasket groove ensure fast and easy 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	13 dB(A) at 4 l/s (EN 14366)
Fire Class	D-s2, d2 according to 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	ISO / DIN 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 EN 1451, the nominal size (DN) is a parameter that approximately indicates the diameter of the pipe system used. The following diameters and wall thicknesses result for GF Silenta Premium:

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 against the vibrations that occur between the pipes used in the waste water installation and the fluids transmitted through these pipes. With GF Silenta Premium GF offers ultimate solutions against the sounds created in the installations.

Sources of sounds in the buildings can be listed as follows:

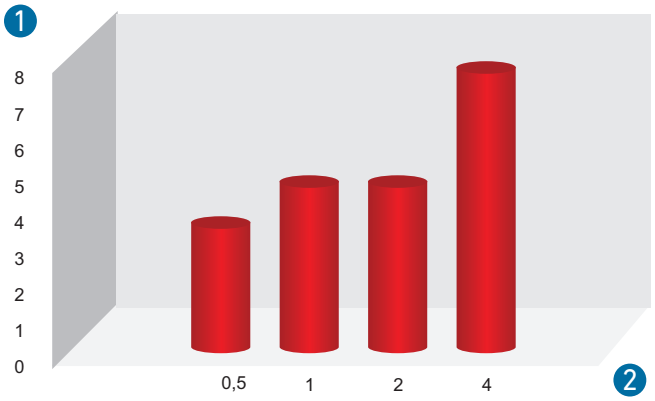
- Flushing
- Clogging of the flowing direction
- High water speeds
- Joints
- Discharge
- Wrong planning
- Faulty design

Due to critical drainage conditions, local vibrations occur in the piping system passages. They could have adverse impacts on sound characteristics.

To minimize and eliminate these impacts, GF Silenta Premium reduce noise in the sound-critical areas with elbows having nominal widths of DN 58 to DN 200, and ensures better noise reduction in the affected areas.

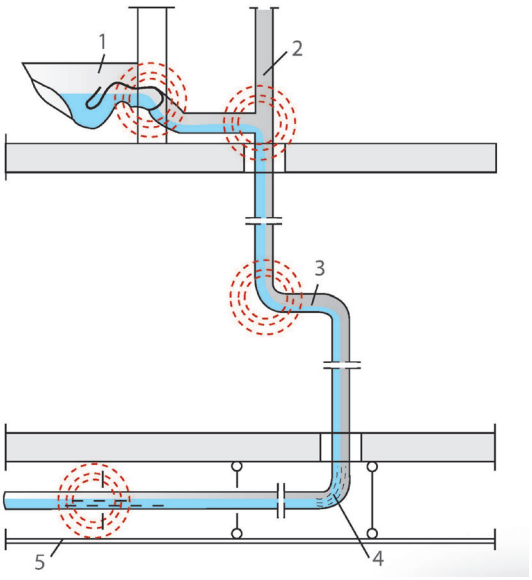
Sound protection measures in a building aims to minimize the noise pollution in the rooms. Residents need to be protected against the noises emitted through air or caused by the building.

Unpleasant noises within the building as caused directly (created by the building) or indirectly (for example due to the construction engineering systems) can be easily resolved with the use of GF Silenta Premium



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 demonstrates excellent acoustic performance at a flow rate of 4 l/s, tested by the Fraunhofer Institute in accordance with EN 14366.
- Designed exclusively for building drainage applications (Type B) according to EN 1451.
- Suitable for conveying domestic wastewater and typical chemical loads found in building drainage systems.
- Not intended for underground or traffic-load applications. Installation is limited to internal (indoor) above-ground building environments.
- An effective alternative to cast iron for internal drainage where sound insulation is required.
- Offers high impact resistance, long service life and corrosion-free performance.
- Provides a complete system range for all standard building drainage layouts.
- Halogen-free material; does not release lethal or corrosive gases in case of fire.
- 100% recyclable and environmentally friendly.
- HOCH (fire performance), EPD (environmental declaration), Fraunhofer certificates available for all countries.

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

Up-to-date information on system approvals is available from Technical Support.

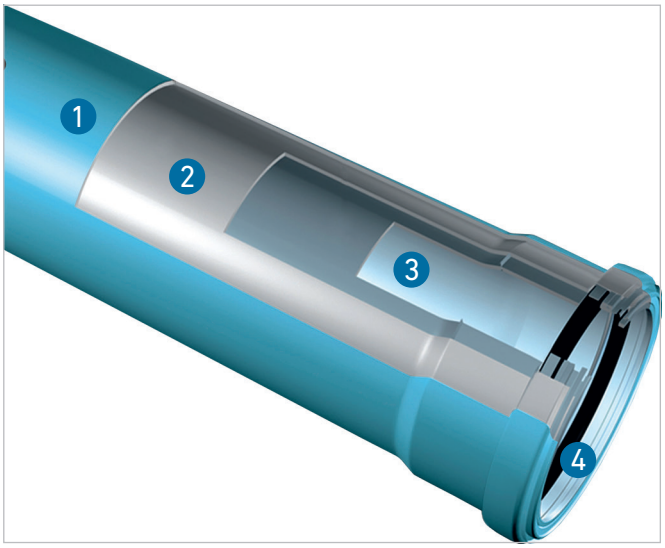
Country	Institute
Germany	DiBt, SKZ - Certification Pending
Austria	Austrian Standard - Certification Pending
Netherlands	KIWA - Certification Pending
Denmark	ETA-DANAK
Sweden	KIWA SwedCert
Norway	Sintef
Italy	IIC/KIWA IT - Certification Pending
Poland	PZH, ITB
France	CSTB - Certification Pending
Spain	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 The outer layer: It is resistant to high temperatures and impacts.
2 The middle layer: With its high molecular structure and special composite formula, the sound waves are absorbed and prevented.
3 The inner layer: It provides a perfect flow performance with its structure. The superior chemical resistance prevents corrosion and abrasion. It is resistant to high water temperatures.
4 Special Gasket System: It guarantees water tightness with its special gasket structure providing ease of montage. The geometrical properties of the gasket groove ensure 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 (EN 14366)
Fire Class	D-s2, d2 according to 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/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	DIN EN ISO 9969. The ring stiffness is at least 4.0 kN/m^2 over the entire dimension range DN32 − DN200
Impact Strength	Complies with TSEK 169 / EN 1451
Density	Pipes: 1.24 g/cm^3; Fitting: 1.34 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 EN 1451, the nominal size (DN) is a parameter that approximately indicates the diameter of the pipe system used. The following diameters and wall thicknesses result for GF Silenta 3A:

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 that guarantees lightweight, high resistance to chemical agents, excellent resistance to abrasion. These perfect characteristics are suitable for the construction of waste and drainage systems of buildings in accordance with EN 1451-1 and they have E flammability class resistance to fire with EN 13501.

- High Impact Resistance

Because of the flexible molecular structure of its raw material, it has higher stroke and impact resistance than other rigid plastic pipelines under low temperature environments.

- High Temperature Resistance

It can be used confidently in installments which produce waste at high temperature in short time like washing machine, dishwasher and alike.

- Smooth Inside Surface

Having smooth inner surface, it provides smooth flow and prevents deposits formation.

- No Poisonous Gas Exhaust

Thanks to their halogen-free composition, no halogen-based toxic gases are released in case of fire.

- Easy Montage and Installation

The push-fit system with specially designed gaskets and sockets allows quick and reliable installation without the need for special tools.

- Superior Chemical Resistance

GF HT-PP system has highest resistance to chemical agents dissolved in waste waters. Accordingly, GF HT-PP waste water pipeline and joints provide the most suitable installment solution in chemical waste drainage. They have corrosion and abrasion resistance.

- 100% recyclable and environmentally friendly
- HOCH (fire performance), EPD (environmental declaration), Fraunhofer certificates available for all countries.

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

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Country	Institute
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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

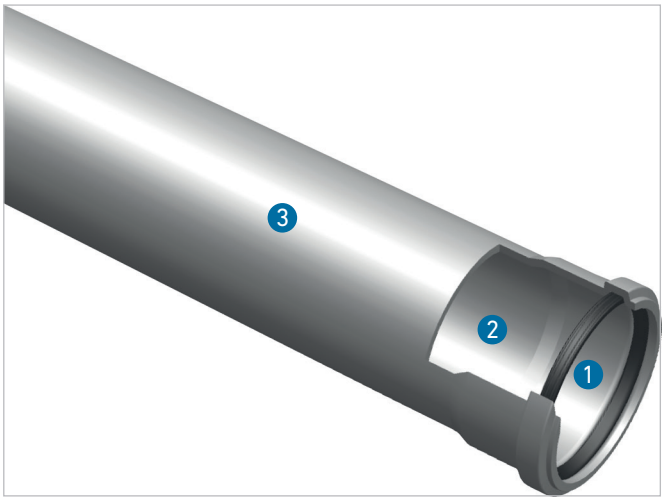
Pipe layout

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

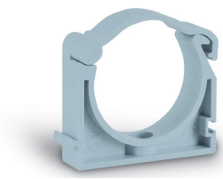
1 Special Gasket System: The push-fit socket with lip seal guarantees water tightness and allows movement of the pipe due to thermal expansion. The geometric characteristics of the socket ensure installation speed and simplicity.

2 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 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 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 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 EN 1451, the nominal size (DN) is a parameter that approximately indicates the diameter of the pipe system used. The following diameters and wall thicknesses result for GF HT-PP:

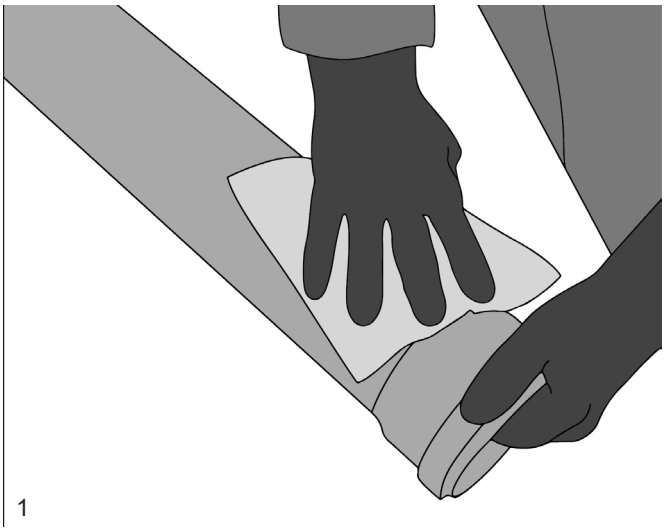
Nominal diameter DN [mm]	GF HT-PP S20			GF HT-PP S16		
	Outer diameter d [mm]	Inside diameter di [mm]	Wall thickness e [mm]	Outer diameter d [mm]	Inside diameter di [mm]	Wall thickness e [mm]
30	32	28.0	2.0	32	28.0	2.0
40	40	36.0	2.0	40	36.0	2.0
50	50	46.0	2.0	50	46.0	2.0
70	75	70.8	2.1	75	70.0	2.5
100	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

Building Technology (BT)
Solid and Waste Water Pipe Range

Installation instructions

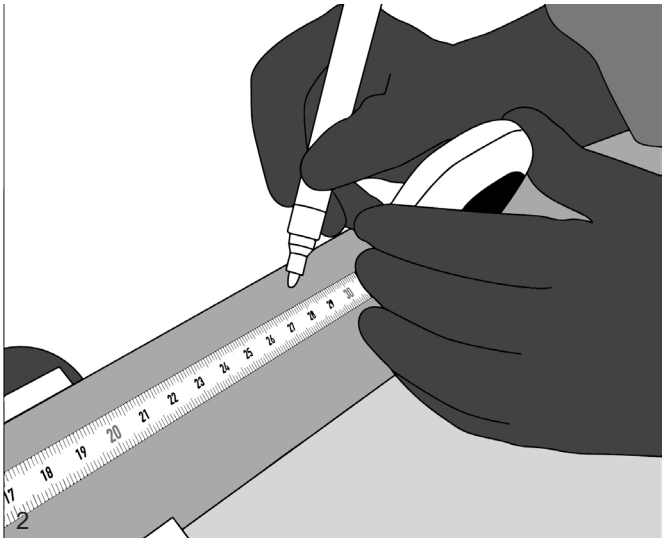
- GF Silenta Premium Sound-Insulated Pipe Systems
- GF Silenta 3A Sound-Insulated Pipe Systems
- GF HT-PP Waste Water Pipe Systems

→ Make sure that your products are clean. If necessary, wipe the jointing points with a dry cloth.



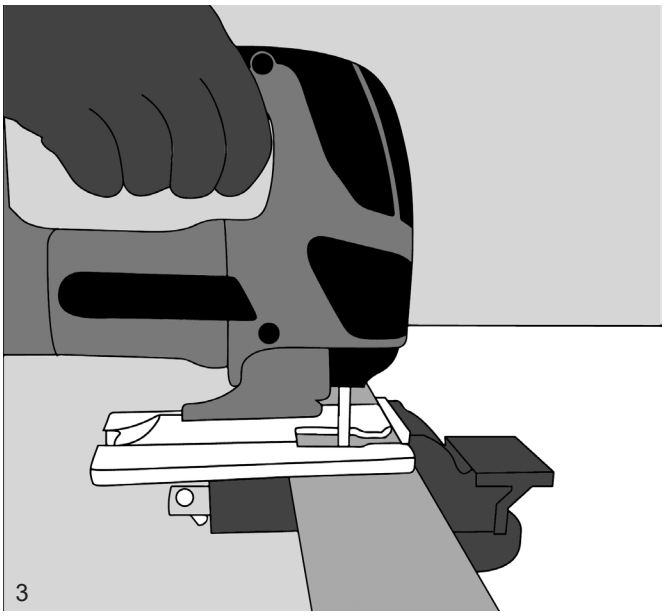
1

→ When interval measurements are required, mark the pipe with the desired measurements.



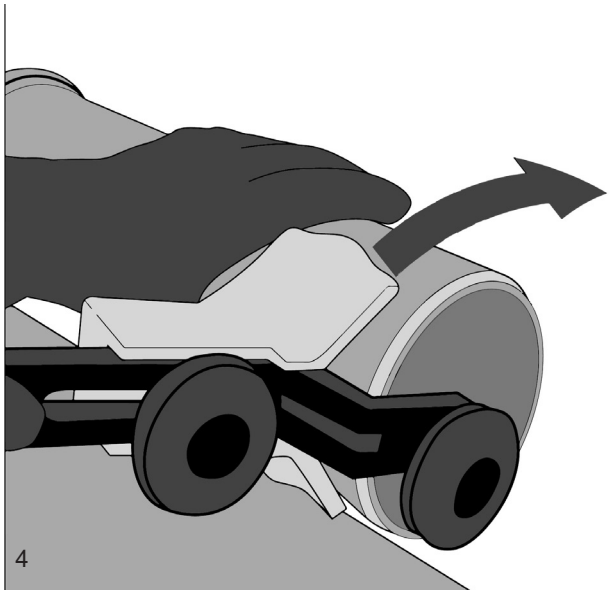
2

→ Cut in 90° angle by using a coping saw or a proper cutter.



3

→ Chamfer the spigot of pipe by using a chamfering device or thick riffler.

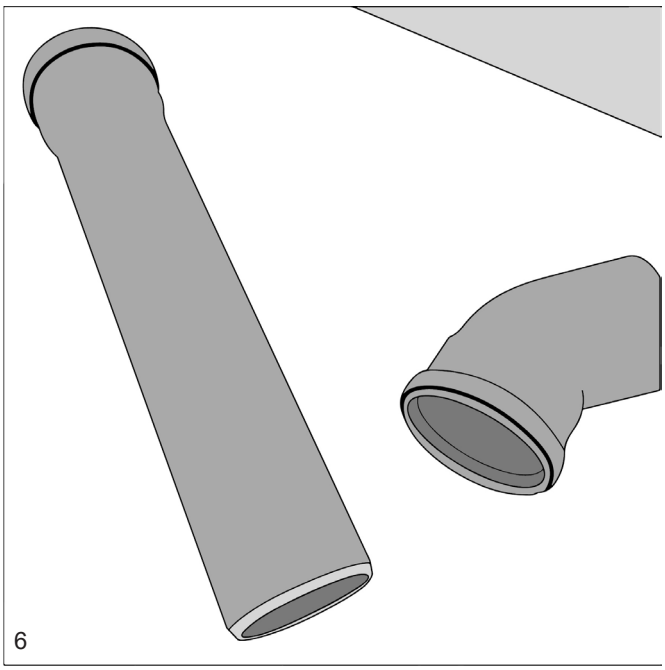


4

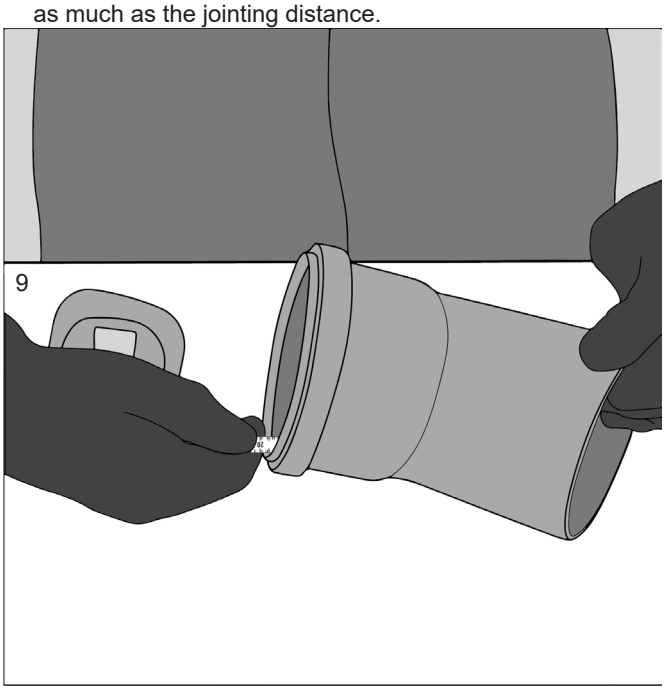
Chamfer Dimension d [mm]	**58**	78	90	110	135	160	200
Chamfer a [mm] (ca.)	4	4	5	6	6	7	8

→ Remove the burrs on the external edges with a knife or scraper.

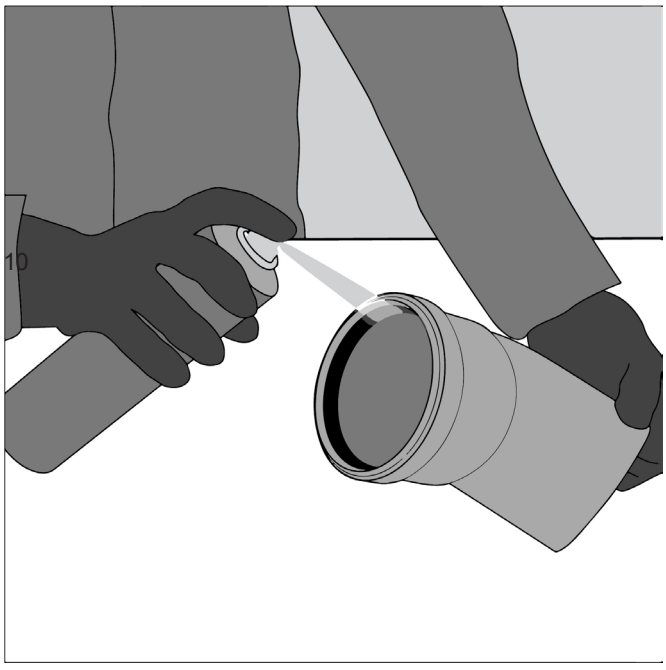
Now, your pipe is ready for installation.



→ Drill the marked points with a driller and place dowels into the holes.
→ Mark the pipe clamp distances properly with 1% inclination on the wall or ceiling where they will be installed. (as flat wall)
→ Mark the part of the pipe that will be attached to the fitting as much as the jointing distance.



→ Apply a lubricating liquid (silicone etc.) to the socket part of the pipe.



→ After the pipe and fittings are jointed, place them and tighten the clamps.

Installation and attachment

Rubber Ring (Push Fit) Jointing

- Mouth of the pipe should be absolutely chamfered. If the mouth of the pipe was cut, it should be chamfered.
- Check if the sealing gasket is accurately placed on the pipe or fitting socket groove.
- All installation parts should be dry and clean. There should be no deformation, notches or similar scratches on the pipes or fittings.
- Apply a proper silicone-based lubricating liquid on the spigot end of the pipe or fitting. Do not use liquid soap, grease or similar petroleum derivatives.
- Parts to be jointed should be levelled.
- Push the spigot end of the pipe or fitting into the socket completely. If the application is longer than 2 m, pull the spigot end 10 mm back after placing it into the socket completely, to prevent the effects of thermal expansion.
- Finally, check again if the gap left for thermal expansion still exists or not.

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 sliding clamp that allows for thermal expansion caused by temperature changes.
- 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).

Pursuant to DIN 4109, pipe clips with sound insulation inserts must be used for fastening all drainage pipes.

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.

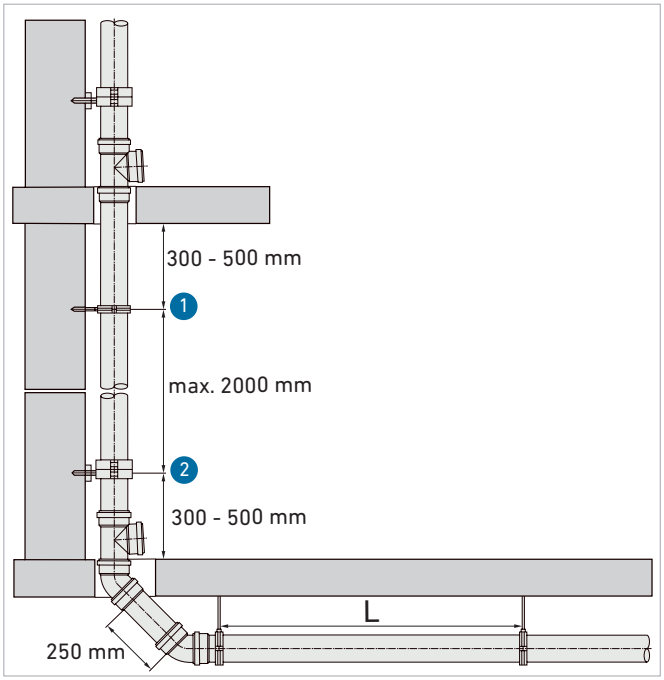
☑ Suitable measures must be taken in order to reduce the flow and sound development in zones where the flow direction changes.

Example

Redirecting the vertical downpipes in a false ceiling area.

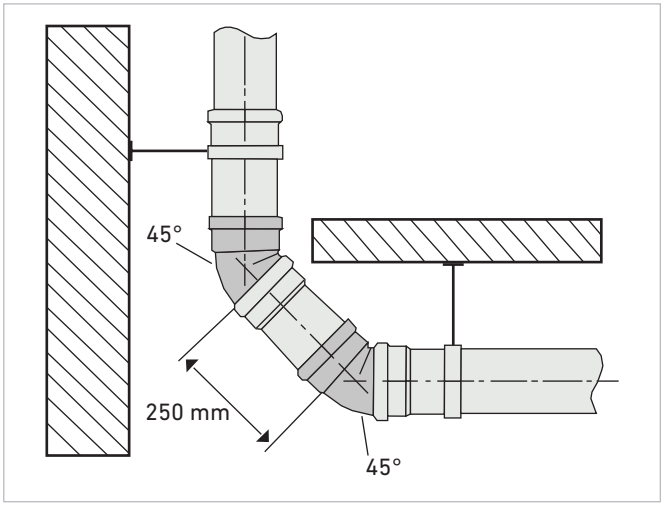
☑ For hydraulic and acoustic reasons, a change in direction by 90°, in which a downpipe enters a horizontal main pipeline, two 45° elbows with an intermediate piece of 250 mm is required.

☑ 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*

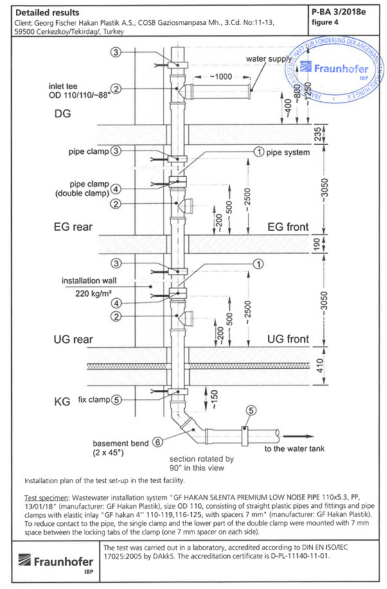
Installation - Silent Pipe Clamp

Silent waste water piping systems are tested by the German Fraunhofer Building Physics Institute in accordance with EN 14366 standard, and the reports about 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.



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 as fixed and movable.

The noise created in the waste water systems is transmitted by two methods as air born and structure born.

- Sound waves transmitted through air cause pressure in the ambient and result in vibration on the objects and surfaces that they hit. Thanks to the special formulas used in GF Silenta products, these vibrations are absorbed and prevented from being transferred out of pipe.
- 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 is intended to transfer the weight of the vertical downpipe safely into the structure of the building. Therefore, the transmission of structure-borne noise is largely avoided. Particularly suitable for this purpose is a support bracket consisting of a fixing and a support bracket. The weight of the vertical pipe section is diverted by the tight fitting pipe support clamp onto the support bracket. This type of attachment in combination with the sound insulation inserts in the pipe clips leads to an excellent insertion loss and the resulting very low residual sound levels.

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).

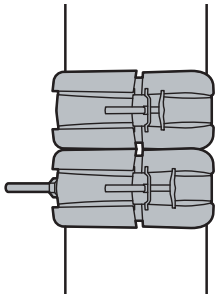
Alternatively, commercially available pipe clips with sound insulation insert can be used as a downpipe support bracket. However, these pipe clips must always be arranged below a pipe sleeve in order to prevent the downpipe from “slipping”.

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.

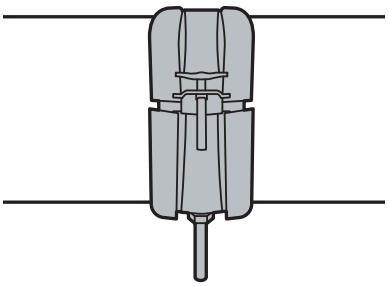
GF silent waste water pipe clamps ensure EN 14366 silence norms. In the waste water systems within buildings, cused clamps, their positions and distances are as important as silent pipes and fittings.

The clamp on top, which is one of the double clamps used in the vertical lines, is fully tightened and grasps the pipe. The lower clamp is tightened up to the plastic wedges on the clamp. It is ensured that the rubber surfaces of the clamp are not jointed. In this system, the purpose is to absorb the vibration transmitted from waste water to pipe inside the first clamp and to minimize the vibration on the wall through the second clamp.



G.6 *Double clamps in vertical lines*

The single clamp in the horizontal lines is tightened up to the plastic wedges on the clamp and it is ensured that the pipe is fixed to the ceiling or wall.



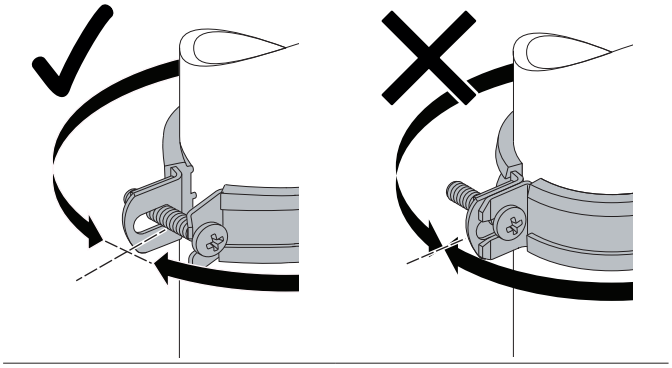
G.7 *Single clamp in horizontal lines*

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



Wastewater installation

Introduction

The following technical information on the design of drainage systems within buildings has been prepared on the basis of the generally accepted rules of technology (DIN 1986-100) in conjunction with the standard series DIN EN 12056.

This chapter outlines and explains in particular the technical relationships that must be taken into account when planning and dimensioning in the defined area of application of the GF Silenta Premium drainage system.

The drainage capacity of the partially filled pipes, installed at an incline, was determined with a pipe inner diameter of the GF Silenta Premium drainage system for this 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

Even though this information contains the most important principles for drainage systems inside buildings, it is essential that every operating company is familiar with and has access to the rules for building and property drainage. It is particularly important to have access to the series of standards DIN EN 12056 in connection with DIN 1986-100.

If the GF Silenta Premium drainage system is used in areas other than those explained here, the system requires the explicit approval for the extended application by GF.

Application technology

The information applies to the discharge of ordinary domestic wastewater and rainwater inside all buildings in conjunction with the standards DIN 1986-100, DIN 1986-3, DIN 1986-4, DIN 1986-30, DIN EN 12056-1 bis DIN EN 12056-4 as well as DIN EN 752 und DIN EN 1610, provided the pipes are installed underground.

The information 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 compliant with the intended operation of the drainage system.

Compliance with the system-specific technical contexts mandatory when using GF products, is covered in the following related chapter on the product system.

The criteria for installing the pipelines with regard to the compliance with the statutory requirements for fire behaviour and noise behaviour are covered in a separate brochure.

Prerequisite for a trouble-free operation of the drainage system is compliance with the planning and design based on the underlying operating requirements as well as regular maintenance according to DIN 1986-3.

When using coloured labelling, compliance with the specifications pursuant to DIN 2425-4 is mandatory:

- Rainwater pipes inside the building: Blue
- Wastewater and rain water pipelines: Brown
- Mixed water pipelines from the building to the connecting sewer: Purple

Harmful substances must not be introduced into the drainage system. These substances attack the building structures and pipe materials of the private and public sewage system or damage its functionality.

Labelling and approvals for construction products

Construction products for the erection, modification and maintenance of building structures may only be used if they are suitable for the intended purpose and if they comply with the requirements of the state building codes. Verification of the construction products' suitability with the recognised technology rules can be provided either by attaching a CE mark, if a particular standard is used, or as in the case of this drainage system, confirmation can be provided by the DIBt (Authority of the German State Governments) in form of a national technical approval.

These construction products receive a conformity mark ÜH-Z (= German national technical approval).

Fire behaviour

When planning and designing drainage systems within buildings, compliance with the fire protection requirements is mandatory pursuant to the state building regulations and the technical building regulations or guidelines on fire protection requirements for pipeline systems in the federal states (LAR/RbALei).

The classification of the fire behaviour for this construction product GF Silenta Premium, GF Silenta 3A follows fire class D-s2, d2 and GF HT-PP follow fire class E according to EN 13501-1.

Separate information provides special requirements for the fire resistance duration including data for pipes penetrating walls and ceilings.

Noise behaviour

When planning and designing a drainage system in conjunction with the building, the noise behaviour of the drainage system must comply with the permissible noise levels pursuant to DIN 4109. If the sound insulation must be increased, VDI 4100 applies.

It is highly recommended that all contracting parties, clients and contractors include in writing the cost of their preferred sound insulation in the construction contract, whether the insulation is pursuant to DIN 4109 or VDI 4100 is irrelevant.

A separate information shall include references and examples of acoustically insulated wall and ceiling ducts.

Wastewater systems

Drainage systems for wastewater must comply with DIN 1986-100 system type 1, pursuant to DIN EN 12056-2. In this system, the drainage objects are linked with partially filled connecting pipelines that have a filling ratio:

$h / d_i = 0.5$.

hese pipelines are usually drained via waste water discharge lines into which main ventilation systems are incorporated into a collecting or underground pipeline. All pipelines must be installed with the pipe invert at an incline.

Trap inserts in odour traps are expected to remain stable as planned under all operating conditions so that unpleasant odours and noise transmissions are prevented.

For pressure equalisation and for the discharge of sewer gases, drainage systems for wastewater must always be ventilated via the roof.

For water-efficient lavatories with flushing water volumes of 4 to 6 litres, smaller nominal diameters than DN100 may have to be used for connection, drop, collection and underground pipelines.

If drainage points are removed or taken out of service, the connection points must be sealed gas- 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 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.

Preventing flooding

In order to prevent buildings from flooding, the following measures are essential:

- Sufficient design of the drainage system.
- Preventing water leaks into the building (for example, due to leaky pipes).
- The installation of backwater safety devices.
- A favourable integration of the building into the terrain (surface water must not penetrate into light wells and through their windows into the building).
- Protecting storage places for substances hazardous to water or other goods from flooding and, for example, protecting these goods in the event of heavy rain falls.

Frost resistance

Drainage systems within buildings, for example, pipelines in underground car parks and outside of buildings must be installed in such a way as to avoid the risk of destruction or loss of function due to the effects of frost.

In ventilated drainage systems inside buildings it can be assumed that the warm sewer gases compensate for the frost effect.

In areas subject to frost, it is necessary to provide individual and collecting pipes or header pipes with thermal insulation. In exceptional cases, for example, in the connection area of roof drains, it may also be necessary to provide such pipeline areas with additional self-regulating, electric heating tapes.

Drains in areas subject to frost a odour trap must not be installed. This trap must incorporated in a frost-proof location within the building.

If the pipes are installed in ditches outside of buildings, the frost-free depth shall be considered the distance from the upper edge of the terrain to the top of the drainage pipe. In most areas, a frost-free installation can be assumed if the pipe is covered with at least 800 mm of soil. However, depending on the local climatic conditions, the required depth of the trench is set by the appropriate authorities at 1,000 mm or 1,200 mm.

Preventing the discharge of sewer gases

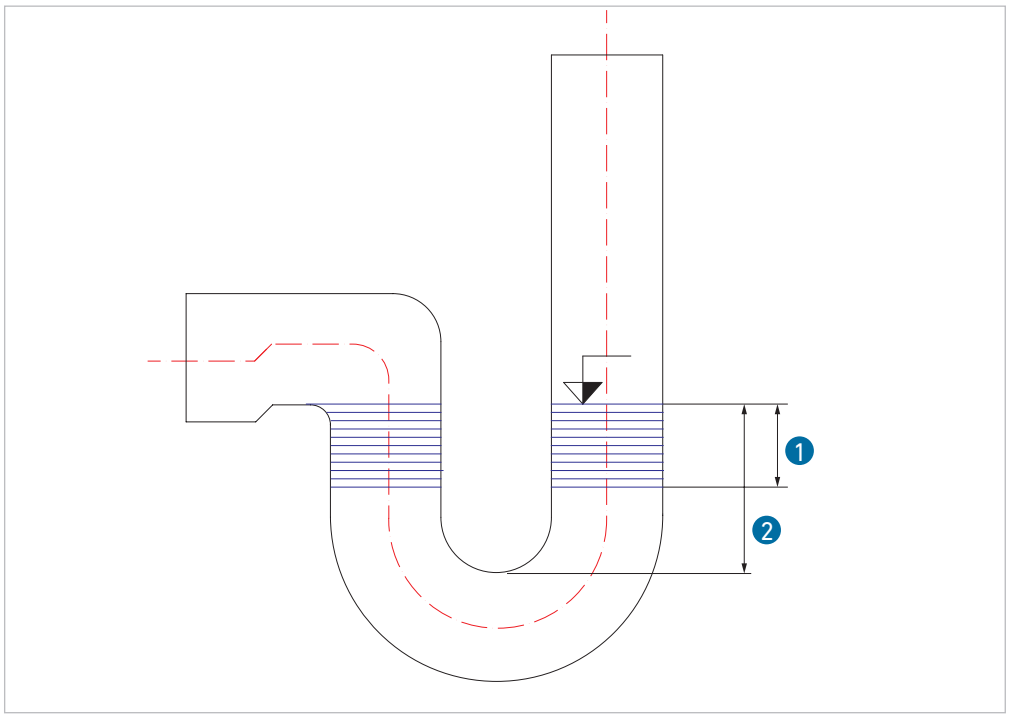
In order to prevent the escape of sewer gases from drainage systems into the building, an odour trap must be incorporated into each drainage point. Several drainage points of the same kind can be directed through a common odour trap.

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

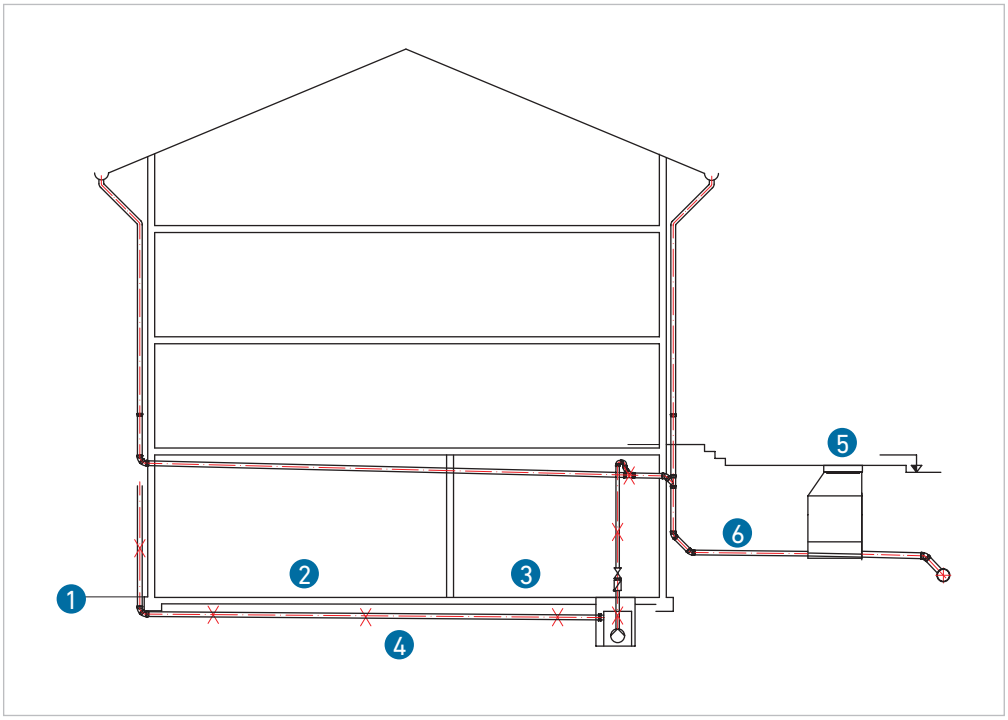
When using pipelines that carry greasy wastewater and if using single and multiple collecting pipes for urinals, special planning principles must be observed to avoid deposits.

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.35]).

Drains underneath water intake points

There must be a drainage point underneath each water outlet inside the building if drainage cannot be done across a watertight floor without creating puddles until the water has reached a drainage point. This rule excludes tapping points for fire fighting purposes and for connecting 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 is the highest level up to which water inside the drainage system can rise. In the local sewage regulations, the uppermost edge of the road at the connecting point is usually specified as the backwater level (➠ [G.36]). Departures from this rule are possible depending on the topography of the 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 against backwater must comply with DIN EN 12056-4. When considering specified limiting conditions, sewage lifting units can be used for special purposes pursuant to DIN EN 12050-3.

Rainwater from areas below the backwater level may only be discharged into the public sewage system if utilising sewage lifting units pursuant to DIN EN 12050-2; they must be separated from domestic wastewater. The lifting units must be located outside the building and the rainwater must be lifted above the backflow level pursuant to DIN 12056-4.

Drain effective 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 $r_{(5.100)}$.

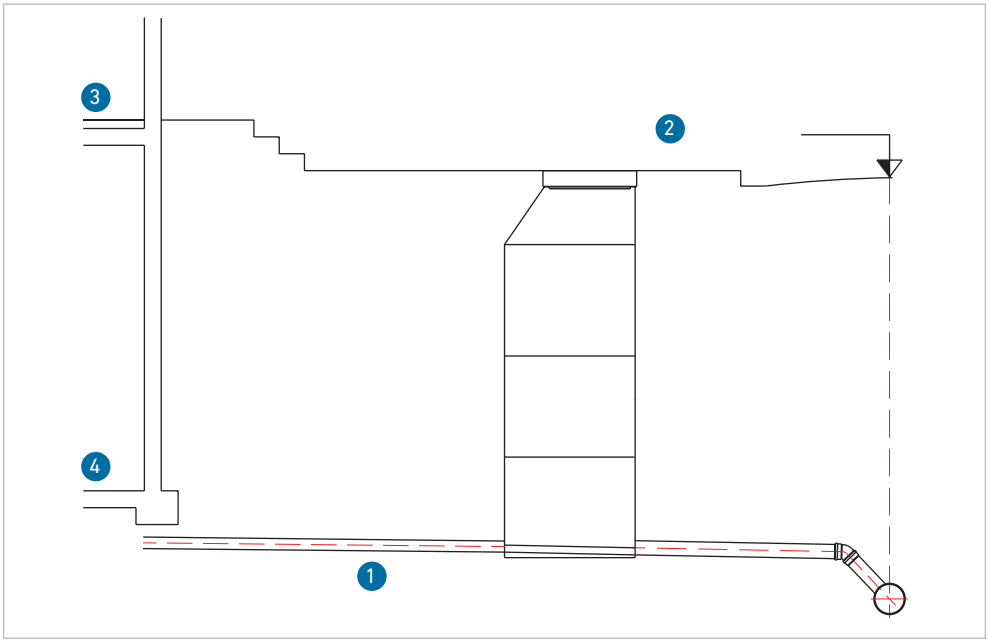
In exceptional cases, for example, on abutting properties or in underground car park entrances, the lifting system should be equipped with a double pump. The installation of the lifting unit is also possible within the building, however, the building must protected using suitable measures in order to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

Rainwater from small areas – up to 5 m^2 – of basement entrances and the like, 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 must comply with DIN EN 13564-1 and must only be used if:

- there is an incline to the sewer system
- the rooms are of ancilliary 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 womitted



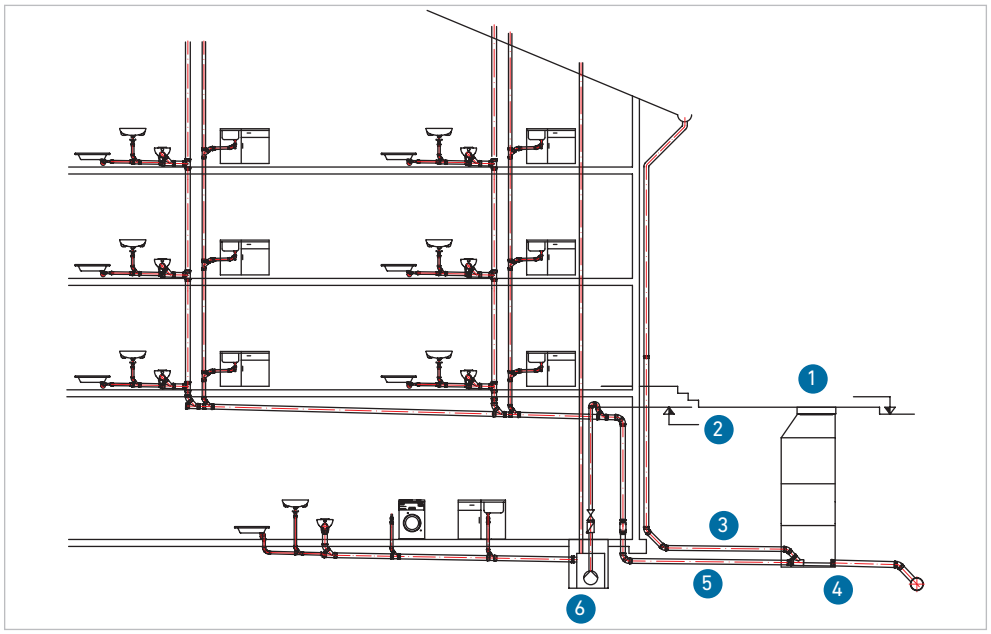
G.10 *Backwater level upper edge of the road*

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

Pursuant to DIN EN 13564 -1, the following types of anti-flooding devices are permitted according to the stated application:

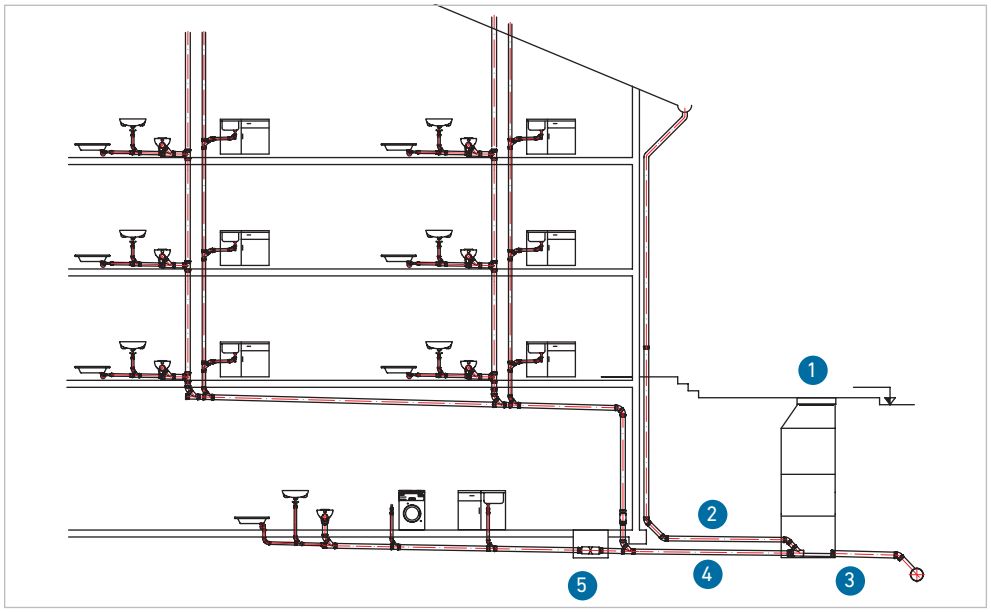
- Types 2, 3 and 5 for wastewater not containing faeces
- Type 3 with labelling "F" for wastewater containing faeces
- Types 0, 1, and 2 for earth tanks used in rainwater harvesting systems, if their overflows are connected exclusively to rainwater channels

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*

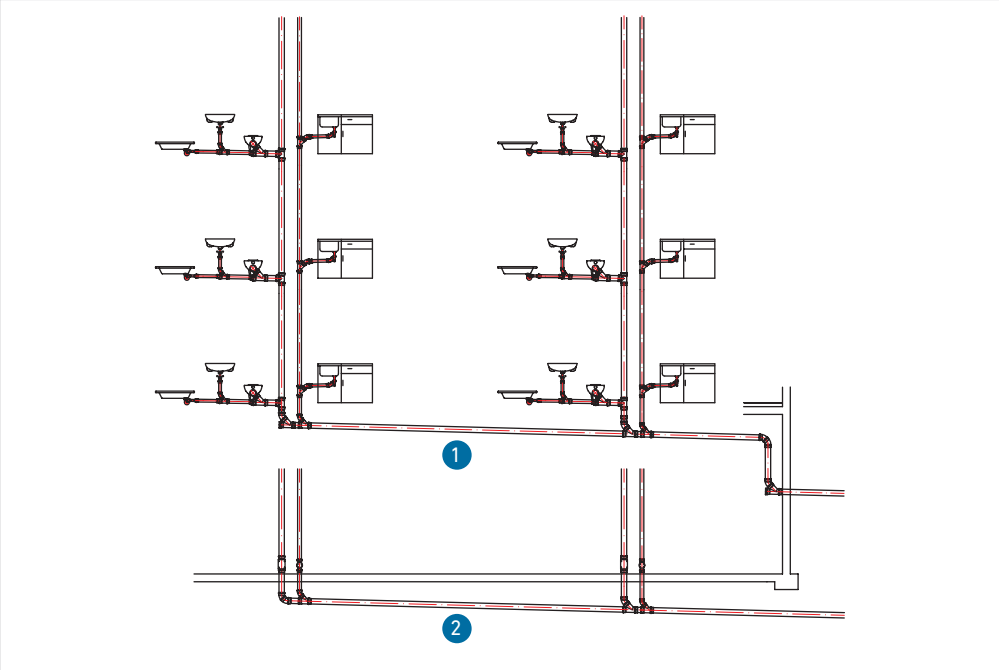
1 Backwater level upper edge of the road in the connecting point
2 Rain water
3 Mixed waster
4 Wastewater
5 Central anti-flooding device, type 3 with marking "F" for wastewater containing faeces

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.39]).

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*

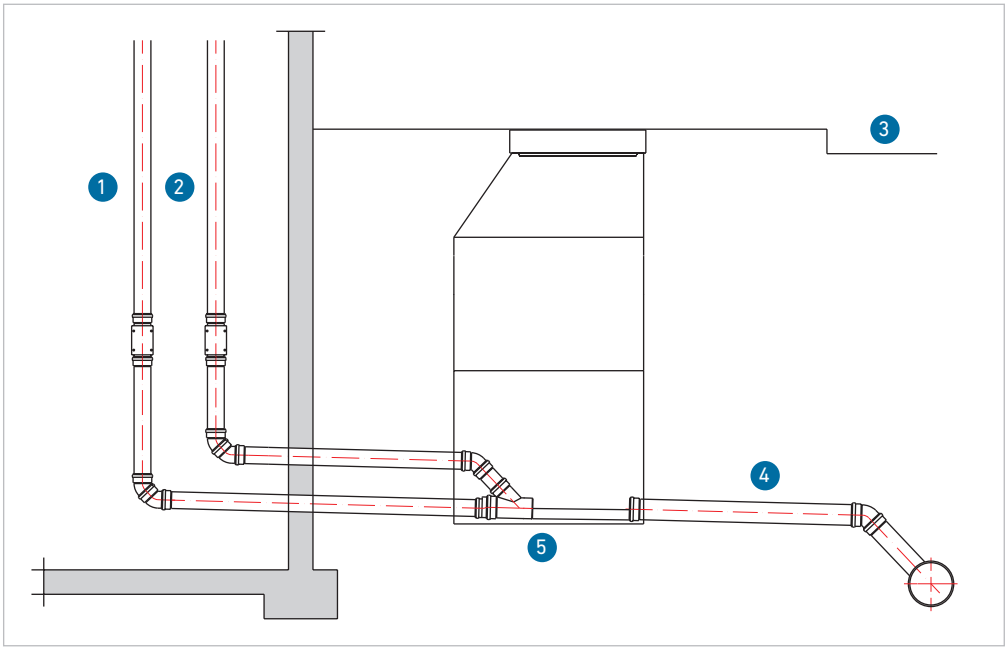
1 Headers
2 Underground pipelines

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.

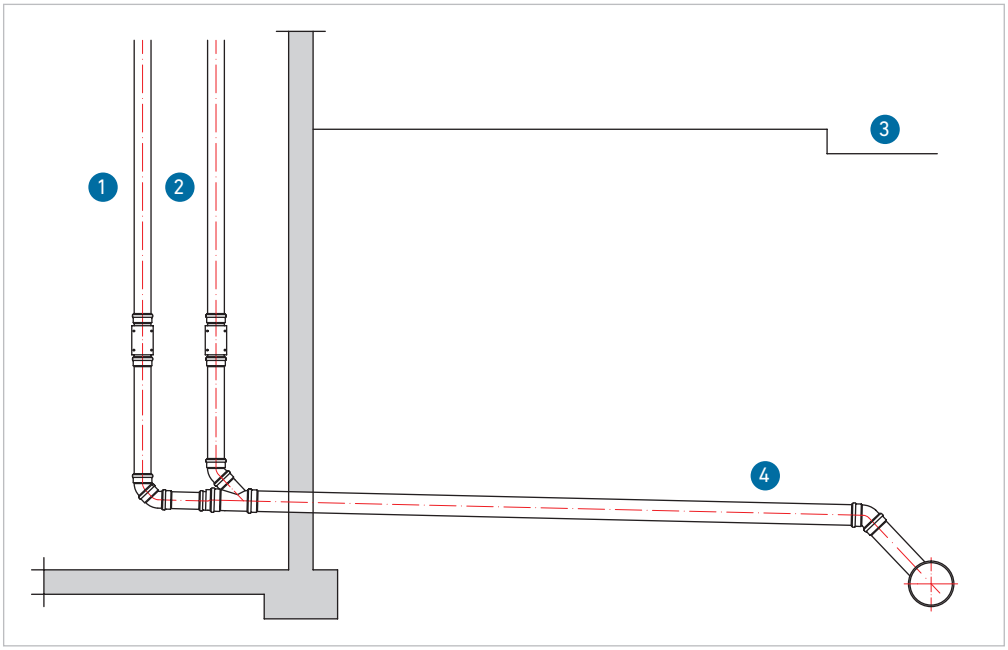
An exception exisist where properties are abutting; here, the wastewater and rainwater pipes may be brought together within the building, however, they must be routed directly along the building's outer wall.

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 all drainage pipes inside or outside buildings and their connections the following applies: Considering the interactions between the pipes and their environment, they must be permanently sealed at an internal or external pressure of up to 0.5 bar.

Buried sewers must be tested pursuant to DIN EN 1610 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 floor 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, and which are installed above ground or are concealed within buildings, for example behind false walls, in pre-wall installations, brick partion brick walls, wall slits or suspended ceilings, must not be checked for leaks according to the generally recognised codes of practice.

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 qualified personnel shall be permitted to install the pipeline.
- 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.).

If, in individual cases, a leak test of drainage pipes inside buildings is considered necessary, a partial check with minimum overpressures must be realized.

In order to prepare for a leak test, all bypasses and end plugs of drainage points must be secured in order to prevent the pipes from slipping apart, considering the static overpressure expected in the pipeline. Experience shows that this additional testing effort stands in no economic relation to the benefits.

According to VOB DIN 18381, the leak test is an “additiona service” and must be tendered and remunerated in the specifications according to type, procedure and scope.

Preventing pipes from slipping apart

Sewer pipes and fittings with connections that are not force-fitted in the longitudinal direction must be secured in order to prevent the pipes from slipping apart and/or causing the misalignment of their mutual axes. This applies in particular to push-in fittings installed in areas where the internal design pressure prevails or may result due to overload, causing internal pressure. This can be done by selecting the proper attachment, using pipe clips and brackets or by additional safety clamps (claw fasteners).

Pipelines, such as rainwater downpipes, lines in the backwater area or pressure lines of lifting units, in which excessive internal pressure must be expected due to operational reasons, must be protected in terms of the requirements for the pipes, fittings, connections, fasteners and brackets. Here, special measures against the reaction forces caused by excessively high or low pressures must be considered.

The spacing between pipe fittings must be observed according to the installation instructions for the GF Silenta Premium pipe system. The same applies to the additional methods intended to prevent the pipes from slipping apart 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 branch pipe measuting 15° or more must be incorporated at the junction. This prevents flushing of external matter and avoids deposits of solids as a result. Therefore, double branch pipes must not be incorporated into horizontal pipelines.

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 preferrd 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).

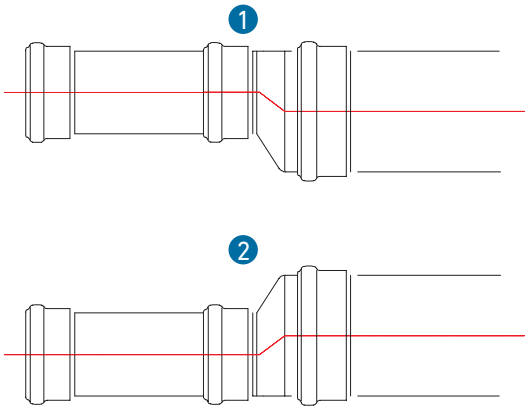
Downpipes

If the geometry of downpipe connections is unfavourable, wastewater can be flushed from one individual or collecting pipe into another pipeline. Fig. [G.45] illustrates how wastewater from the connecting pipe of a higher level drain can be flushed into the water seal head of a toilet bowl. When flushing the toilet, wastewater containing faeces get also enter into 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 faecal wastewater – into other single or collection pipelines.

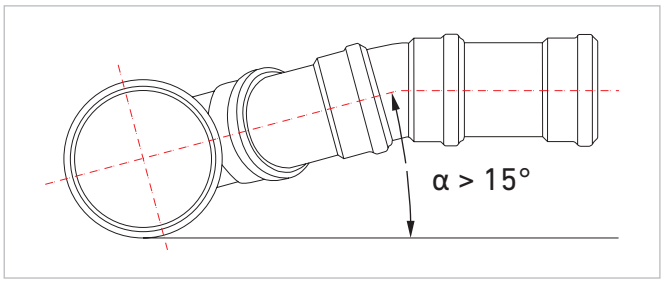
The following design principles must be taken into account:

- 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.47]) 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.48] 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.50] should be taken into account.
- When installing single or multiple collecting pipes which carry sewage-free and faecal 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.49] must be maintained.

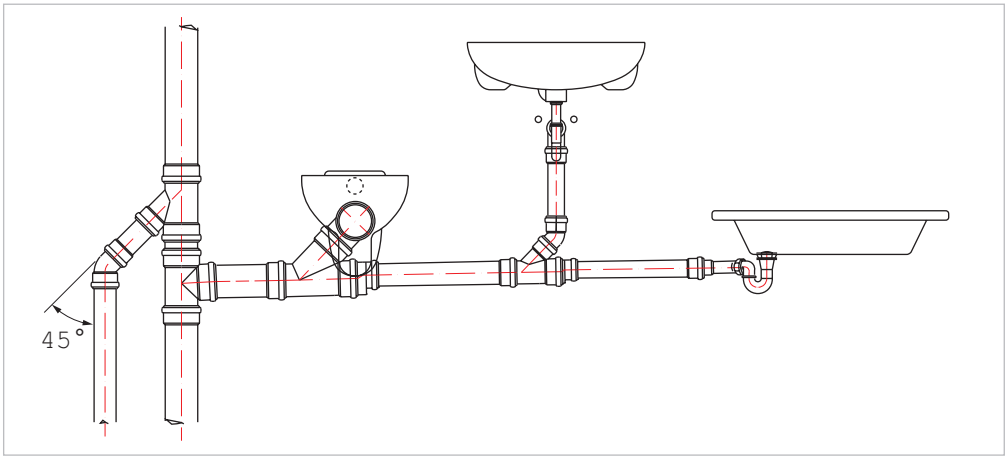


G.17 *Design of transitions in horizontal pipelines*

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

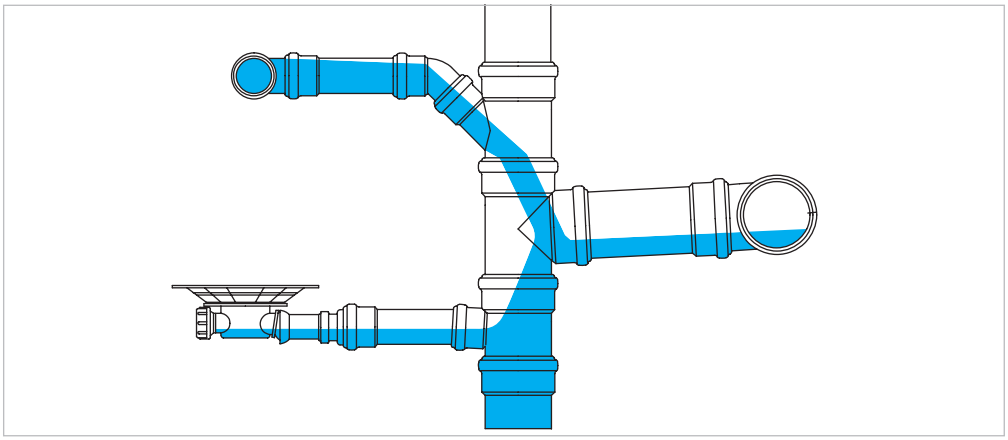


G.16 *Alignment of branches connecting to underground pipes and headers*



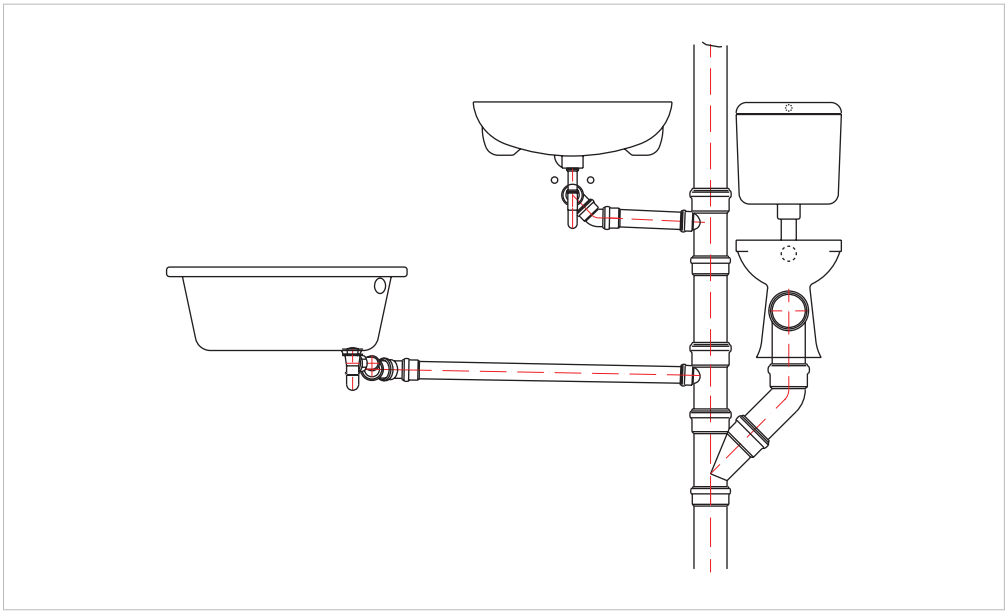
G.18 *Overflow-proof collecting pipes*

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



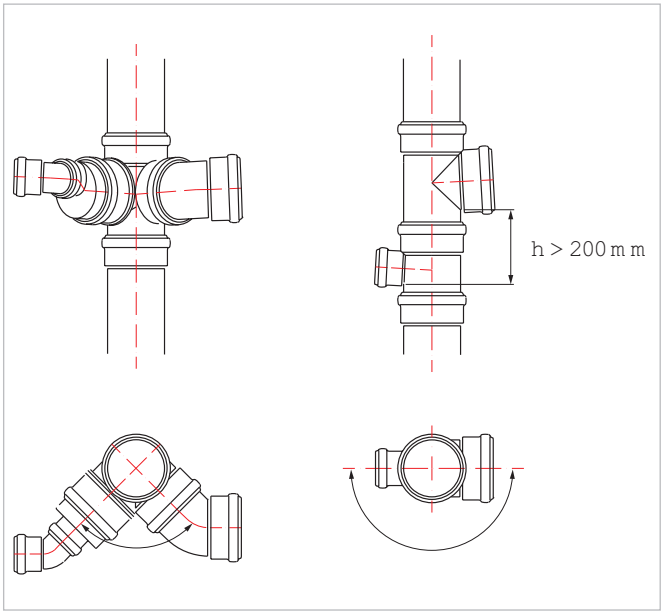
G.19 *External flushing into single connection lines*

... if the geometry of downpipe connections is unfavourable



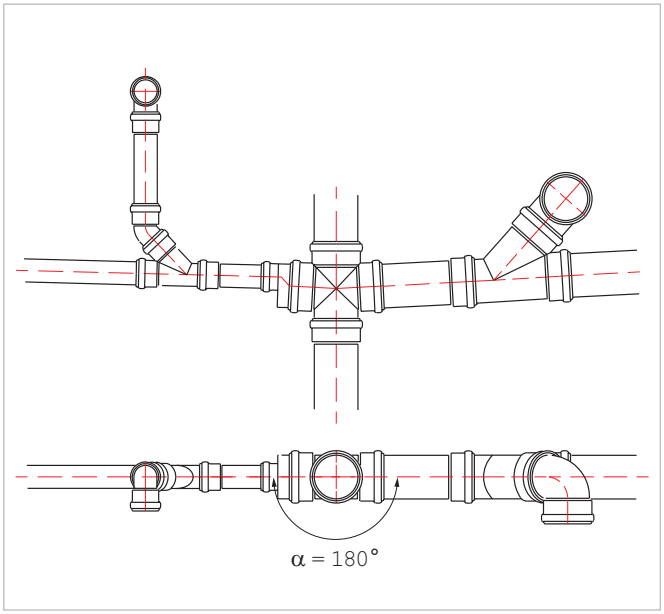
G.20 *Overflow-proof connections of individual connection pipelines to the downpipe*

... by adhering to minimum required distances required



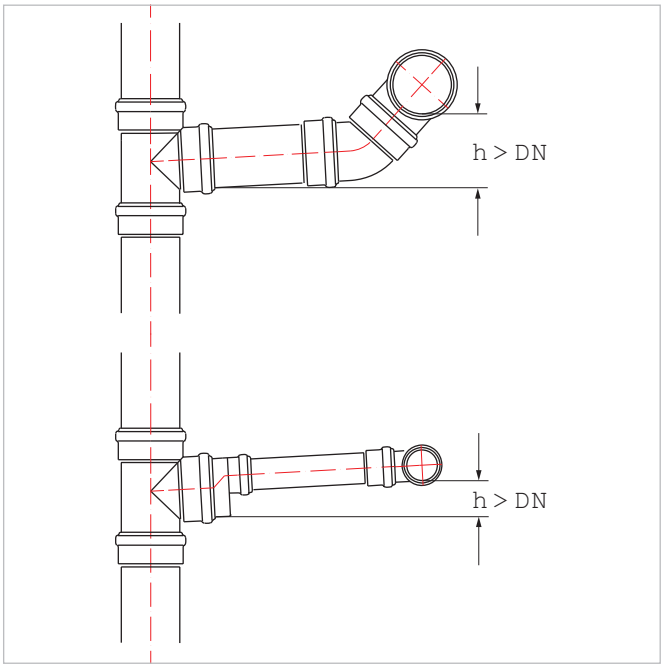
G.21 *Minimum height difference “h” required*

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



G.23 *Overflow-proof connection*

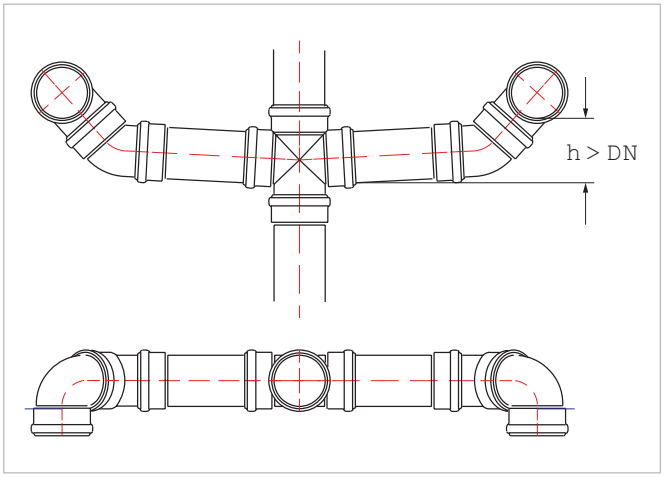
... when using double branches of the same diameter with an inside radius or 45° inlet angle



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 trap inserts inside the odour traps, pressure fluctuations caused by drainage processes in the drainage system must be limited. The expected pressure fluctuations are greatest in the area of the downpipes, as drainages 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 is strongly influenced by the resistance, which opposes the flowing air in the drainage system. All wastewater pipes in which not only wastewater but also air for pressure equalisation must be carried, require – among other things – a streamlined design. Therefore, it is preferred to resolve any flow deviation 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 in the area of the end pipe of the ventilation duct is not permitted.

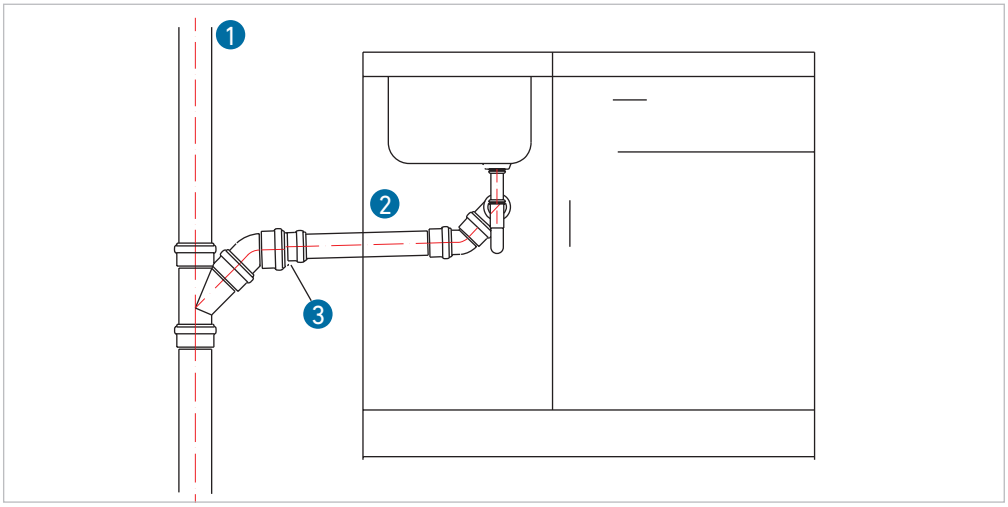
Adjacent flats may only be connected to a downpipe if noise and fire safety requirements are met.

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.65]).

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.51]).

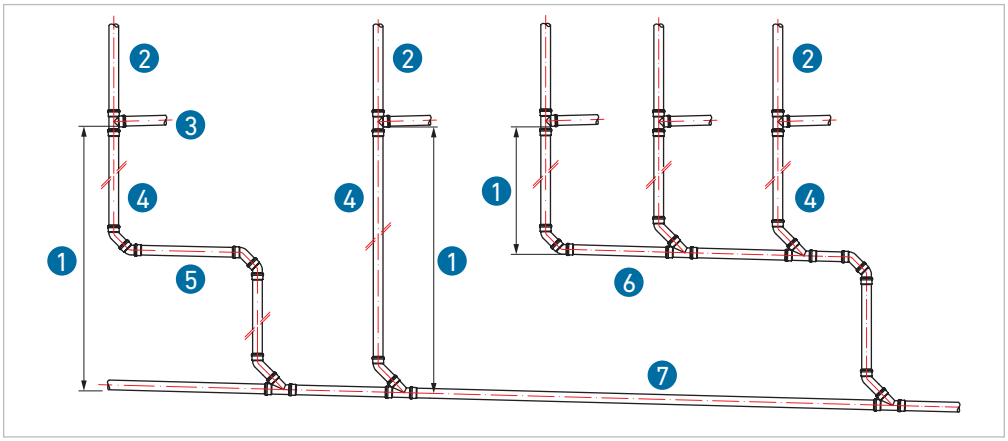
If the nominal diameter of the downpipe and the connecting line are the same, 45° branches or 88.5° branches with inner radius should be preferred. This ensures that the pressure fluctuations in the downpipes are reduced to a minimum.

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.52].



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

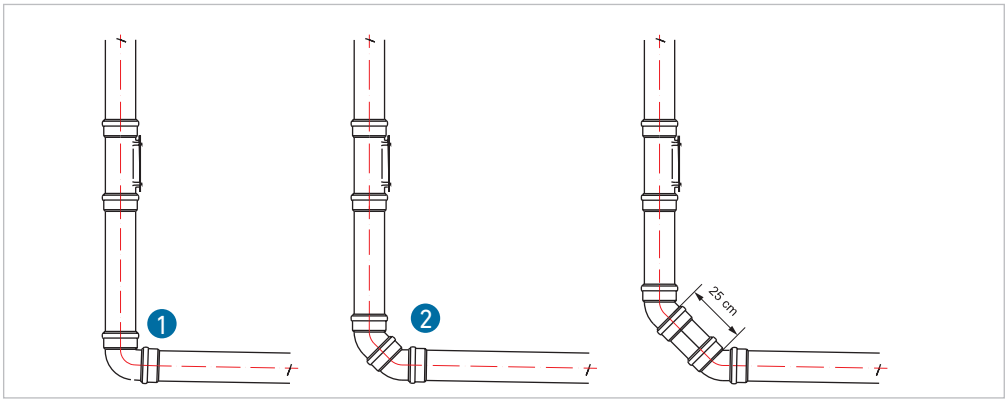
1 DN70
2 DN50
3 Excentric reduction DN70 / DN50



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.53]).



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.53]).

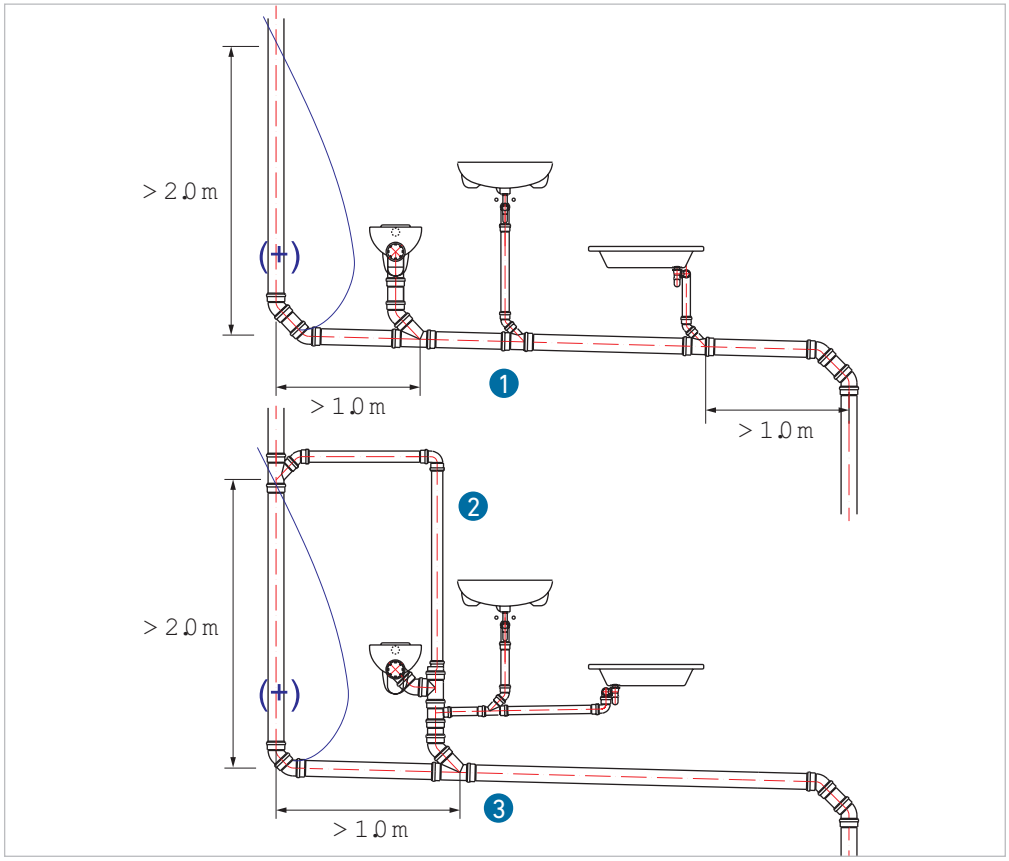
If the downpipe offset requires directional changes that exceed 45° and which are located in an area subject to critical excessive pressure, connections to the downpipe up to a height of at least 2.00 m are not permitted any more(➠ [G.54] and ➠ [G.55]).

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.54]).

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.54] and ➠ [G.55]).

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.55]).

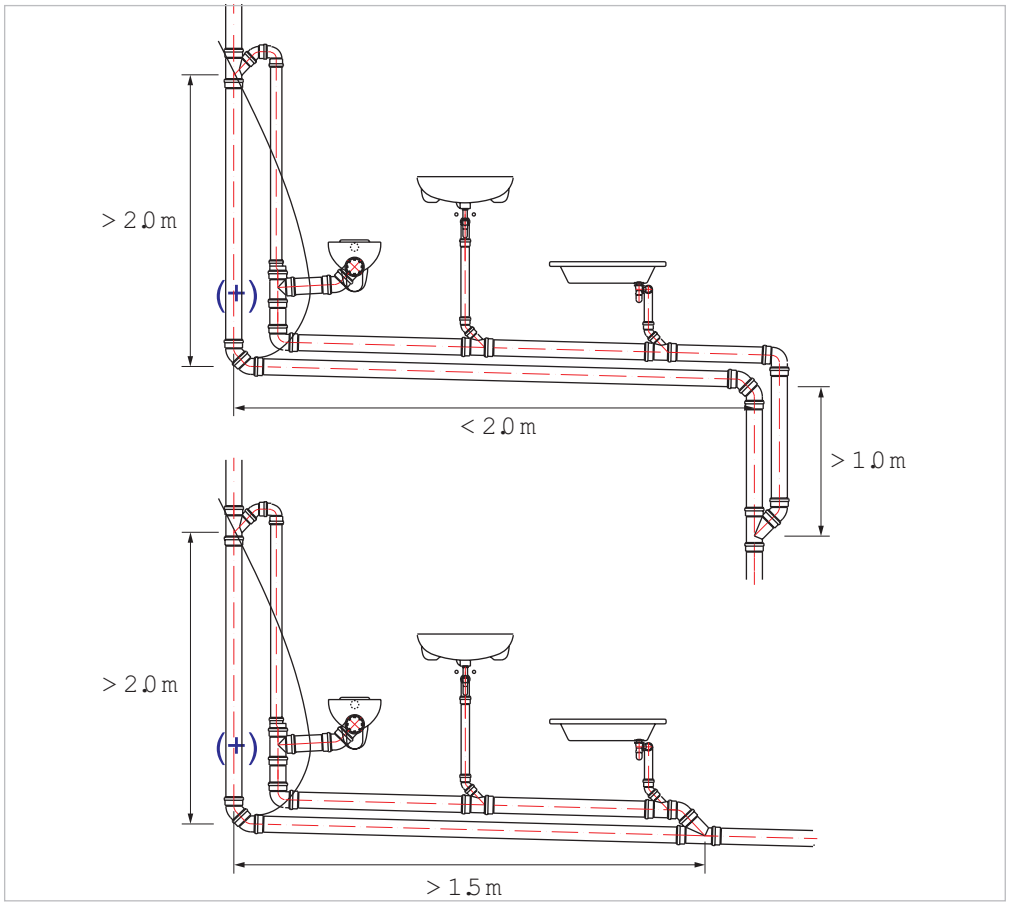
Downpipes exceeding a length of 22 m
If the length of a downpipe exceeds 22 m, connections in an area subject to critical excessive pressure are only permitted on bypass lines (➠ [G.54] and ➠ [G.55]).



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

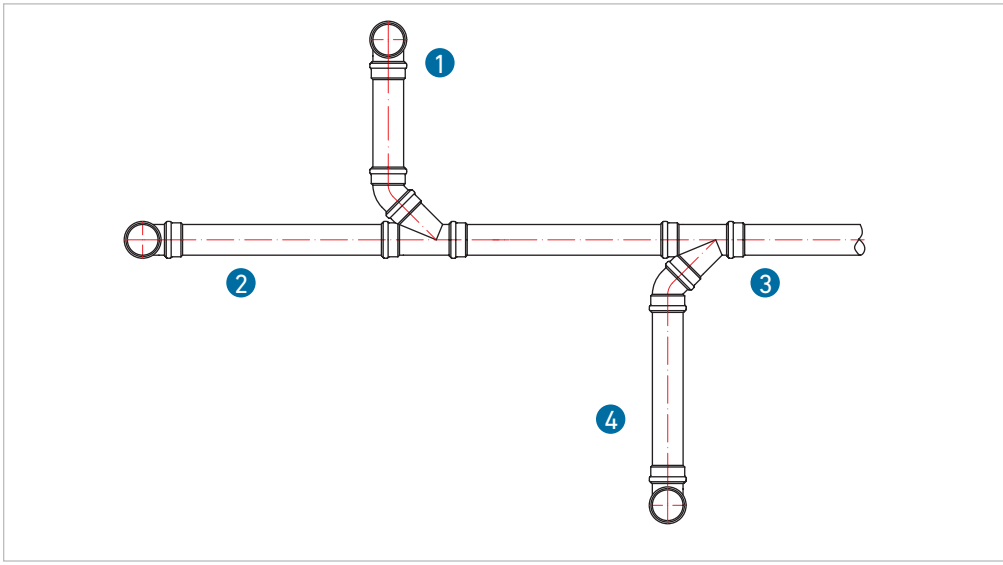
The interaction of the building and property drainage system with the public sewer system, requires compliance with the intended use of the roof ventilation for the safe and proper operation. Reasons for this are:

- 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 this 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, odor traps.

In drainage systems without downpipes, at least one ventilation pipe with a nominal diameter of DN70 must be routed through the roof 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*

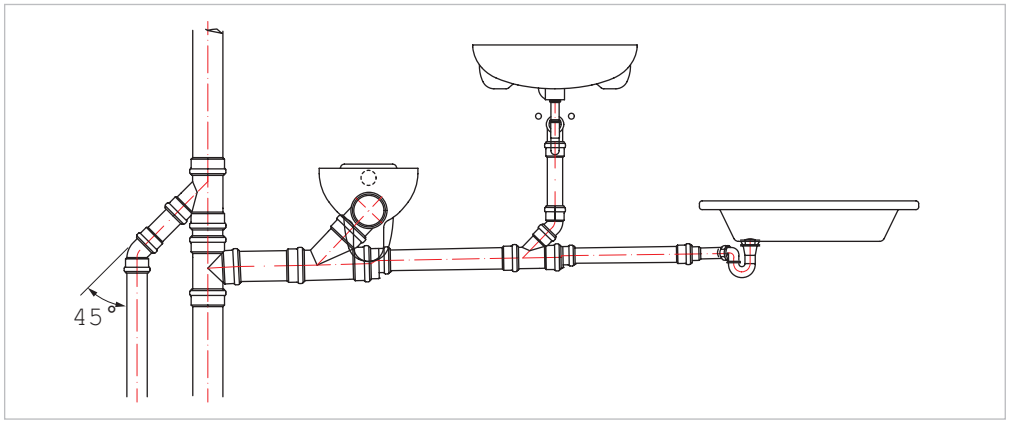
1 Ventilation through the roof must be at least DN70
2 Collecting pipe
3 Headers
4 Collecting pipe

Merging ventilation pipes

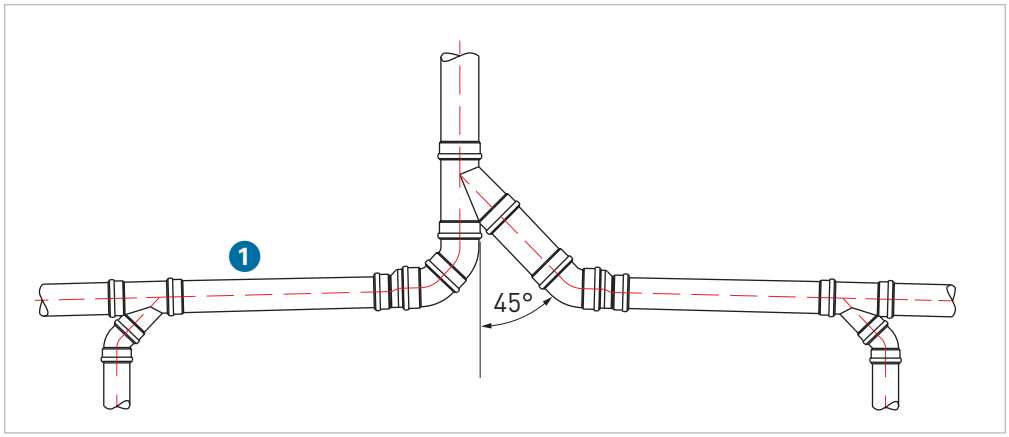
Merging ventilation pipes must only be installed above the highest connecting pipeline at an angle of 45°. The cross-sections of the common nominal diameter must be made in accordance with the design principles (➠ Chapter 'Nominal diameters of ventilation pipes').

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').

In order for the natural buoyancy – caused by the density differences in the horizontally installed ventilation pipes – to flow effectively over the roof, 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.58]).



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 DIN 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:

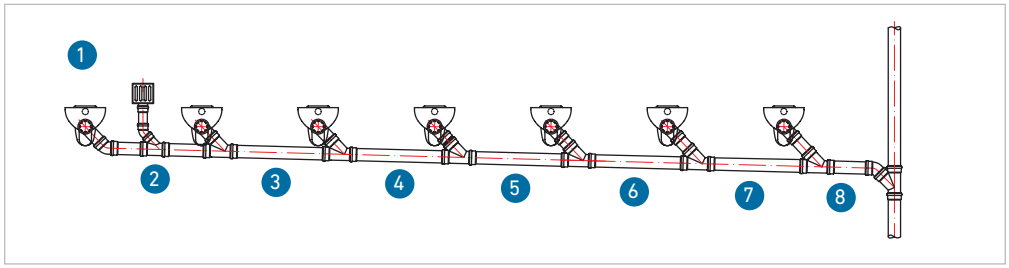
- For the ventilation of single or collecting pipes, if the maximum permissible lengths from Table [T.5] and Table [T.6] are exceeded
- For semi-detached dwelling and duplexes or comparable units these valves can be used as a replacement for additional main ventilation ducts, if at least one downpipe 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.60] und ➠ [G.59]).

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:

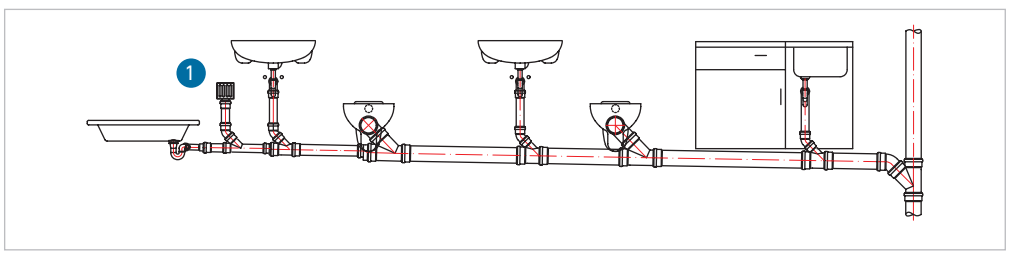
- The stack vent must leave the roof at a perpendicular angle.
- Preferably, the stack vent is open on top. Covers or hoods on the stack vent should be omitted for aerodynamic reasons.
- If covers are used, the air flow must not be deviated by more than 90°.
- The outlet cross-section must be at least 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*

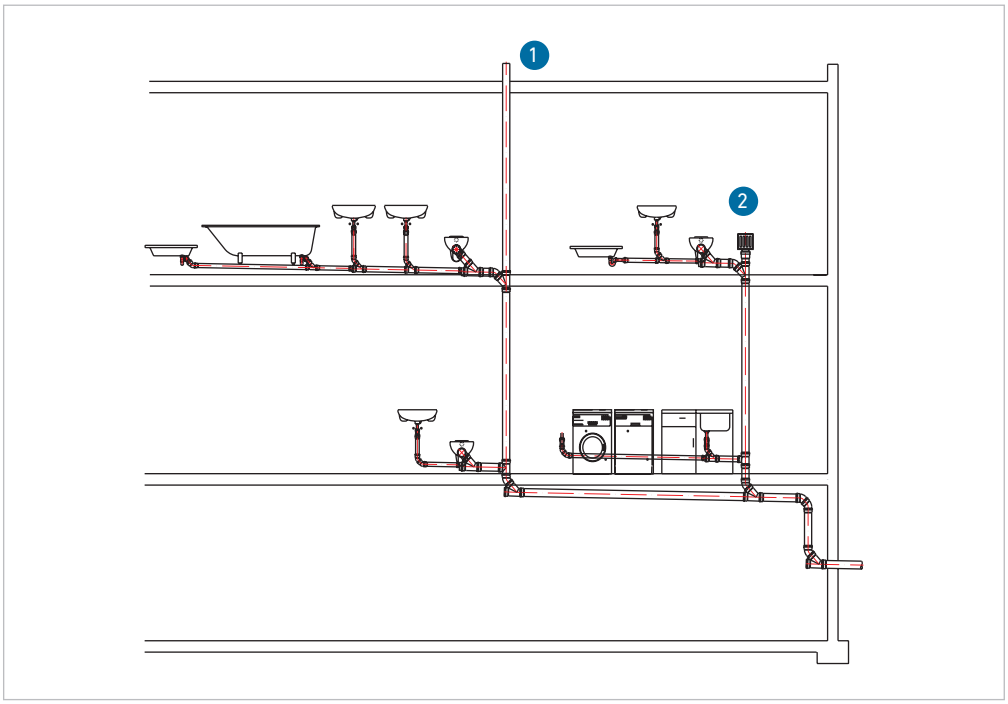
... in a heavily loaded collecting pipe (in-line toilet system)

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



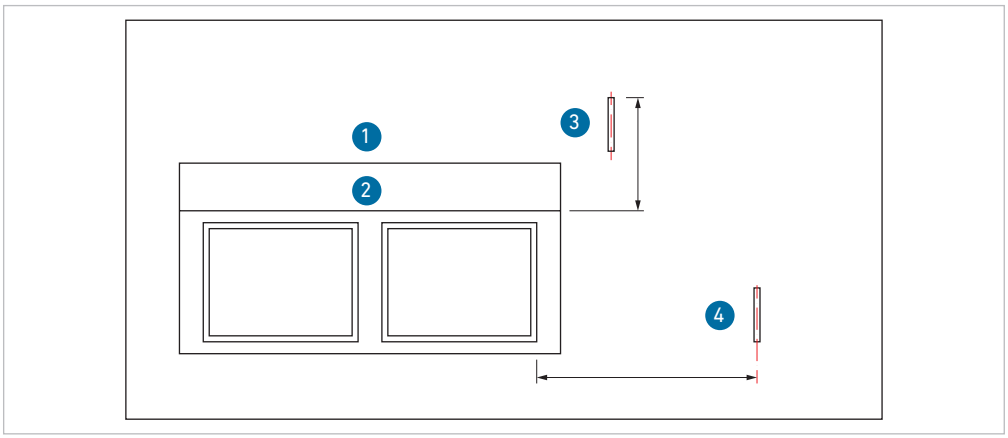
G.33 *Ventilation valve for longer single or multiple collecting pipes*

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 ($h \geq 1{,}0$ m)
4 End of ventilation pipe ($l \geq 2{,}0$ m)

Ventilation of sewage lifting units

Sewage lifting units pursuant to DIN 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 faecal-free 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.

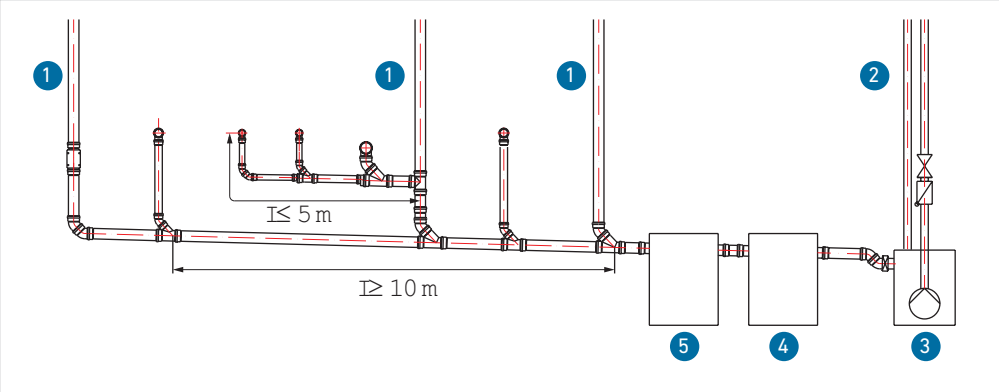
Ventilation of the pipelines to the grease separator

The inlet line to the grease separator must be ventilated, using a ventilation pipe above the roof pursuant to DIN 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.63]).

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

Self-cleaning during operation 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 independently 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 inserts in the odour traps. During such operating conditions, water seal head can be completely sucked off 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 invert 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 invert 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 invert (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 invert (J) and the permissible degree of filling (h/d_i) must not change. The designations of the pipe segments must be chosen without umbiguity 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.

Fl.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

Fl.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].

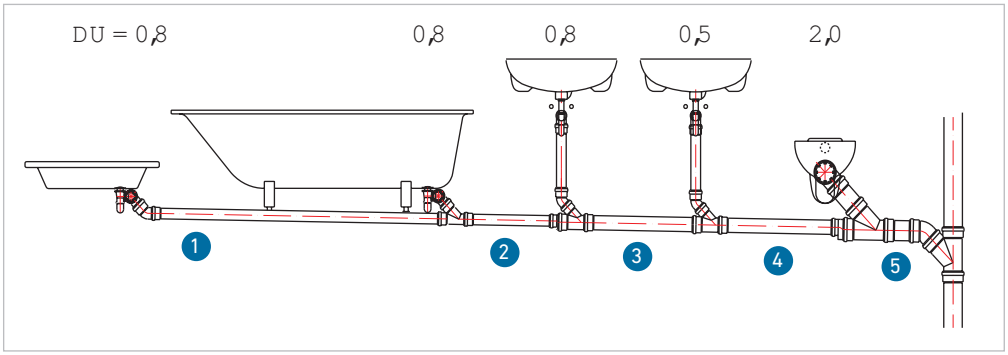
In the first step. the longest flow path in the collecting pipe must be determined and subdivided into pipe segments. The length of the respective pipe segment and the sum of the connection values are also required for design purposes. With this output data. the required diameters can be determined with 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			Maximum permissible length
		K = 0.5	K = 0.7	K = 1.0	
		∑(DU) [l/s]	∑(DU) [l/s]	∑(DU) [l/s]	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

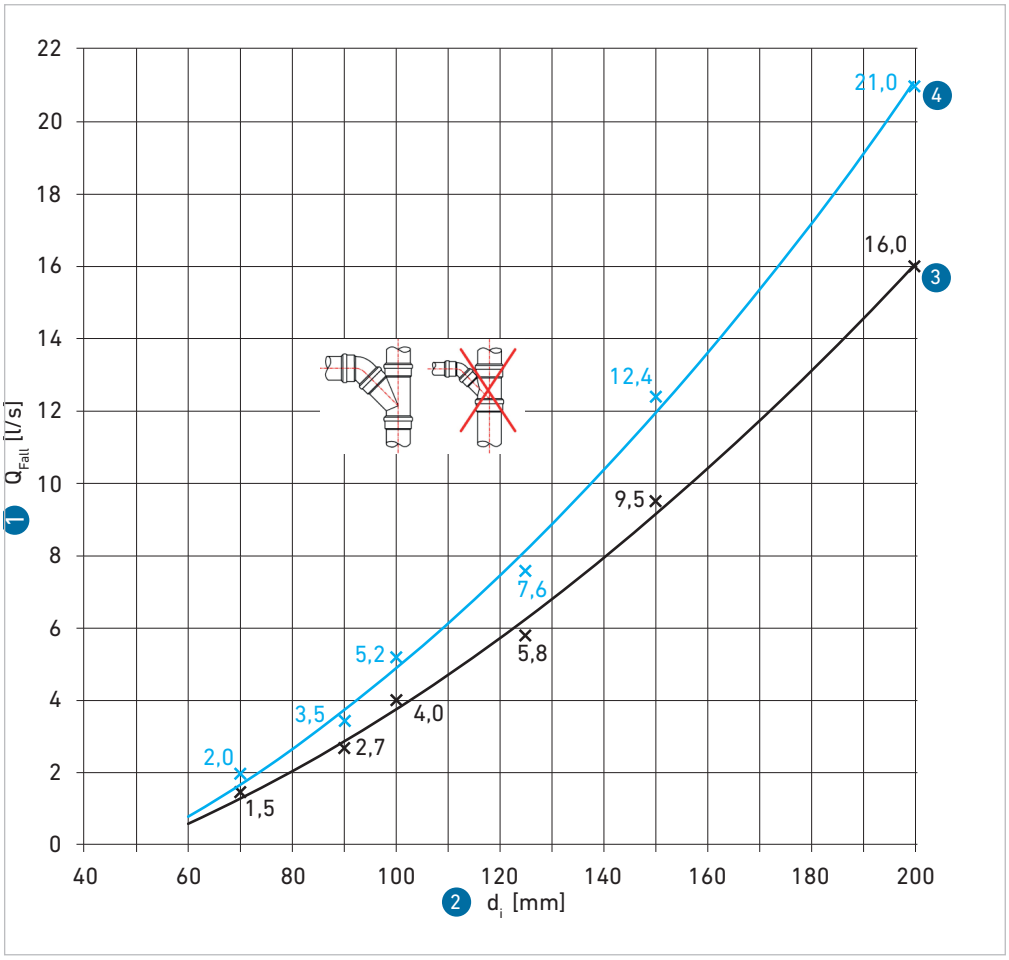
Downpipes with main ventilation must be dimensioned depending on the total wastewater drainage and the geometry of the branch linking the downpipe with the connection or collecting pipeline (➠ [T.8]).

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	Branches with inner radius
	Q_{max} [L/s]	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

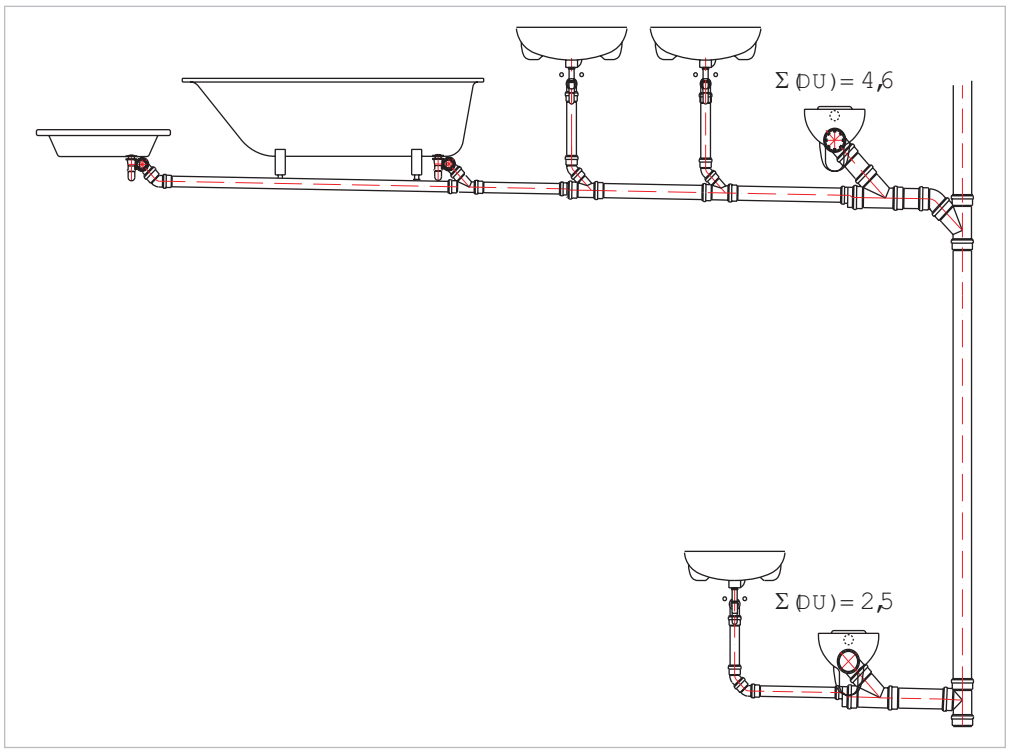
The following information must be available for the dimensioning of a downpipe:

- 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*

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]).

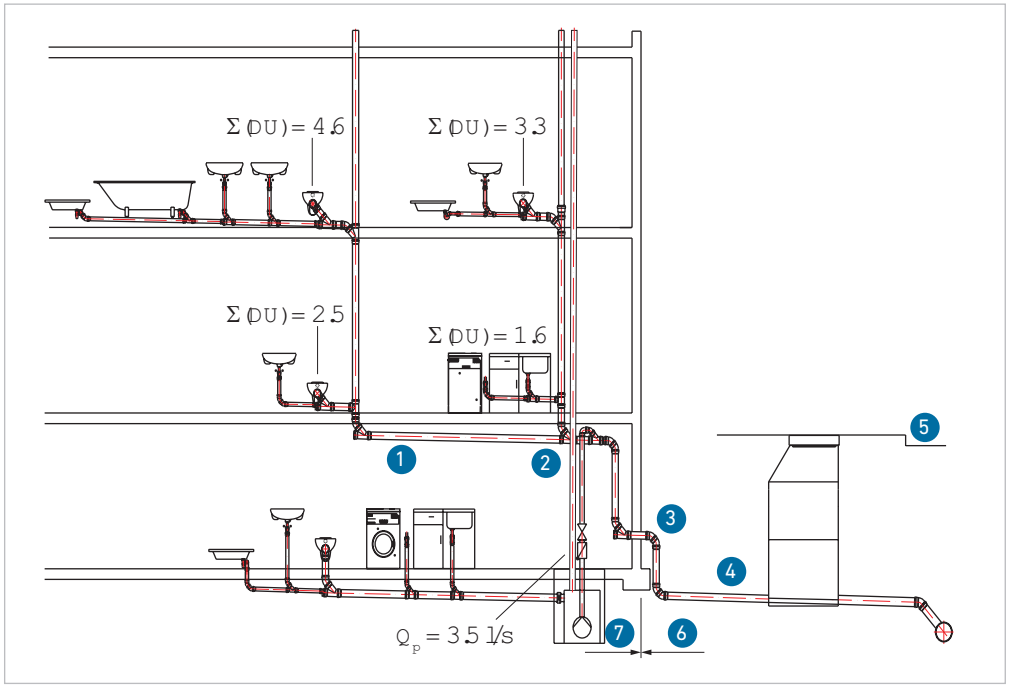
Dimensioning example for a heavily loaded collecting/ header (series toilet system)

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*

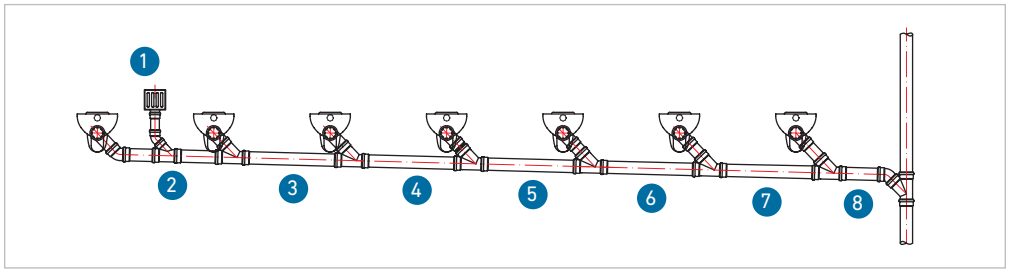
1 TS 7
2 TS 8 / TS 9
3 TS 10
4 TS 11
5 Street
6 Outside the building
7 Inside the building

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

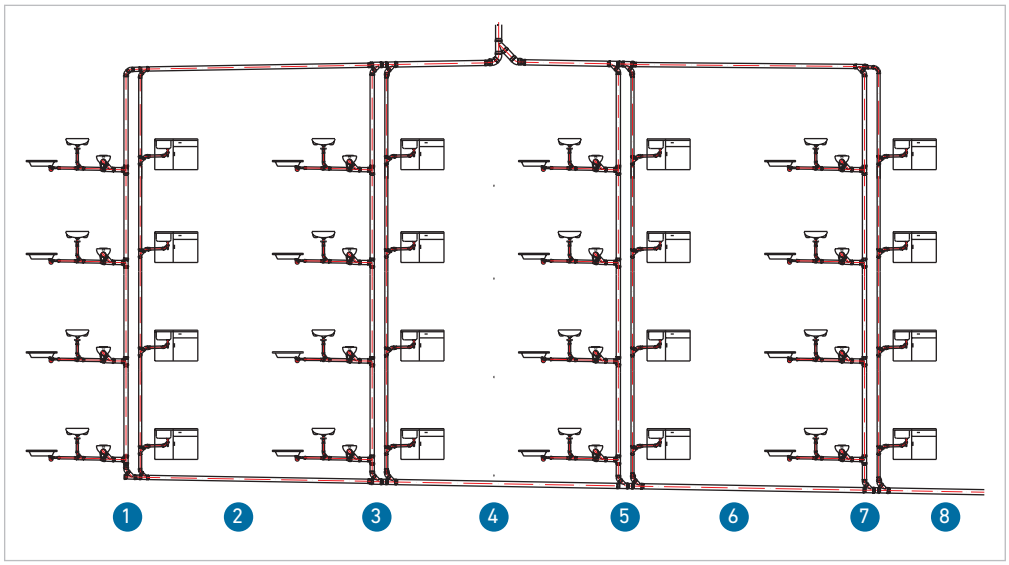


G.42 *Collecting pipelines/header pipes subject to excessive loads (in-line lavatory) used in public facilities*

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*

TS	Length	Calculation of peak discharge ∑(DU)	K	Q_{ww}	Q_P	Q_C	Q_{tot}	Drainage capacity of the selected pipeline 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]
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*

TS	Length	Calculation of peak discharge ∑(DU)	K	Q_{ww}	Q_P	Q_C	Q_{tot}	Drainage capacity of the selected pipeline 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]
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*

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

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*

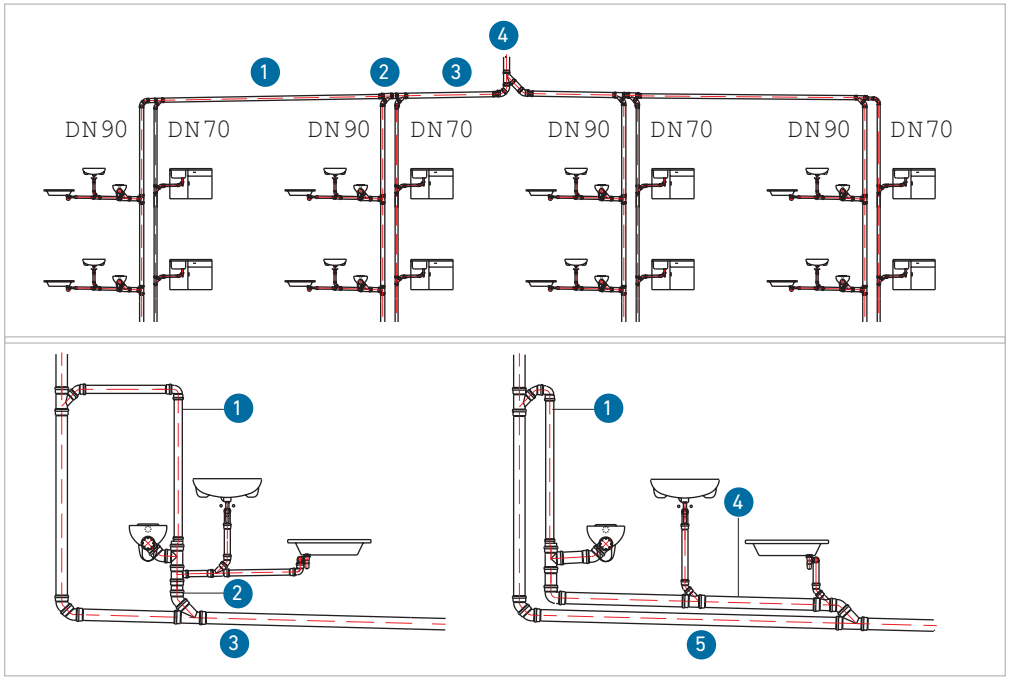
TS	$\Sigma(A_{HL})$ [cm²]	A_{SHL} [cm²]	$d_{i,min}$ [mm]	d_i [mm]	DN
1	88.2	44.1	74.9	99.0	**100**
2	139.2	69.6	94.1	99.0	**100**
3	176.4	88.2	106.0	124.6	**125**
4	352.8	176.4	149.9	149.9	**150**

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

In order to proceed with inspection and cleaning tasks on drainage pipes, cleaning openings must be provided.

Internal drainage pipes can be fitted with cleaning pipes having rectangular, round or oval openings as well as pipe end closures.

In underground pipelines inside buildings, only shafts with closed off flow and rectangular cleaning pipes may be used.

In underground pipelines outside the building, the use of open-flow shafts is preferred.

In underground pipelines and header, cleaning openings must be installed at least every 20 m.

Other rules and clearance dimensions of shafts or inspection openings apply to drainage pipes installed outside buildings (DIN 1986-100, 6.6).

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. The cleaning opening may also be installed in the header instead of in the downpipe. However, in this case the cleaning opening must be located inside the flat.

Operation, maintenance and repair

DIN EN 12056 and DIN EN 752 regulate the operation and maintenance of drainage systems.

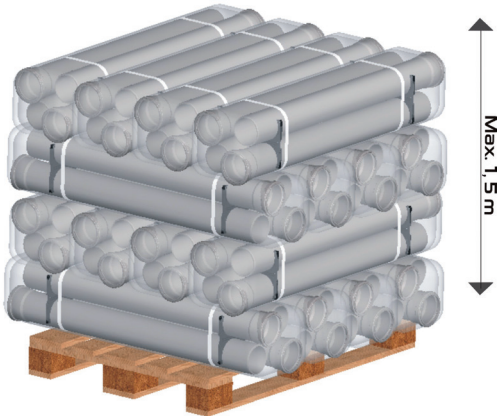
In addition to the system's intended operation, regular inspections of the drainage systems to verify their proper function and safe condition is mandatory. If necessary, maintenance measures (inspection, maintenance, repair) must be carried out in order to keep the system fail-safe.

The owner or authorised user (operator) shall be responsible for the appropriate operation and regular maintenance.

Pursuant to DIN EN 12056 and DIN EN 752, maintenance, repairs and changes to drainage systems may only be carried out by expert personnel.

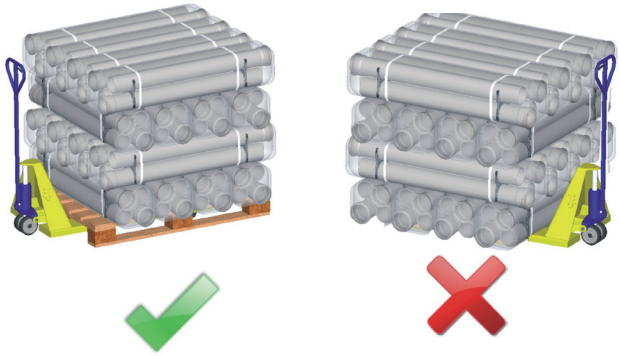
According to VOB DIN 18381 "Section 3.5 Applicable Documents", the contractor must hand over all operating and maintenance instructions required for the safe and cost-effective operation no later than at the time of acceptance. The trained operating and maintenance personnel for the systems must be instructed by the contractor.

Storage



Method of storage should not cause any outflow and should not damage the pipes. As long as they are stored properly, no permanent deformations or damages will occur on the pipes and fittings. 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 materials such as pallet etc. should be used to prevent any damage on the socket parts of the pipes stored for a long time. This also makes it easier to lift the pipes by from the floor.



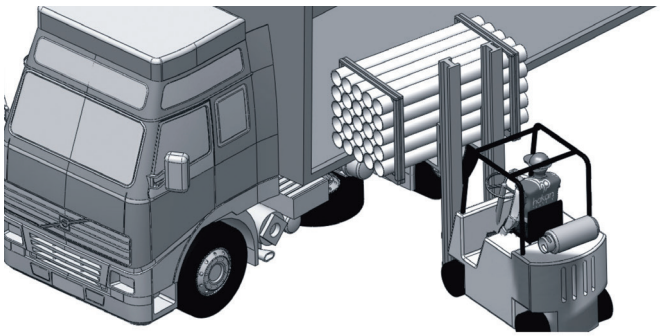
Products that are not resistant to UV should not be stored outdoors and should be protected against sunlight.

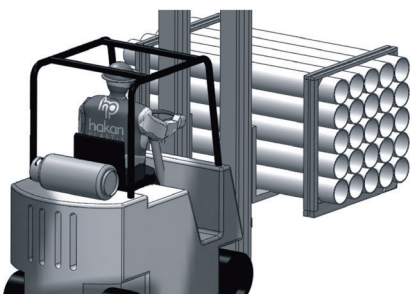
Pipes and fittings packed in carton boxes should be protected against moisture.

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

Transportation

Pipes should be carefully transported to prevent any damages. Avoid sudden and hard pressures on pipes and fittings that might cause freezing in cold weather conditions. Ensure that pipes are not slided and dropped on the floor. Loading and unloading and packing of pipes in a block should be carried out by means of forklifts having flat threads and extensions.





Directories

Glossary

The terms are listed in accordance with the standards DIN EN 752, DIN 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 – A rain event defined ing to the rain duration and occurance per year

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

DIN EN 752	Drain and sewer systems outside buildings
DIN EN 1253-1	Gullies for buildings – Part 1: Requirements
DIN 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
DIN EN 1610	Construction and testing of drains and sewers
DIN EN 1825-2	Grease separators – Part 2: Selection of nominal size, installation, operation and maintenance
DIN EN 12050	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 1: Faecal matter lifting plants
DIN EN 12050	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 2: Lifting plants for wastewater containing faecal matter
DIN EN 12050	Wastewater lifting plants for buildings and sites – Construction and testing principles – Part 3: Lifting plants for limited applications
DIN EN 12056-1	Gravity drainage systems inside buildings – Part 1: General and performance requirements
DIN EN 12056-2	Gravity drainage systems inside buildings – Part 2: Sanitary pipework, layout and calculation
DIN EN 12056-3	Gravity drainage systems inside buildings – Part 3: Roof drainage, layout and calculation
DIN EN 12056-4	Gravity drainage systems inside buildings – Part 4: Wastewater lifting plants, layout and calculation
DIN EN 12056-5	Gravity drainage systems inside buildings – Part 5: Installation and testing, instructions for operation, maintenance and use
DIN EN 12380	Air admittance valves for drainage systems – Requirements, test methods and evaluation of conformity
DIN EN ISO 9969	Thermoplastics pipes - Determination of ring stiffness
EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
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

Georg Fischer Rohrleitungssystem (Schweiz) AG

Amsler-Laffon-Straße 9

8201 Schaffhausen, Schweiz

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