Build

JRG Sanipex

JRG Sanipex

Overview

This chapter contains basic information about the JRG Sanipex system.

Additional technical and sales information

- For more information on the use and connection of other system components, piping and controls and instruments, see the chapters applicable to the appropriate systems.
- More technical information about this system and ordering information can be found on the GF website and in the sales catalogue.

1 System overview

1.1 System description

JRG Sanipex is a pipe-in-pipe installation system. The system consists of a water-carrying inner pipe made of cross-linked polyethylene (PE-X) in a protective and insulating conduit, which is installed directly from the basement or floor level distribution to the fitting connections. All water-carrying system parts (distributors, bends, valves, transitions) are made of corrosion resistant gunmetal.

The pipe-in-pipe technology enables the pipes to be installed directly into the concrete. The water-carrying inner pipe of dimensions d12 and d16 – if it has been installed in the protective conduit – can be replaced without prising open the floor coverings and wall plates if damaged.

JRG Sanipex	Description
Pipe dimension	d12, d16, d20, d25, d32
Application area	Cold and hot water, HVAC, compressed air, greywater
Installation	above all, flush-mounted pipes from distributors to the location of the taps in pipe-in-pipe technology
Pipes	Pipes made of cross-linked polyethylene and multilayer composite pipes
Fittings and system parts	Gunmetal
Method	Crimped clamping connection

1.2 Approvals and quality assurance

The JRG Sanipex system is subject to constant inspection by internal and external bodies. These inspections range from quality assurance during production to ISO certification for environmental and process safety. The JRG Sanipex system meets the requirements for the most important applications in the building technology and is subject to constant monitoring by the licensing offices for drinking water installations on land and water.

System approvals
General information:
➨ Annex A , Section 'Approvals'
Up-to-date information on system approvals is available from Technical Support.

1.3 Scope and application areas

The installation system JRG Sanipex is intended for the following applications:
- Drinking water installations in the cold and hot water area
- Heating and air conditioning installations (only with diffusion-proof pipe)
- Greywater installations (rainwater and the like)
- Compressed air installations

JRG Sanipex is particularly suitable for connection lines in single and multi-family dwellings as well as large objects in sanitary, heating and compressed air installations.

Potential equalisation

The installation of the system is not a conductive metallic pipework. The installation cannot be used as a grounding conductor for electrical installations.

☑ The installation must **not** be used for potential equalisation purposes and must **not** be used as an earth connection.

Responsibility for potential equalisation
The installer of the electrical system is responsible for the correct implementation of the equipotential bonding.

DHW heaters

It is feasible to connect the system to **DHW heaters** without a metallic connection. In this case, restrictions do not apply if the water temperatures never exceed 70°C.
The use in conjunction with **flow DHW heaters** is permitted. However, only the manufacturer of the device is authorised to approve the use of the tankless water heaters.

☑ Compliance with the manufacturer's instructions for the devices is mandatory.

Protection of piping materials and connections

☑ If using flow DHW heater: Only use **thermostats** or **safety temperature limiter**, which ensure that the water temperature of 95°C is not exceeded at any point or at any time – not even when reheating.

☑ When using hydraulically controlled devices: Ensure that the **automatic switch-off** does not permit any pressures above 10 bar, even in case of the reheat effect.

Recommendation
If the temperature cannot be kept below 95°C or in older hydraulically controlled, electrically or gas-fired instantaneous water heaters, where the temperatures cannot be reliably maintained below 95°C, the following shall apply:
☑ A metallic connection with a length of at least 1.0 m shall be provided.

Fire extinguishing systems

When installing fire extinguishing pipes and sprinkler systems using JRG Sanipex system components:

☑ Compliance with local regulations and fire protection requirements is mandatory.

1.4 Properties and requirements

Service life limitation applicable to the installation
The water quality (pH value), the water constituents, as well as the operating conditions can have a direct influence on the service life of the installation, especially if chlorinated waters are being used.

1.4.1 Materials

Materials Polyethylene (PE-X) and gunmetal
Detail information:
➨ Part III 'The basics', Section 'Materials and jointing technology'

1.4.2 Hygienic properties

Verification of the system's hygienic safety is provided. The test certificate issued by the DVGW-Technologiezentrums Wasser – TZW (the German Water Centre – as part of DVGW e.V., the German Gas and Waterworks Association) proves that the plastic components comply with the KTW (official German recommendation concerning the levels of polymers in drinking water) recommendations by the German Federal Health Agency, the specifications of the Umweltbundesamtes (UBA) (Federal Environmental Agency) in Germany and the basic requirements of the Federal Food Control Institute according to ÖNORM B 5014, Part 1. This also applies to other institutions in the field of building technology and the shipbuilding industry, for example, ACS, SINTEF, BS 6920 and KIWA/ATA.

All plastic and metal components are continuously inspected in accordance with the recommendations mentioned above in order to ensure they meet national and international requirements, such as the DVGW worksheet W270.

Test certificate issued by the Fraunhofer Institute for the JRG Sanipex system
According to the test, all connecting parts of the system demonstrably fulfil the criteria of asepsis (dead space clearance: 0 KBE/cm²).

1.4.3 Chemical resistance

The system exhibits a high chemical resistance to all natural drinking water substances (acc. to DIN 2000 and TrinkwV 2001), against disinfectants and cleaning agents (acc. toDVGW-Arbeitsblatt W291) and against corrosion inhibitors (acc. to DIN 1988, Part 4).

In addition to the utilisation for drinking water, the system can also be used for the liquid and gaseous media mentioned in [TV.1].

Suitability of the system
However, the suitability of the system is not limited to the defined chemical resistance mentioned above, but also depends on the use of the appropriate medium.
The characteristics of the medium may be changed by the pipes and fittings.

TV.1 **Media**

Medium	Classification	Max. operating temperature [°C]	Max. operating pressure [bar]
Drinking water	Cold water	0 – 20	10
	Hot water	20 – 70*	
Heating water	–	0 – 70*,**	
Softened water	pH neutral (0°fH)	0 – 70	
Rain water	pH value >6.0	0 – 40	
Osmosis treatment***	–	0 – 70	
VE water***	desalinated	70	
Cooling water****	40 Vol.% ethylene glycol, Antifrogen®, ethyl alcohol	–25 – 40**	
	25 Vol.% propylene glycol	–10 – 40**	
	Saline solutions	–20 – 40**	
Disinfectant solution*****	ready for use	40	
Compressed air	Class 1 acc. to DIN ISO 8573-1 • Residual oil content: 0.01 mg/m³ • oil and fat free	0 – 40	
	Class 2 and 3 acc. to DIN ISO 8573-1 • Residual oil content: 1.0 mg/m³ • Residual water content: 0.88 mg/m³ • Dew point: –20°C • low in oil and fat	0 – 40******	
Nitrogen	–	0 – 40******	
Vacuum	–	40	-0.8 $p_a \approx 0.2$

* Short term peak temperature of 95°C during max. 150 h/a
** Only permissible with oxygen diffusion-tight pipes
*** Brass and gunmetal fittings release small amounts of metal ions into osmosis-treated water. If ion-free water is desired, additional treatment at the tap is required or RG fittings with epoxy coating inside (JRG Sanipex MT up to 30°C) should be used.
**** Higher concentrations must be requested.
***** Concentrations must be requested.
****** Not suitable for PB pipes

Requests concerning resistance in special cases
If the system must be used for applications or concentrations exceeding the values in the table, the resistance of the materials etc. must be checked and approved by GF JRG.
The following information is required in advance for testing and approval:
- Product and safety data sheet of the medium
- Operating temperature and pressure
- Concentration, exposure time, frequency and flow rate of the medium (even a sample, if required)

The use of the system for **medical gases** is **not** recommended.
Medical gases include gases that meet the requirements of the European Pharmacopoeia or which are anaesthetic gases, medical oxygen or medical carbonic acids. All of the above are approved according to the drug regulations as finished medicinal products.

1.4.4 Fire protection

Fire protection
Up-to-date information on fire protection for the system, including information on solutions, applications and product properties, can be found in the brochure "**Planungshilfe Rohrabschottung" (Planning aid pipe sealant)**.

Country-specific regulations
Fire protection may be regulated differently in each countries by laws, directives, ordinances, standards, regulations and bulletins.
☑ Compliance with the local fire protection regulations is mandatory.

1.4.5 Soundproofing

The basics

Water pipes do not generate any noise if the nominal pipe dimension, design, fastening method and operation are correct. There are no test regulations specified in standards or other directives to determine or assess the noise behaviour in drinking water systems. Plastic piping systems exhibit advantages over metal pipe systems due to their corrosion resistance and flexibility.
By default, drinking water systems are designed so that the volumetric flow is 2 m/s for distribution lines (standard value, which is and may only be exceeded for certain line sections) and max. 4 m/s for discharge lines is maintained. These are flow velocities at which the inherent noise of the pipelines comparted to the noise generated by the fittings or other ambient noise is not noticeable. However, the noises resonating from sanitary equipment and fittings are being transmitted. Therefore, sound insulation – which absorbs the structure-borne noise reverberating from the building – must be added to the system components.

JRG Sanipex

The JRG Sanipex installation system is compliant with the requirement of DIN 4109 and SIA I81 (6.2006). However, this implies that the installation must be carried out according to the recognised rules of technology and the assembly instructions.

1.4.6 Insulation

Insulation

General information on insulation:

➨ Part IV 'Plan', Section 'Insulation, Fire protection'

Country-specific regulations

The insulation may be regulated differently in each country by laws, directives, ordinances, standards, regulations and bulletins.

☑ When it comes to insulation methods, compliance with the applicable rules and regulations is mandatory.

The basics

Insulation recommendations

If local specifications do not apply, the following instructions shall be considered as minimum requirements. A protective wrapping shall be wrapped around the pipelines, a thin insulating hose or a protective conduit shall be used. For most systems, a **pre-insulated** design (e.g. with 6 mm thick insulation) is available.

☑ Piping systems must always be insulated in order to prevent heat loss and/or heat absorption.
- Cold water pipeline: In order to prevent condensation, DHW heating and sound transmission
- Hot water, circulation and heating pipes: To reduce heat loss, absorb expansion and prevent sound transmission

☑ Select the insulation or sheathing according to the respective field of application.

☑ Ensure that the insulation does not cause corrosion to the piping materials.

Soundproofing

☑ The soundproofing may be subject to special requirements. Ensure that these potential prerequisites are considered in the design of the insulation.

Hygiene

Applying insulation to cold water pipes, for example, in order to prevent them from heating can improve the hygiene and help reduce the risk of legionella.

Planning fundamentals

The EnEV (German Energy Saving Ordinance) or DIN 1988 in Germany or the model regulations of the cantons in the energy sector (MuKEn) in Switzerland are available in the current version with comprehensive, detailed and practice-oriented documents. They are equally valid for new constructions, renovations and modernisations.

1.4.7 Protecting the installation

System components installed flush with the wall or walled in

Pipe installations flush with the wall are lines that are not easily accessible, for example, inside an in-wall installation, in a wall slot or in the concrete floor.

☑ Fittings and pipes must be insulated with a suitable material in order to absorb thermally induced changes in length, to prevent the transmission of sound, to preclude the formation of condensation, heat emission, heat loss or heating of the medium and other influences caused by building materials.

☑ Piping system and building structure must be separated from each other, for example, by using protective conduits made of PE, wrappings, insulating hoses or half shells with and without sheathing or a combination thereof.

☑ All system components must be protected from direct contact with oils, greases, solvents, solvent-based adhesives (adhesive tapes), foams, bitumen (also bituminous membranes). Furthermore, the components must not contact building materials such as screed, concrete, mortar or plaster.

Protection against environmental influences and building materials

Special measures apply to the following rooms:

- permanently or periodically wet rooms
  - Slaughterhouses, butcher shops (pressure washer)
  - Carwash
  - Tiled shower stalls, spa areas
  - Commercial kitchens
  - Rooms with risk of external water ingress
  - Swimming pools, sauna
- Areas subject to offensive gases or aggressive environments
  - Stables (ammonia)
  - Dairy factories/cheese dairies (nitric acid)
  - Swimming pools/swimming pool centres (chlorine, hydrochloric acid)
- Areas subject to uncontrollable environmental influences

Due to the moisture permeating the building materials and the resulting permanent wetness (e.g. in public showers and baths or commercial wet rooms), it is possible for an aggressive environment to form around the pipe.

☑ Appropriate precautions must be taken to protect the installation, e.g. by using the following measures:
  - Use of suitable anti-corrosion tapes (e.g. supplied by KEBU, Gyso or DENSO)
  - Wrapping the pipe with heat-shrinkable materials

☑ Ensure that pipes and fittings are dry when mounting.

Protection from UV radiation

☑ Appropriate precautions must be taken in order to prevent the installation from permanent exposure to UV rays.

When using the pipe-in-pipe system with protective conduit, this will ensure sufficient UV protection.

Sheathing with insulating material can assume the function of UV protection.

☑ Pipes and fittings must be shielded from direct sunlight and UV radiation.

☑ During transport and storage: Pipes and fittings must be covered after they have been removed from the original packing.

Protection against aggressive waters

Recommendation

☑ In areas with particularly aggressive waters: Installations must be easily accessible.

☑ Distribution lines in the single tap system (pipe-in-pipe) must be designed and installed such in order to ensure system components can be replaced at any time without damaging the building's structure.

1.4.8 Disinfection procedure

Disinfection

General information on common disinfection procedures:

➨ Part VI 'Operate', Chapter [4] 'Disinfection'

Information on the hygiene concept used at GF:

➨ Part II 'Plan – Build – Operate', Chapter [4] 'The Hycleen Concept'

Chlorine dioxide

The use of chlorine dioxide for chemical disinfection can severely limit the lifetime of the entire drinking water installation. Before implementation, the conditions must be recorded on site.

The water quality (pH value), the water constituents, as well as the operating conditions can have a direct influence on the service life of the installation, especially if chlorinated waters are being used.

1.5 Safe application and processing

☑ Only use the product as intended and in accordance with the defined areas of application and usage.
☑ Check compatibility of medium and material.
☑ Do not use the product if it is damaged or defective. Damaged product must be removed immediately.
☑ Use only approved accessories.
☑ Only trained personnel shall be permitted to assemble the product and accessories.
☑ All personnel shall be instructed on all applicable issues of local occupational safety and environmental regulations, in particular for pressurised piping. These instructions must be held on a regular basis.
☑ Compliance with the valid standards for drinking water and greywater installations as well as compliance with the regulations of the system manufacturer is mandatory.
☑ Compliance with the local water supply regulation is mandatory.
☑ Make sure that the piping system is installed correctly and inspected regularly.
☑ All installations must comply with the instructions specified in the technical documentation of the product.
☑ Compliance with the operating, maintenance and assembly instructions of the tools is mandatory.
☑ Tools must be used as intended and must not be applied for other purposes.
☑ When assembling the JRG Sanipex installation system, only JRG Sanipex mounting tools must be used.

Combination of JRG Sanipex MT with JRG Sanipex

In conjunction with JRG Sanipex, pipes of the JRG Sanipex MT system can also be used.

1.5.1 Transport and storage

For hygienic reasons, all openings in pipes, fittings, controls and instruments must be closed until final assembly.

☑ Ensure to protect the product against external force (shock, impact, vibration, etc.) during transport.
☑ Transport and/or store the product in unopened original packing.
☑ Protect the product from dust, dirt, moisture, heat and UV radiation.
☑ Ensure that the product is not damaged by mechanical or thermal influences.
☑ Before proceeding with the assembly, inspect the product for damage that may have occurred during the transport.

1.5.2 Installation and assembly

The JRG Sanipex System is suitable for the following types of installation:

- Surface or flush-mounted installations
- Installation in shafts and channels, on ceilings and on floors
- Installation in-wall, element, wood and lightweight constructions
- Installation in concrete (in the pipe-in-pipe system, with PE-X pipes)

1.5.3 Acceptance and putting into operation

§ **Country-specific regulations**
Acceptance and putting into operation may be regulated differently in each country by laws, directives, ordinances, standards, regulations and bulletins.
☑ When it comes to acceptance and putting into operation, compliance with the applicable rules and regulations is mandatory.

Acceptance, pressure test, flushing and putting into operation
General information and master copies of the test reports:
➨ Part V 'Build', Section 'Putting into operation'

1.5.4 Operation, maintenance, servicing, repair and decommissioning

☑ To ensure trouble-free operation: Check installation and all control and safety fittings regularly.

Risk of injury due to pressure or explosion!
If the system is not completely depressurised, media may escape uncontrolled from the installation.
☑ Before removal, maintenance, disassembly: Pipeline must be completely depressurised.
☑ If harmful, combustible or explosive media is used: Completely empty and flush the pipeline before disassembling it. Look for potential residues.
☑ Use appropriate measures to ensure the medium is collected properly.

Risk of injury due to media harmful to health and the environment!
Risk of personal injury or environmental damage due to uncontrolled escape of hazardous media.
☑ During maintenance, servicing, repair and decommissioning, prescribed protective clothing must be worn.
☑ Compliance with the media safety data sheets is mandatory.
☑ Collect leaking media and dispose of according to local regulations.

Risk of injury due to the use of unsuitable spare parts!
Damage to the installation and risk of injury.
☑ Only use replacement parts from the current product range during the installation and repairs.

1.5.5 Disposal

The entire JRG Sanipex MT product range is made from environmentally friendly and recyclable materials.

§ **Country-specific regulations**
Disposal and recycling may be regulated differently in each country by laws, ordinances, standards, regulations, and bulletins.
☑ When disposing of or recycling the product, the individual components and the packaging, compliance with the local regulations is mandatory.

☑ Before disposing of individual materials, they must be separated according to their recyclability, and whether these materials are considered normal waste or special waste.

2 System components

The JRG Sanipex installation system consists of cross-linked polyethylene pipes and fittings made of gunmetal. In addition, there are controls and instruments with direct transition to the system.

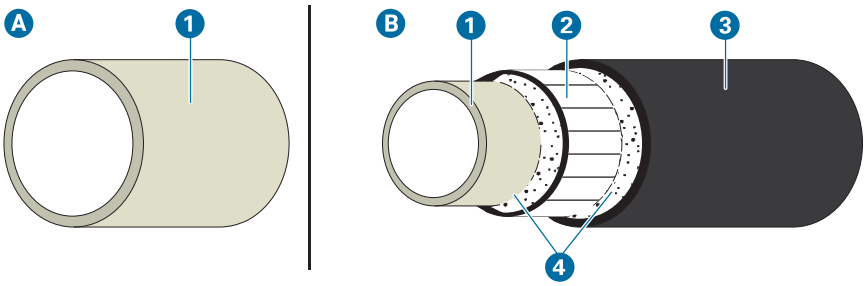
2.1 JRG Sanipex pipes

The 100% plastic pipes from the JRG Sanipex assortment, which are available pre-cut, in coils and in various designs (e.g. with insulation or in a protection conduit), consist either of radiation-crosslinked polyethylene (PE-Xc) or of peroxide crosslinked polyethylene (PE-Xa). Common to both variants are the hygienic properties of the base material. For use in heating or air conditioning installations, the PE-X pipe – which is specially tailored to these requirement – is equipped with an additional EVOH barrier, which reliably prevents oxygen permeability according to DIN 4726.

Processing JRG Sanipex MT pipes
JRG Sanipex MT multilayer composite pipes can also be processed in the dimensions d12 to d20.

2.1.1 Pipe construction and pipe labelling

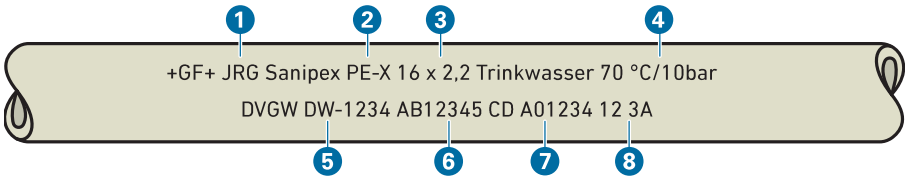
The pipes for the JRG Sanipex system are designed as follows.



GV.1
Pipe design
A 100% plastic pipe
1 PE-X pipe

B Multilayer composite pipe
1 Inliner (PE-X)
2 Aluminium pipe
3 Outer coating (PE-X)
4 Bonding agent

The pipes are marked as follows.



GV.2
Pipe marking

Labelling (example)		Meaning
1	JRG Sanipex	Product name: Company name and system name
2	PE-X	Material code
3	16 × 2.2	Dimension: Outside diameter x wall thickness
4	70°C / 10 bar	Medium: Operating temperature/max. operating pressure
5	SVGW-.. / DVGW XX-123.. / ÖVGW X1.123..	Approval(s) and number(s)
6	AB 12345	Production location and production date
7	CD A01234	Order number
8	12 3A	Internal factory code

2.1.2 Technical data

JRG Sanipex

Feature	Pipe	PE-Xa, PE-Xc
Conditions in continuous operation (SF 1.5)		70°C, 10 bar (50 years)
Max. operating temperature [°C]		95 (briefly)
Max. operating pressure [bar]		10
Surface roughness k [mm]		0.007
Material constant C		12
Coefficient of thermal expansion α [mm/(m·K)]		0.18
Thermal conductivity [W/(m·K)]		0.38
Oxygen-tightness		acc. to DIN 4726 (only pipes with EV0H)
Processing temperature [°C]		up to –20
Density [kg/dm³]		~0.94
Fire code		CH: IV.2 (VKF) / D: B2 (DW 4102)
Building material class		D: B2 (DW 4102) / E (DW 13501-1)

Feature	Dimension	d12	d16	d20	d25	d32
Nominal width DN [mm]		8	12	15	20	25
Outside diameter d_a [mm]		12	16	20	25	32
Wall thickness s [mm]		1.7	2.2	2.8	3.5	4.4
Internal diameter d_i [mm]		8.6	11.6	14.4	18	23.2
Weight [g/m]		54	89	142	222	358
Cross section inside A [cm²]		0.58	1.06	1.63	2.54	4.23
Volume [l/m]		0.06	0.11	0.16	0.25	0.42
Fire load [MJ/m]		3.08	4.30	6.72	10.45	16.78

Bending radius	Dimension	d12	d16	d20	d25	d32
Bending radius R, not interchangeable: $5 \cdot d_a$ [mm]		60	80	100	125	160
Bending radius R, interchangeable: $8 \cdot d_a$ [mm]		96	128	160	200	256

Mounting distance	Dimension	d12	d16	d20	d25	d32
Mounting distances [mm]		1.0	1.0	1.0	1.0	1.5
Assembly with pipe saddles [m]		1.5	1.5	1.5	1.5	2.0

Protective conduits

Feature	Pipe	PE pipe
Density [kg/dm³]		~0.95
Tensile strength [N/mm²]		~25
Temperature resistance [°C]		100
Melt flow index		MFI 190/5: 0.4 g/10 min
Elongation at break [%]		600
Thermal conductivity [W/(m·K)]		0.45

Feature	Dimension	d12	d16	d20	d25	d32
Outside diameter d_a [mm]		18	25	29	34	42
Internal diameter d_i [mm]		14.6	20	23	29	36

Crimped clamping connection

Feature	Dimension	d12	d16	d20	d25	d32
Threads		M17 × 1.25	M22 × 1.5	M27 × 1.5	M34 × 2.0	M42 × 2.0

Material: Brass

2.2 Fittings

All fittings in the JRG Sanipex assortment are made of gunmetal (CC499K). In addition to this material's non-problematic material properties and low susceptibility to corrosion and incrustation, this material is especially known for its excellent hot water resistance and it has been used for decades for mouldings and fittings in the building technology.

2.3 Controls and instruments

Controls and instruments for the Sanipex system with special connections and transitions are available in the JRG Controls and Instruments program.

Information on controls and instruments
Technical product information:
➨ Part V 'Build', Section 'JRG Valves'

3 Tools

When processing the JRG Sanipex, special tools must be used depending on the pipe dimension. This will ensure that the correct and safe JRG Sanipex crimped clamping connection is created.

☑ Compliance with the tool's operating instruction is mandatory.

Material damage and risk of injury when using unsuitable tools or non-original spare parts.

→ Only use tools available from the current product range.

→ Tools must be used compliant with the operating instructions.

→ Only use replacement parts from the current product range.

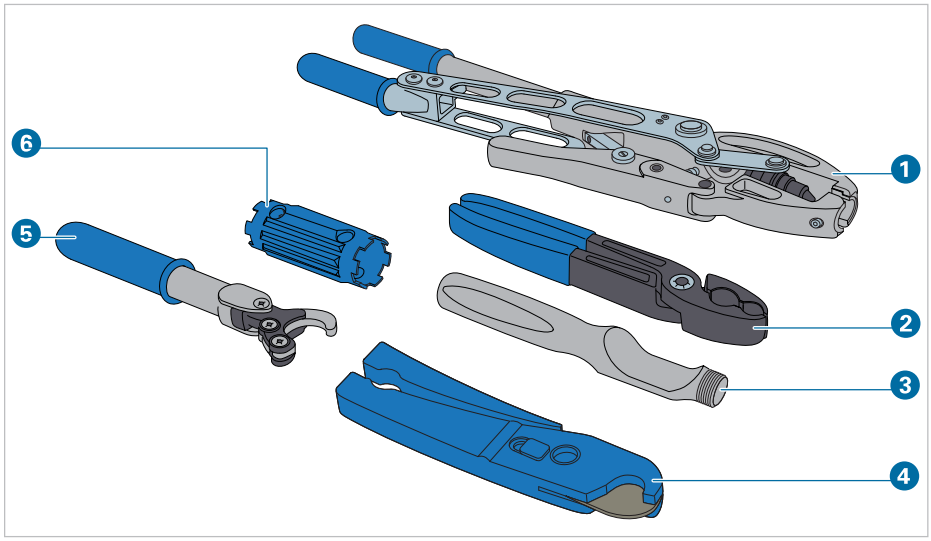
Care, testing and maintenance of tools

A flawlessly functioning tool is a basic prerequisite for a permanently sealed connection.

Risk of injury and material damage due to poor care, incorrect testing and faulty maintenance.

→ Tools must be maintained as specified in the operating instructions and their operation must be inspected regularly, at least once a year.

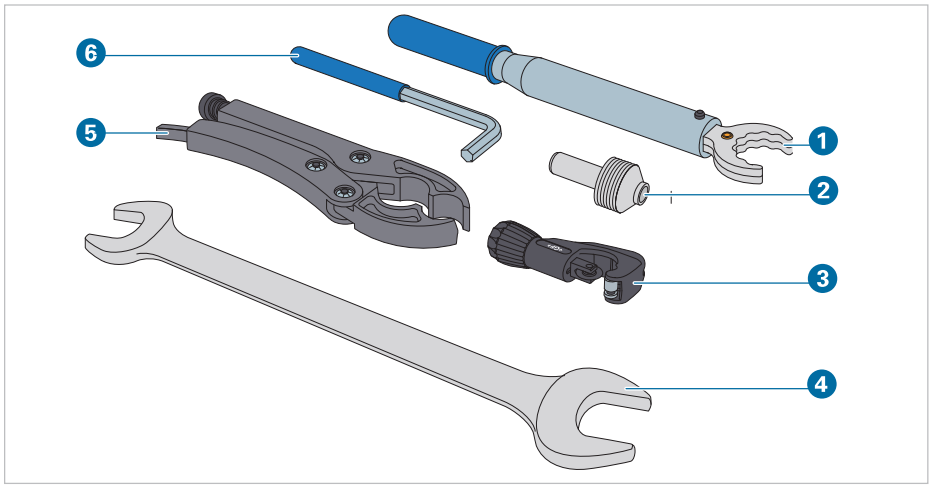
3.1 Assembly tools (d12 – d20)



GV.3
Assembly tools

1. Circlip pliers
2. Pipe wrench
3. Alignment gauge
4. Combination shears
5. Ratchet torque wrench
6. Socket mounting keys

3.2 Assembly tools (d25 – d32)



GV.4
Assembly tools

1. Torque wrench
2. Turn up device
3. Pipe cutter
4. Open-end spanner (SW27, SW32)
5. Pipe wrench
6. L-keys

4 Dimensioning

Simplified calculation method
Basic information, examples and sample tables for simplified calculation:
➡ Part IV 'Plan', Section 'Drinking water installation'

The product-specific data for the simplified calculation and the calculation method are available in this chapter.

4.1 Loading units

+ The loading unit (LU – previously abbreviated BW) designates the flow rate provided at the connection point upstream of the tap as a function of the intended use and the duration of use. The loading unit does not correspond to the withdrawal flow, listed in the respective product specification.

A loading unit LU is equal to a flow of 0.1 l/s.

4.1.1 Controls and instruments and equipment

TV.2
Loading units according to intended purpose

Usage Connections DN15 (½")	Volumetric flow rate Q_A per connection		LU per connection
	[l/s]	[l/min]	
Wash-hand basin, washing trough, vanity unit, bidet, cistern, vending machine, hairdresser, household dishwasher	0.1	6	1
Sink, utility sink, taps for balcony and terrace, washing trough, shower, standing and wall spout, household washing machine	0.2	12	2
Urinal flushing (automatic), bathtub	0.3	18	3
Tap for the garden or garage	0.5	30	5

Source: SVGW Guidelines W3 Edition 2013

4.1.2 JRG Sanipex pipes

TV.3 **Loading units applicable to JRG Sanipex pipes**

Description	Dimension							
Total loading units LU	1	2	3	4	5	8	14	35
Largest single value LU	–	1	–	–	4	5	–	–
$d_a \times s$ [mm]	12 × 1.7		16 × 2.2			20 × 2.8	25 × 3.5	32 × 4.4
d_i [mm]	8.6		11.6			14.4	18	23.2
Length of pipeline, recommended [m]	10	6	9	5	4	–	–	–
Controls and instruments	–	½"	½"			½"	¾"	1"

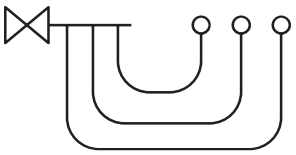
4.1.3 Installation with individual supply lines

Group of equipment/distribution at floor level
→ A velocity of max. 4 m/s must be maintained.

Directional change with pipe bend

Max. developed length [m]	5		10		15	
Residential water meter	without	with	without	with	without	with
Loading unit (LU)	[$d_a \times s$]					
1	12 × 1.7	12 × 1.7	12 × 1.7	12 × 1.7	12 × 1.7	12 × 1.7
2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2
3	16 × 2.2	16 × 2.2	16 × 2.2	20 × 2.8	20 × 2.8	20 × 2.8
4	16 × 2.2	16 × 2.2	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8
5	20 × 2.8	no counter	20 × 2.8	no counter	–	–
Pipe $d_a \times s$ [mm]	12 × 1.7	16 × 2.2	20 × 2.8			
Pipe d_i [mm]	8.6	11.6	14.4			
Instrument	½"	½"	½"			

TV.4
Loading units (LU) for PE-Xa pipes



Straight-seat shut-off valve ¾ "and distributor ¾" are taken into account in the calculation model.
Source: SVGW 2014

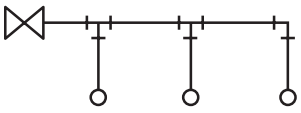
4.1.4 Installation with tees

Group of equipment/distribution at floor level
→ A velocity of max. 3 m/s must be maintained.

Directional change with fittings

Max. developed length [m]	5		10		15	
Residential water meter	without	with	without	with	without	with
Loading unit (LU)	[$d_a \times s$]					
1	12 × 1.7	12 × 1.7	12 × 1.7	16 × 2.2	16 × 2.2	16 × 2.2
2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2	16 × 2.2
3	16 × 2.2	16 × 2.2	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8
4	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8
5	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	–
6	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	20 × 2.8	–
8	20 × 2.8	20 × 2.8	20 × 2.8	–	–	–
10	20 × 2.8	20 × 2.8	–	–	–	–
12	20 × 2.8	20 × 2.8	–	–	–	–
15	–	–	–	–	–	–
Pipe $d_a \times s$ [mm]	12 × 1.7	16 × 2.2	20 × 2.8			
Pipe d_i [mm]	8.6	11.6	14.4			
Instrument	½"	½"	½"			

TV.5
Loading units (LU) for PE-Xa pipes



Source: SVGW 2014, SVGW Certificate No.: 8611-1923

Pressure losses and discharge times

If using tee installations:
→ Calculate the discharge times and pressure losses.

For systems with individual tap locations:
→ The maximum length of 12 m of the pipe must not be exceeded.

4.2 Pressure loses for pipes

4.2.1 The basics

Designation	Value [m/s]*
Discharge pipeline	max. 4.0
Groups of equipment	max. 3.0
Pipelines on individual floor levels	max. 3.0
Distribution pipelines	max. 2.0

TV.6
Flow velocities

* recommended (acc. to SVGW - Swiss Gas and Water Industry Association Guideline W3/2013)

4.2.2 Pressure losses applicable to JRG Sanipex pipes

A loading unit LU is equal to a flow of 0.1 l/s.

Pipe, Dimension	Pressure loss [hPa/m pipe (= mbar/m)]					
	LU	1	2	3	4	5
	[l/s]	0.1	0.2	0.3	0.4	0.5
d12		56.5	190.8	388.8	–	–
d16		13.4	45.3	92.4	153.1	226.6
d20		4.8	16.1	32.7	54.2	80.2
d25		1.6	5.5	11.2	18.6	27.5
d32		0.5	1.6	3.3	5.5	8.1

TV.7
Pressure losses applicable to JRG Sanipex pipes

LU 1 up to LU 5

4.2.3 Pressure losses at 10°C

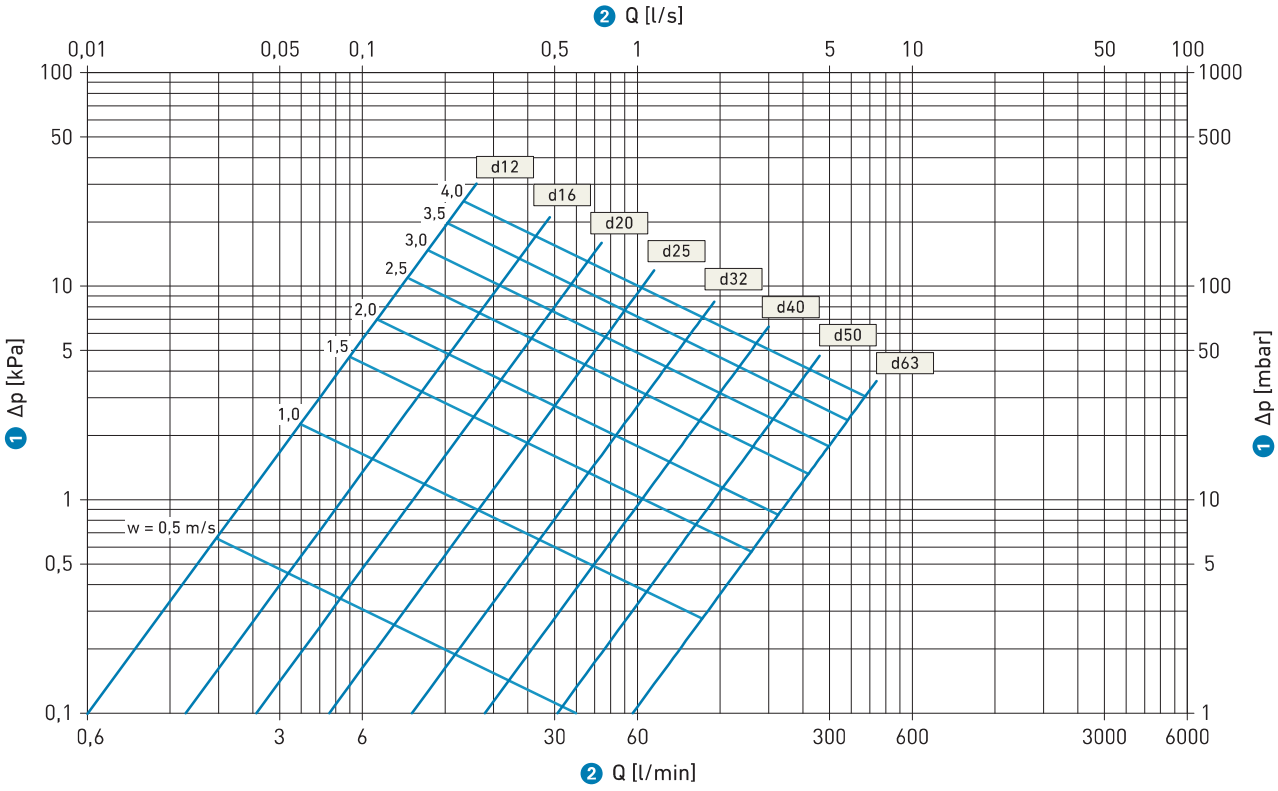
The basics

Designation	Value
Dimension	d12 – d63
Density ρ (water)	999.70 kg/m³
Water temperature	10°C
Surface roughness k (inner pipe)	0.007 mm
Viscosity	0.00131 Pa · s

TV.8
Design fundamentals

Pipe friction pressure drop as a function of the volumetric flow

The diagram and the tables show the pipe friction pressure drop R and the calculated flow velocity v as a function of the volumetric flow Q.



1 Pressure loss
2 Volumetric flow rate

Pressure losses at 10°C

TV.9 **Pipe friction pressure drop, flow velocity, peak flow**

d	12		16		20		25		32		40		50		63	
DN	8		12		15		20		25		32		40		50	
Q	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R
[l/s]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]
0.01	0.2	1.0	0.1	0.2	0.1	0.1	–	–	–	–	–	–	–	–	–	–
0.02	0.3	3.3	0.2	0.8	0.1	0.3	0.1	0.1	–	–	–	–	–	–	–	–
0.03	0.5	6.8	0.3	1.6	0.2	0.6	0.1	0.2	–	–	–	–	–	–	–	–
0.04	0.7	11.3	0.4	2.7	0.2	1.0	0.2	0.3	–	–	–	–	–	–	–	–
0.05	0.9	16.7	0.5	4.0	0.3	1.4	0.2	0.5	0.1	0.1	–	–	–	–	–	–
0.06	1.0	23.0	0.6	5.5	0.4	1.9	0.2	0.7	0.1	0.2	0.1	0.1	–	–	–	–
0.07	1.2	30.2	0.7	7.2	0.4	2.5	0.3	0.9	0.2	0.3	0.1	0.1	–	–	–	–
0.08	1.4	38.2	0.8	9.1	0.5	3.2	0.3	1.1	0.2	0.3	0.1	0.1	–	–	–	–
0.09	1.5	46.9	0.9	11.2	0.6	4.0	0.4	1.4	0.2	0.4	0.1	0.1	–	–	–	–
0.10	1.7	56.5	0.9	13.4	0.6	4.8	0.4	1.6	0.2	0.5	0.2	0.2	0.1	0.1	–	–
0.15	2.6	115.1	1.4	27.4	0.9	9.7	0.6	3.3	0.4	1.0	0.2	0.3	0.1	0.1	–	–
0.20	3.4	190.8	1.9	45.3	1.2	16.1	0.8	5.5	0.5	1.6	0.3	0.6	0.2	0.2	0.1	0.1
0.25	4.3	282.3	2.4	67.1	1.5	23.8	1.0	8.1	0.6	2.4	0.4	0.8	0.2	0.3	0.2	0.1
0.30	5.2	388.8	2.8	92.4	1.8	32.7	1.2	11.2	0.7	3.3	0.5	1.1	0.3	0.4	0.2	0.1
0.35	–	–	3.3	121.1	2.1	42.9	1.4	14.7	0.8	4.3	0.5	1.5	0.3	0.5	0.2	0.2
0.40	–	–	3.8	153.1	2.5	54.2	1.6	18.6	0.9	5.5	0.6	1.9	0.4	0.6	0.2	0.2
0.45	–	–	4.3	188.3	2.8	66.7	1.8	22.8	1.1	6.8	0.7	2.3	0.4	0.8	0.3	0.3
0.50	–	–	4.7	226.6	3.1	80.2	2.0	27.5	1.2	8.1	0.8	2.8	0.5	1.0	0.3	0.3
0.55	–	–	5.2	267.9	3.4	94.9	2.2	32.5	1.3	9.6	0.8	3.3	0.5	1.1	0.3	0.4
0.60	–	–	–	–	3.7	110.5	2.4	37.9	1.4	11.2	0.9	3.8	0.6	1.3	0.4	0.4
0.65	–	–	–	–	4.0	127.2	2.6	43.6	1.5	12.9	1.0	4.4	0.6	1.5	0.4	0.5
0.70	–	–	–	–	4.3	144.9	2.8	49.6	1.7	14.7	1.1	5.0	0.7	1.7	0.4	0.6
0.75	–	–	–	–	4.6	163.5	2.9	56.0	1.8	16.6	1.1	5.7	0.7	2.0	0.5	0.6
0.80	–	–	–	–	4.9	183.1	3.1	62.7	1.9	18.6	1.2	6.4	0.8	2.2	0.5	0.7
0.85	–	–	–	–	5.2	203.7	3.3	69.8	2.0	20.6	1.3	7.1	0.8	2.4	0.5	0.8
0.90	–	–	–	–	–	–	3.5	77.1	2.1	22.8	1.4	7.8	0.9	2.7	0.6	0.9
0.95	–	–	–	–	–	–	3.7	84.8	2.2	25.1	1.4	8.6	0.9	3.0	0.6	1.0
1.00	–	–	–	–	–	–	3.9	92.8	2.4	27.4	1.5	9.4	1.0	3.2	0.6	1.1
1.05	–	–	–	–	–	–	4.1	101.1	2.5	29.9	1.6	10.2	1.0	3.5	0.6	1.2
1.10	–	–	–	–	–	–	–	–	2.6	32.4	1.7	11.1	1.1	3.8	0.7	1.3
1.15	–	–	–	–	–	–	–	–	2.7	35.1	1.7	12.0	1.1	4.1	0.7	1.4
1.20	–	–	–	–	–	–	–	–	2.8	37.8	1.8	12.9	1.2	4.5	0.7	1.5
1.25	–	–	–	–	–	–	–	–	3.0	40.6	1.9	13.9	1.2	4.8	0.8	1.6
1.30	–	–	–	–	–	–	–	–	3.1	43.5	2.0	14.9	1.3	5.1	0.8	1.7
1.35	–	–	–	–	–	–	–	–	3.2	46.5	2.0	15.9	1.3	5.5	0.8	1.8
1.40	–	–	–	–	–	–	–	–	3.3	49.6	2.1	17.0	1.4	5.9	0.9	1.9
1.45	–	–	–	–	–	–	–	–	3.4	52.7	2.2	18.1	1.4	6.2	0.9	2.1
1.50	–	–	–	–	–	–	–	–	3.5	55.9	2.3	19.2	1.5	6.6	0.9	2.2
1.55	–	–	–	–	–	–	–	–	3.7	59.3	2.3	20.3	1.5	7.0	0.9	2.3
1.60	–	–	–	–	–	–	–	–	3.8	62.6	2.4	21.5	1.6	7.4	1.0	2.4
1.65	–	–	–	–	–	–	–	–	3.9	66.1	2.5	22.7	1.6	7.8	1.0	2.6
1.70	–	–	–	–	–	–	–	–	4.0	69.7	2.6	23.9	1.7	8.2	1.0	2.7
1.75	–	–	–	–	–	–	–	–	–	–	2.6	25.1	1.7	8.7	1.1	2.9
1.80	–	–	–	–	–	–	–	–	–	–	2.7	26.4	1.7	9.1	1.1	3.0
1.85	–	–	–	–	–	–	–	–	–	–	2.8	27.7	1.8	9.5	1.1	3.2
1.90	–	–	–	–	–	–	–	–	–	–	2.9	29.0	1.8	10.0	1.2	3.3
1.95	–	–	–	–	–	–	–	–	–	–	3.0	30.4	1.9	10.5	1.2	3.5
2.00	–	–	–	–	–	–	–	–	–	–	3.0	31.8	1.9	10.9	1.2	3.6
2.10	–	–	–	–	–	–	–	–	–	–	–	–	2.0	11.9	1.3	3.9
2.20	–	–	–	–	–	–	–	–	–	–	–	–	2.1	12.9	1.3	4.3
2.30	–	–	–	–	–	–	–	–	–	–	–	–	2.2	14.0	1.4	4.6

d	12		16		20		25		32		40		50		63	
DN	8		12		15		20		25		32		40		50	
Q	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R
[l/s]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]
2.40	–	–	–	–	–	–	–	–	–	–	–	–	2.3	15.1	1.5	5.0
2.50	–	–	–	–	–	–	–	–	–	–	–	–	2.4	16.2	1.5	5.3
2.60	–	–	–	–	–	–	–	–	–	–	–	–	2.5	17.4	1.6	5.7
2.70	–	–	–	–	–	–	–	–	–	–	–	–	2.6	18.5	1.7	6.1
2.80	–	–	–	–	–	–	–	–	–	–	–	–	2.7	19.8	1.7	6.5
2.90	–	–	–	–	–	–	–	–	–	–	–	–	2.8	21.0	1.8	6.9
3.00	–	–	–	–	–	–	–	–	–	–	–	–	2.9	22.3	1.8	7.4
3.10	–	–	–	–	–	–	–	–	–	–	–	–	3.0	23.6	1.9	7.8
3.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.0	8.2
3.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.0	8.7
3.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.1	9.2
3.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.1	9.7
3.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.2	10.1
3.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.3	10.6
3.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.3	11.2
3.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4	11.7
4.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4	12.2
4.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.5	12.7
4.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.6	13.3
4.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.6	13.9
4.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.7	14.4
4.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8	15.0
4.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8	15.6
4.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.9	16.2
4.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.9	16.8
4.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3.0	17.4

4.2.4 Pressure losses at 60°C

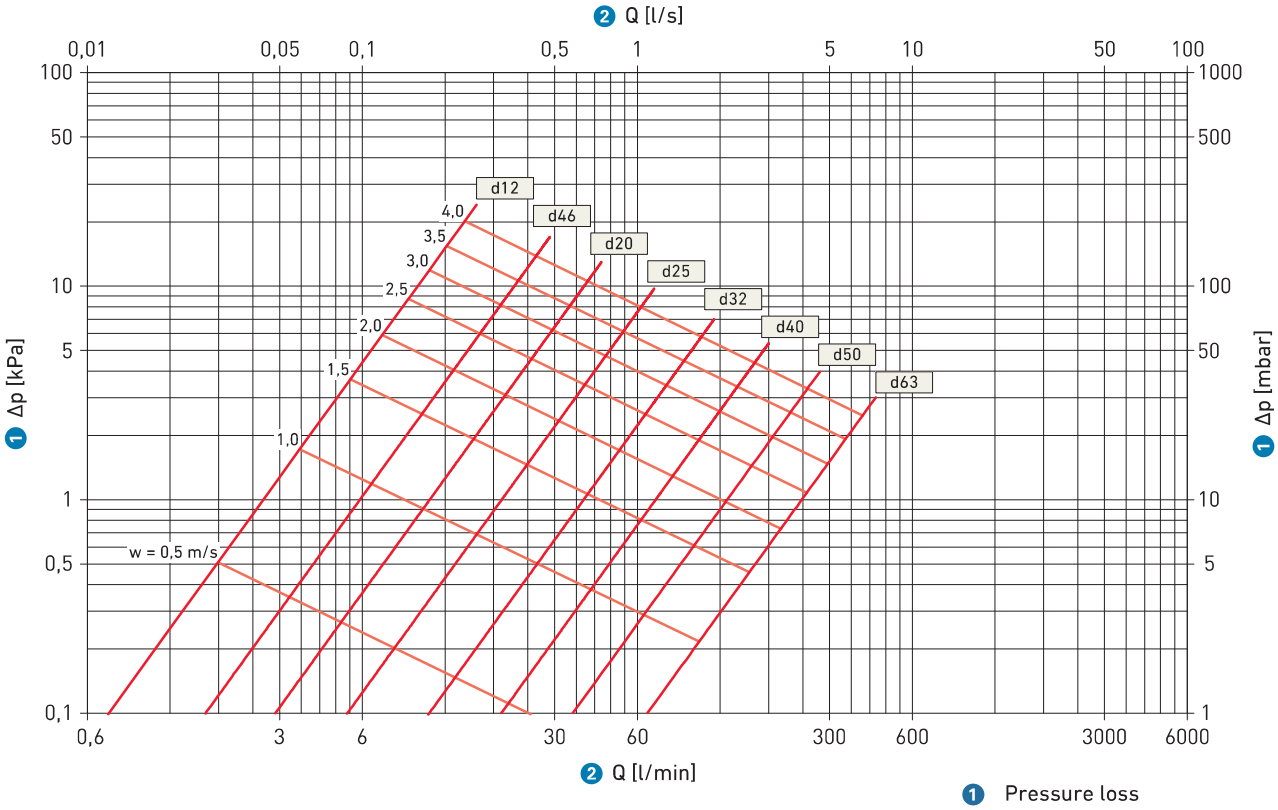
The basics

Designation	Value
Dimension	d12 – d63
Density ρ (water)	983.19 kg/m³
Water temperature	60°C
Surface roughness k (inner pipe)	0.007 mm
Viscosity	0.00476 Pa · s

TV.10
Design fundamentals

Pipe friction pressure drop as a function of the volumetric flow

The diagram and the tables show the pipe friction pressure drop R and the calculated flow velocity v as a function of the volumetric flow Q.



Pressure losses at 60°C

TV.11 **Pipe friction pressure drop, flow velocity, peak flow**

d	12		16		20		25		32		40		50		63	
DN	8		12		15		20		25		32		40		50	
Q	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R
[l/s]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]
0.01	0.2	0.7	0.1	0.2	0.1	0.1	–	–	–	–	–	–	–	–	–	–
0.02	0.3	2.5	0.2	0.6	0.1	0.2	0.1	0.1	–	–	–	–	–	–	–	–
0.03	0.5	5.1	0.3	1.2	0.2	0.4	0.1	0.1	–	–	–	–	–	–	–	–
0.04	0.7	8.6	0.4	2.0	0.2	0.7	0.2	0.2	0.1	0.1	–	–	–	–	–	–
0.05	0.9	12.8	0.5	3.0	0.3	1.1	0.2	0.4	0.1	0.1	–	–	–	–	–	–
0.06	1.0	17.7	0.6	4.2	0.4	1.5	0.2	0.5	0.1	0.1	0.1	0.1	–	–	–	–
0.07	1.2	23.3	0.7	5.5	0.4	1.9	0.3	0.7	0.2	0.2	0.1	0.1	–	–	–	–
0.08	1.4	29.5	0.8	7.0	0.5	2.5	0.3	0.8	0.2	0.2	0.1	0.1	–	–	–	–
0.09	1.5	36.4	0.9	8.6	0.6	3.0	0.4	1.0	0.2	0.3	0.1	0.1	–	–	–	–
0.10	1.7	43.9	0.9	10.4	0.6	3.7	0.4	1.3	0.2	0.4	0.2	0.1	–	–	–	–
0.15	2.6	90.5	1.4	21.4	0.9	7.6	0.6	2.6	0.4	0.8	0.2	0.3	0.1	0.1	–	–
0.20	3.4	151.1	1.9	35.8	1.2	12.6	0.8	4.3	0.5	1.3	0.3	0.4	0.2	0.1	–	–
0.25	4.3	224.9	2.4	53.2	1.5	18.8	1.0	6.4	0.6	1.9	0.4	0.6	0.2	0.2	0.2	0.1
0.30	5.2	311.3	2.8	73.7	1.8	26.0	1.2	8.9	0.7	2.6	0.5	0.9	0.3	0.3	0.2	0.1
0.35	–	–	3.3	97.0	2.1	34.2	1.4	11.7	0.8	3.4	0.5	1.2	0.3	0.4	0.2	0.1
0.40	–	–	3.8	123.0	2.5	43.4	1.6	14.8	0.9	4.4	0.6	1.5	0.4	0.5	0.2	0.2
0.45	–	–	4.3	151.8	2.8	53.6	1.8	18.3	1.1	5.4	0.7	1.8	0.4	0.6	0.3	0.2
0.50	–	–	4.7	183.1	3.1	64.6	2.0	22.1	1.2	6.5	0.8	2.2	0.5	0.8	0.3	0.3
0.55	–	–	5.2	217.0	3.4	76.6	2.2	26.2	1.3	7.7	0.8	2.6	0.5	0.9	0.3	0.3
0.60	–	–	–	–	3.7	89.5	2.4	30.6	1.4	9.0	0.9	3.1	0.6	1.1	0.4	0.3
0.65	–	–	–	–	4.0	103.2	2.6	35.2	1.5	10.4	1.0	3.5	0.6	1.2	0.4	0.4
0.70	–	–	–	–	4.3	117.7	2.8	40.2	1.7	11.8	1.1	4.0	0.7	1.4	0.4	0.5
0.75	–	–	–	–	4.6	133.2	2.9	45.5	1.8	13.4	1.1	4.6	0.7	1.6	0.5	0.5
0.80	–	–	–	–	4.9	149.4	3.1	51.0	1.9	15.0	1.2	5.1	0.8	1.8	0.5	0.6
0.85	–	–	–	–	5.2	166.4	3.3	56.8	2.0	16.7	1.3	5.7	0.8	2.0	0.5	0.6
0.90	–	–	–	–	–	–	3.5	62.9	2.1	18.5	1.4	6.3	0.9	2.2	0.6	0.7
0.95	–	–	–	–	–	–	3.7	69.3	2.2	20.4	1.4	7.0	0.9	2.4	0.6	0.8
1.00	–	–	–	–	–	–	3.9	75.9	2.4	22.4	1.5	7.6	1.0	2.6	0.6	0.9
1.05	–	–	–	–	–	–	4.1	82.8	2.5	24.4	1.6	8.3	1.0	2.9	0.6	0.9
1.10	–	–	–	–	–	–	–	–	2.6	26.5	1.7	9.1	1.1	3.1	0.7	1.0
1.15	–	–	–	–	–	–	–	–	2.7	28.7	1.7	9.8	1.1	3.4	0.7	1.1
1.20	–	–	–	–	–	–	–	–	2.8	31.0	1.8	10.6	1.2	3.6	0.7	1.2
1.25	–	–	–	–	–	–	–	–	3.0	33.3	1.9	11.4	1.2	3.9	0.8	1.3
1.30	–	–	–	–	–	–	–	–	3.1	35.7	2.0	12.2	1.3	4.2	0.8	1.4
1.35	–	–	–	–	–	–	–	–	3.2	38.2	2.0	13.0	1.3	4.5	0.8	1.5
1.40	–	–	–	–	–	–	–	–	3.3	40.7	2.1	13.9	1.4	4.8	0.9	1.6
1.45	–	–	–	–	–	–	–	–	3.4	43.4	2.2	14.8	1.4	5.1	0.9	1.7
1.50	–	–	–	–	–	–	–	–	3.5	46.1	2.3	15.7	1.5	5.4	0.9	1.8
1.55	–	–	–	–	–	–	–	–	3.7	48.8	2.3	16.7	1.5	5.7	0.9	1.9
1.60	–	–	–	–	–	–	–	–	3.8	51.7	2.4	17.7	1.6	6.1	1.0	2.0
1.65	–	–	–	–	–	–	–	–	3.9	54.6	2.5	18.6	1.6	6.4	1.0	2.1
1.70	–	–	–	–	–	–	–	–	4.0	57.6	2.6	19.7	1.7	6.8	1.0	2.2
1.75	–	–	–	–	–	–	–	–	–	–	2.6	20.7	1.7	7.1	1.1	2.3
1.80	–	–	–	–	–	–	–	–	–	–	2.7	21.8	1.7	7.5	1.1	2.5
1.85	–	–	–	–	–	–	–	–	–	–	2.8	22.9	1.8	7.9	1.1	2.6
1.90	–	–	–	–	–	–	–	–	–	–	2.9	24.0	1.8	8.2	1.2	2.7
1.95	–	–	–	–	–	–	–	–	–	–	3.0	25.1	1.9	8.6	1.2	2.8
2.00	–	–	–	–	–	–	–	–	–	–	3.0	26.3	1.9	9.0	1.2	3.0
2.10	–	–	–	–	–	–	–	–	–	–	–	–	2.0	9.9	1.3	3.2
2.20	–	–	–	–	–	–	–	–	–	–	–	–	2.1	10.7	1.3	3.5
2.30	–	–	–	–	–	–	–	–	–	–	–	–	2.2	11.6	1.4	3.8

d	12		16		20		25		32		40		50		63	
DN	8		12		15		20		25		32		40		50	
Q	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R
[l/s]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]	[m/s]	[hPa/m]
2.40	–	–	–	–	–	–	–	–	–	–	–	–	2.3	12.5	1.5	4.1
2.50	–	–	–	–	–	–	–	–	–	–	–	–	2.4	13.4	1.5	4.4
2.60	–	–	–	–	–	–	–	–	–	–	–	–	2.5	14.4	1.6	4.7
2.70	–	–	–	–	–	–	–	–	–	–	–	–	2.6	15.4	1.7	5.1
2.80	–	–	–	–	–	–	–	–	–	–	–	–	2.7	16.4	1.7	5.4
2.90	–	–	–	–	–	–	–	–	–	–	–	–	2.8	17.5	1.8	5.8
3.00	–	–	–	–	–	–	–	–	–	–	–	–	2.9	18.6	1.8	6.1
3.10	–	–	–	–	–	–	–	–	–	–	–	–	3.0	19.7	1.9	6.5
3.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.0	6.9
3.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.0	7.3
3.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.1	7.6
3.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.1	8.1
3.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.2	8.5
3.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.3	8.9
3.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.3	9.3
3.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4	9.8
4.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.4	10.2
4.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.5	10.7
4.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.6	11.1
4.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.6	11.6
4.40	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.7	12.1
4.50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8	12.6
4.60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.8	13.1
4.70	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.9	13.6
4.80	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.9	14.1
4.90	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3.0	14.7

4.3 Pressure losses for system parts

The ζvalues and the equivalent lengths of the pipelines were determined in accordance with the specifications of the SVGW (SV EN 1267).

Loading unit and ζ value
A loading unit **LU** is equal to a flow of 0.1 l/s.
The ζvalue for w = 2 m/s, as shown in the table.

4.3.1 Simplified representation for 1 loading unit (LU)

TV.12 **Pressure losses in JRG Sanipex system parts**

JRG code	Designation		Symbol	Dimension	ζ value	Equivalent length of pipeline [m]
5400 5401 5402	JRG Sanipex box, single, 90°			1/2"-d12	1.2	0.35
				1/2"-d16	1.2	0.55
				1/2"-d20	1.2	0.70
				3/4"-d20	1.5	0.95
5404	JRG Sanipex box, 2-way, 90°	Discharge		1/2"-d16-d12	2.3	0.83
				1/2"-d16-d16	2.4	1.10
				1/2"-d20-d12	2.9	1.80
		Flow rate		1/2"-d16-d12	1.3	0.45
				1/2"-d16-d16	1.4	0.60
				1/2"-d20-d16	1.0	0.65
5415	Connections to controls and instruments, single			1/2"-d12-35 mm	2.1	0.60
				1/2"-d16-35 mm	2.2	1.05
				1/2"-d20-35 mm	3.0	1.85
				1/2"-d20-50 mm	2.1	1.30
5416	Connections to controls and instruments, double	Discharge		1/2"-d16-50 mm	2.6	1.20
		Flow rate		1/2"-d16-50 mm	2.0	0.90
5421 – 5427	Distributor including transition	Discharge		3/4"-d12	1.2	0.35
				3/4"-d16	1.0	0.45
				3/4"-d20	0.8	0.50
		Flow rate		3/4"	0.5	0.35
5520 – 5525	90° bend			d12	2.7	0.75
				d16	0.8	0.35
				d20	0.9	0.55
5463 – 5471	Tees (equal and reduced)	Flow rate		d12	2.4	0.65
				d16	0.4	0.20
				d20	0.7	0.45
5463 – 5471	Tees (equal and reduced)	Pipe branch		d12	3.4	0.95
				d16	1.2	0.55
				d20	1.6	1.00
5510	Coupling			d12	1.8	0.50
				d16	0.3	0.15
				d20	0.3	0.20
5437 5438	Shut-off valve			d12	0.6	0.15
				d16	7.7	3.30
				d20	7.7	4.60
5439	Angle seat valve			d16	2.9	1.20
				d20	2.9	1.70
5450	Residential water meter			d25	15.0	12.0

4.4 Discharge times

The discharge times indicate the time elapsed until a temperature of 40°C is reached at the tap (in accordance with SIA 385/2, 2015 edition) and signal the beginning of usability. These discharge times apply to fully opened taps set to maximum "hot". In the interests of economical water and energy consumption, these discharge times should not be set too high.

In order to keep the discharge losses within economically justifiable limits and at the same time to meet the comfort requirements of the hot water user, the requirements defined in [TV.13] for discharge periods apply.* The measurement itself is carried out with the fitting installed at the installation site.

If it is not possible to choose a distribution system that conveys the hot water from the hot water storage tank to the tap within a reasonable time (discharge time), a circulation pipeline or auxiliary heating system must be planned and installed, or the arrangement of the sanitary equipment and riser zones must be optimised.

TV.13
Discharge times – Requirements
* Excerpt from SIA 385/1

Sanitary fixtures	Discharge time t [s]	
	without keeping warm (e.g. without circulation)	with keeping warm (e.g. with circulation)
Vanity unit, wash-hand basin, bidet, showers, bathtubs, sink (kitchen), utility sink	15	10

Calculation

Calculating the discharge time
➨ Part IV 'Plan', Section 'Drinking water installation', Chapter [12] 'Dimensioning'

The discharge times must be matched to the pipe dimension, length of the pipeline and the volume flows. Especially when using energy-saving mixers (flow restrictors), the effective volumetric flow must always be determined and converted (acc. to SIA 385/2, Issue 2015, Annex G), because the reduced volumetric flow results in a longer discharge time.

The calculation is based on the standard SIA 385/1, which contains the fundamental principles and requirements for domestic hot water systems. The calculation is also based on the standard SIA 385/2, which describes the hot water demand, the overall requirements and the design, such as the calculation of the discharge times.

Discharge times applicable to JRG Sanipex PE-X pipe

The table does not consider fittings but only pipes.

- Input variables: Outside diameter d, wall thickness s_w
- Calculated quantities: [l/m], max. length of pipeline [m], discharge times [s/m]

TV.14 **Discharge times and lengths – JRG Sanipex PE-X pipe**

Pipe, Dimension				max. feasible duration of the discharge times [s] of						Discharge time [s] for each 1 m length of pipeline		
			[s]	15			10			Cold phase + warm-up phase		
			[l/s_w]	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
DN	d	s_w	[l/m]	max. length of pipeline [mm]						[s]		
8	12	1.7	0.055	13.5	27.0	40.6	9.0	18.0	27.0	1.1	0.6	0.4
12	16	2.2	0.106	7.1	14.1	21.2	4.7	9.4	14.1	2.1	1.1	0.7
15	20	2.8	0.163	4.6	9.2	13.8	3.0	6.1	9.2	3.3	1.6	1.1

4.5 Change in length and expansion compensation

+ Due to heat and depending on the material, pipelines expand to varying degrees. Even if the temperatures of the medium (e.g. drinking water) exceeds room temperature, this causes a thermal expansion and must be taken into account in the design of the installation.

How to calculate the change in length
In order to calculate the change in length, product and material-specific values are required:
➨ Technical data for system, Chapter [2.1]

This thermally induced change in length can be **compensated** during the installation and mounting of the pipe. Suitable measures are:

- Directional changes of the pipeline
- Providing expansion space
- Installation of expansion joints
- Setting the fixed points and floating points

The bending and torsional forces occurring during the operation of a pipeline are safely absorbed, taking into account the above-mentioned measures. The following parameters have a significant influence on the expansion compensation:

- Material
- Structural conditions
- Operating conditions

Minor changes in length of the pipelines, especially if using smaller dimensions, can be compensated for by the elasticity of the piping system or with a corresponding insulation.

For larger piping systems, the changes in length must be absorbed by the **expansion joints**: Insulations, flexible pipe legs and U-shaped expansion loops compensate for the thermally induced change in length. The required measures for GF's plastic piping systems are – depending on the type of installation:

TV.15
Measures for the expansion compensation for plastic pipelines made by GF

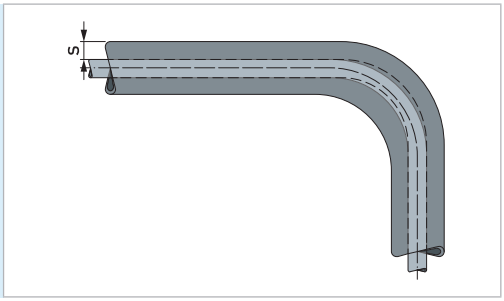
Medium	Cold water	Hot water/circulation/heater	
Dimension	d16 – d110	d16 – d26	d32 – d110
Length of pipeline L ≤12 m	If using insulated pipelines, compensation for the change in length does **not** require floating points and fixed points		
Length of pipeline L ≥12 m	If using insulated pipelines, compensation for the change in length does **not** require floating points and fixed points		Compensation for the change in length requires floating points and fixed points

4.5.1 Compensation for the change in length by using insulation

When using insulation in order to compensate for the change in length, the minimum insulation thickness **s** must be at least 1.5 times the length change. From the calculated amounts of the change in length, the insulation thickness per meter of straight pipeline length is calculated according to the following formula:

$$s = 1.5 \cdot \Delta l$$

s Insulation thickness, min.
Δl Change in length



Installations with temperatures up to 60°C (ΔT = 50 K), a length change Δl of 1.3 mm must be taken into account for each meter of straight pipe. This equals to an insulation thickness of 2.0 mm per meter of straight pipe length.

Insulation

General information on insulation:

➨ Part IV 'Plan', Section 'Insulation, Fire protection'

Information about insulation when installing riser pipes:

➨ Part IV 'Plan', Section 'Drinking water installation', Chapter [13] 'Installation and attachment'

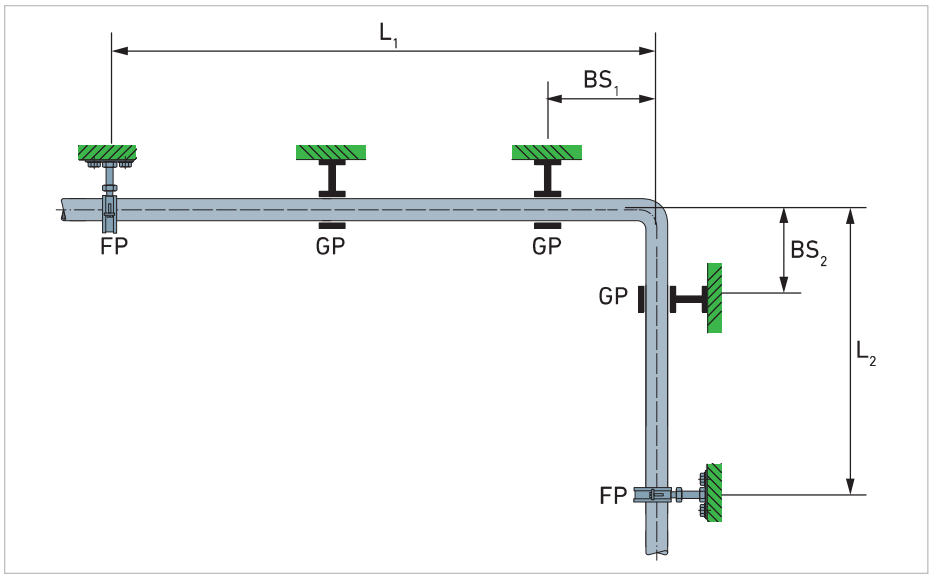
4.5.2 Compensation for the change in length by using expansion joints

Flexible pipe legs and **U-shaped expansion loops** are used as **expansion joints**. In order to ensure the function of the 2D expansion loop, **fixed points** and **floating points** (with sliding pipe clips) are installed.

Fixed points can be created at a suitable location along the pipeline, using a commercially available, precisely fitting fixed point clips or a system-specific solution (e.g. fixed point clip in combination with a system-specific fixed-point pipe clip).

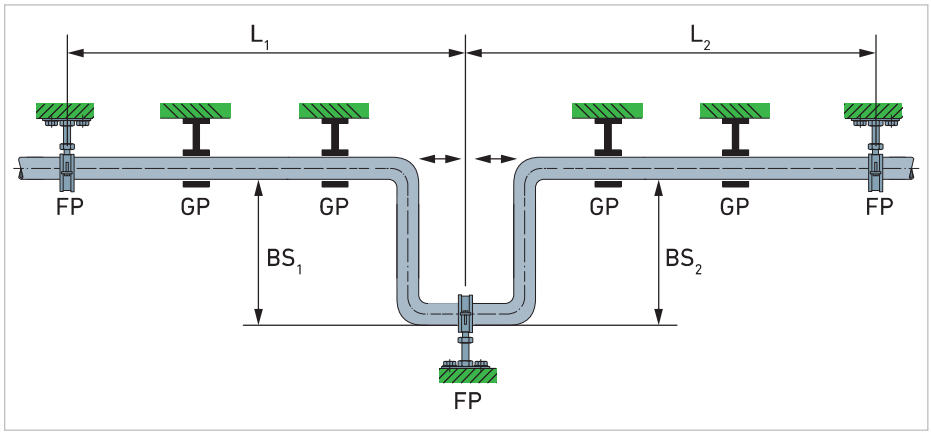
The **pipe clip** must assume the shape of the pipe and, when tightening the clip, the actual pipe diameter must not be constrict by more than 0.5 mm.

Examples – Basic design of a flexible pipe leg and U-shaped expansion loop



GV.5
Flexible pipe leg

FP Fixed point
GP Floating point (with sliding pipe clip)
BS Flexible pipe leg
L Pipe length between fixed point and deflection



GV.6
U-shaped expansion loop

FP Fixed point
GP Floating point (with sliding pipe clip)
BS Flexible pipe leg
L Pipe length between fixed point and deflection

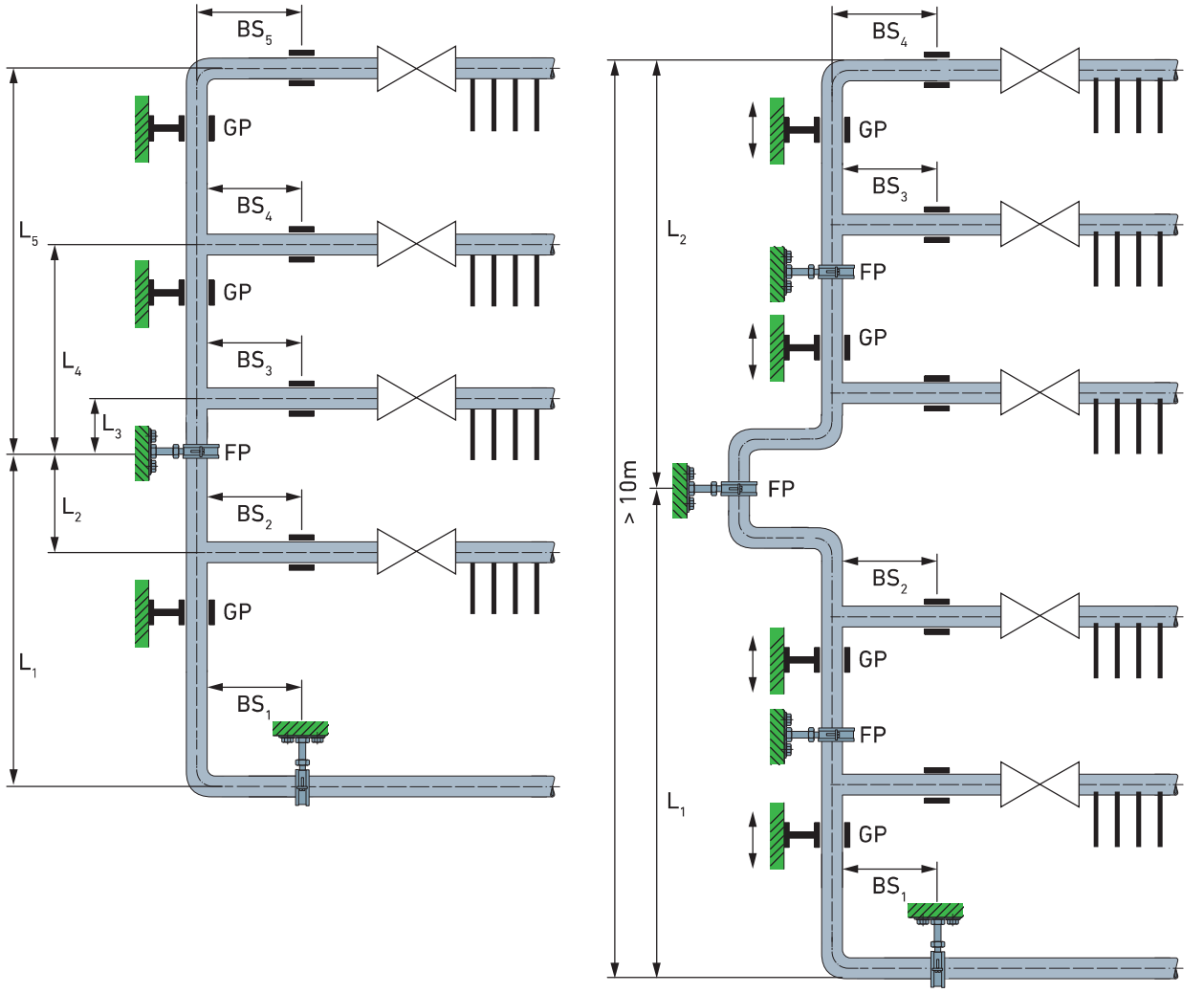
4.5.3 Fixed points and floating points when using riser pipes

If riser pipes are leading up to several storeys and accordingly have multiple fixed points (FP), the change in length between the individual fixed points must be absorbed by the flexible pipe leg (BS). The sliding pipe clamp mounted to the horizontal pipe affects the **vertical** expansion of the pipe similar to a fixed point (FP).

Examples – Basic design of fixed points and floating points

TV.16 **Spacing of fixed points and floating points in a riser pipe**

Riser pipe up to a height of 10 m	Riser pipe starting at a height of 10 m



Up to a **riser pipe height of 5 m,** neither a U-shaped expansion loop nor a fixed point shall be installed along the riser pipe.

Up to a **riser pipe height of 10 m,** a U-shaped expansion loop can be omitted. In the middle of the riser pipe, however, a fixed point (FP) must be installed.

Starting at a **riser pipe height of 10 m,** a U-shaped expansion loop with fixed points (FP) must be installed at intervals of 10 m.

L_{1-5} Pipe length between fixed point and deflection
FP Fixed point
BS_{1-5} Flexible pipe leg
GP Floating point (with sliding pipe clip)

4.5.4 How to calculate the change in length

The **change in length of a pipeline** and the corresponding design of the flexible pipe leg and U-shaped expansion loop also depend on the material used. When calculating the change in length, this must be taken into account by using corresponding material-dependent parameters.

The **calculation of the length of the flexible pipe leg** depends on the design of the flexible pipe leg:

- If using a **flexible pipe leg** in order to compensate for an extension, or if a branch line is used, the length of the flexible pipe leg must be calculated.
- If a **U-shaped expansion loop** is used to compensate for the expansion, the length of both flexible pipe legs that form the U-shaped expansion loop must be calculated.

Material constant and coefficient of thermal expansion

In order to calculate the change in length, product and material-specific values are required:

➨ Technical data for system, Chapter. [2.1]

How to calculate the change in length

The thermally induced **change in length** Δl of pipes is calculated (in non-resisting installations) from the **temperature difference** ΔT and the **pipe length** L, using the following formula:

$$\Delta l = \alpha \cdot L \cdot \Delta T$$

Symbol	Meaning	Unit	Remark
L	Length of pipeline	[m]	–
α	Linear coefficient of thermal expansion	[mm/(m·K)]	product/material-specific
Δl	Change in length	[mm]	–
ΔT	Temperature difference	[K]	–

Sample calculation using a plastic pipe (PB)

The length of the pipeline is 7 m. The thermally induced change in length of this pipe section must be absorbed by a flexible pipe leg. The difference between the installation temperature and the maximum operating temperature is 60 K (10 to 70°C).

Plastic pipe, PE-X, Dimension	d40
Length of pipeline L	7.0 m
Linear coefficient of thermal expansion α	0.2 mm/(m·K)
Temperature difference ΔT	60 K

How to calculate the change in length

- with linear coefficient of thermal expansion α = 0.2 mm/(m·K)

$$\Delta l = \alpha \cdot L \cdot \Delta T$$

$$\Delta l = 0.2\ [\mathrm{mm/(m \cdot K)}] \cdot 7\ [\mathrm{m}] \cdot 60\ [\mathrm{K}]$$

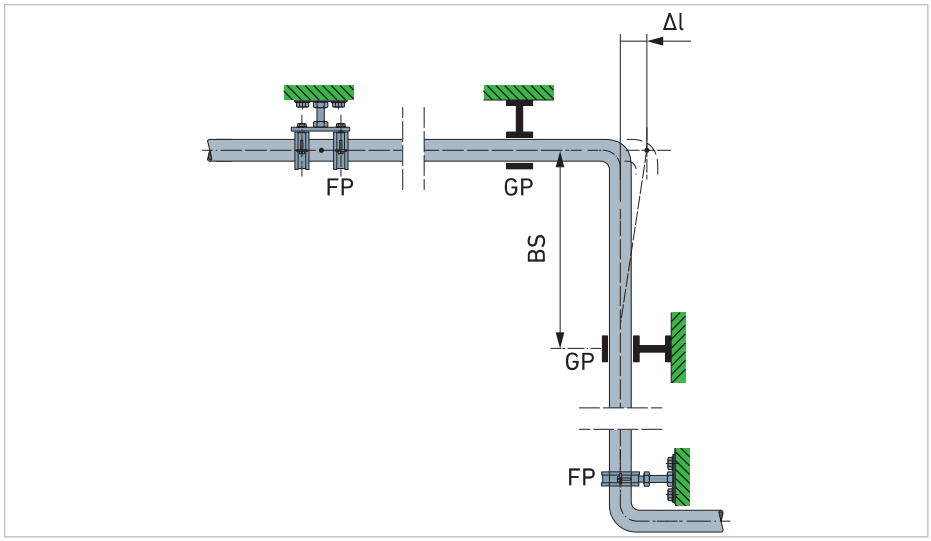
$$\Delta l = 84,.\ \mathrm{mm}$$

4.5.5 Calculation of the flexible pipe leg

Calculation of the length of the flexible pipe leg

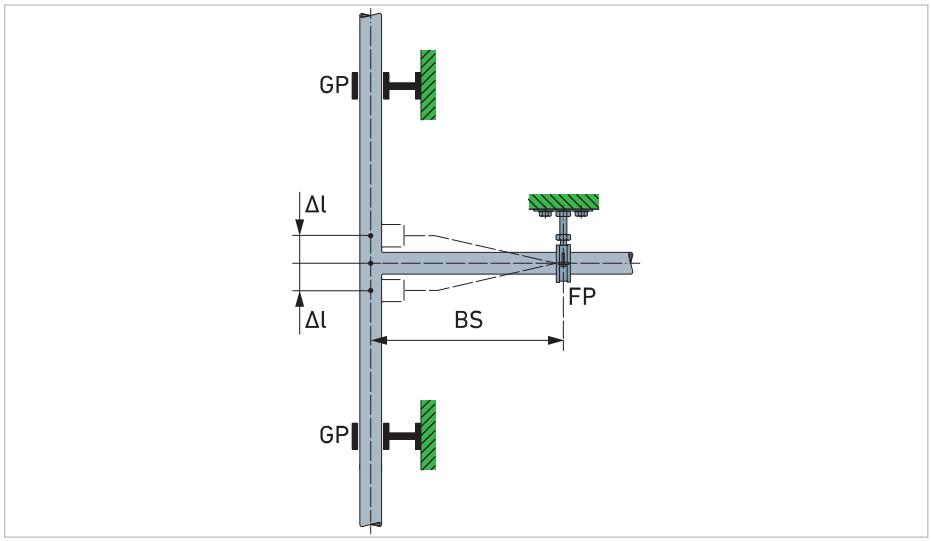
Due to the thermally induced change in length **Δl** , a pipeline shifts a pipe bend by a value **Δl**.
This change must be absorbed by a flexible pipe leg with a length equal to **BS**.

Length of flexible pipe leg



GV.7
Length of flexible pipe leg
GP Floating point
FP Fixed point
BS Length of flexible pipe leg

Length of flexible pipe leg intended to use for the branch line



GV.8
Length of flexible pipe leg
GP Floating point
FP Fixed point
BS Length of flexible pipe leg

The **length of the flexible pipe leg** BS is calculated from the **change in length** Δl and the **outside diameter** d of the pipe, using the following formula:

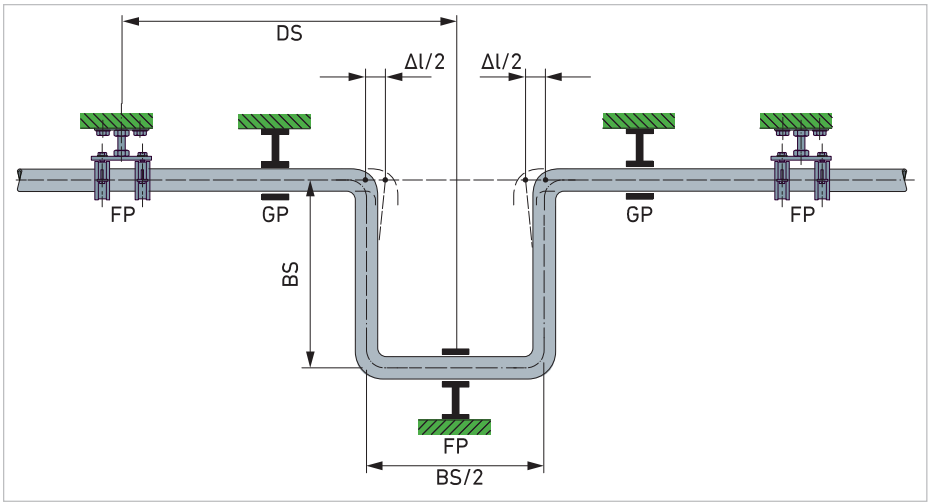
$$BS = C \cdot \sqrt{d \cdot \Delta l}$$

Symbol	Meaning	Unit	Remark
BS	Length of flexible pipe leg	[mm]	–
d	Outside diameter of pipe	[mm]	–
Δl	Change in length	[mm]	–
C	Material constant	–	product/material-specific

Calculation of the length of the flexible pipe leg in a U-shaped expansion loop

Due to the thermally induced change in length, **Δl** a pipe displaces a U-shaped loop at both bends by half the value **Δl**. This change must be absorbed by the two flexible pipe legs **BS**.

Length of the U-shaped expansion loop



GV.9
Length of the U-shaped expansion loop

GP Floating point
FP Fixed point
BS Length of flexible pipe leg
DS Length of the 2D expansion loop

Sample calculation using a plastic pipe (PE-X)

The length of the pipeline is 7 m. The thermally induced change in length of this pipe section must be absorbed by a flexible pipe leg. The difference between the installation temperature and the maximum operating temperature is ~60 K.

Plastic pipe, PE-X, Dimension	d40
Material constant C	12
Change in length Δl	84 mm

Calculation of the length of the flexible pipe leg

- with linear coefficient of thermal expansion α = 0.2 mm/(m·K)

$$BS = C \cdot \sqrt{d \cdot \Delta l}$$

$$BS = 12 \cdot \sqrt{(40\ mm \cdot 84.0\ mm)}$$

$$BS = 696\ mm$$

In order to simplify the determination of the required length of the flexible pipe leg, a material-specific diagram can also be used to determine the length of the flexible pipe leg.

When comparing this result with the result of a metal pipe – which has the same dimension – the size of a flexible pipe leg made of metal will be significantly larger. The explanation for this is the much higher material constant C for metal pipes than the material constant C for a PB pipe.

4.6 Diagrams – Change in length and length of flexible pipe leg

4.6.1 Change in length

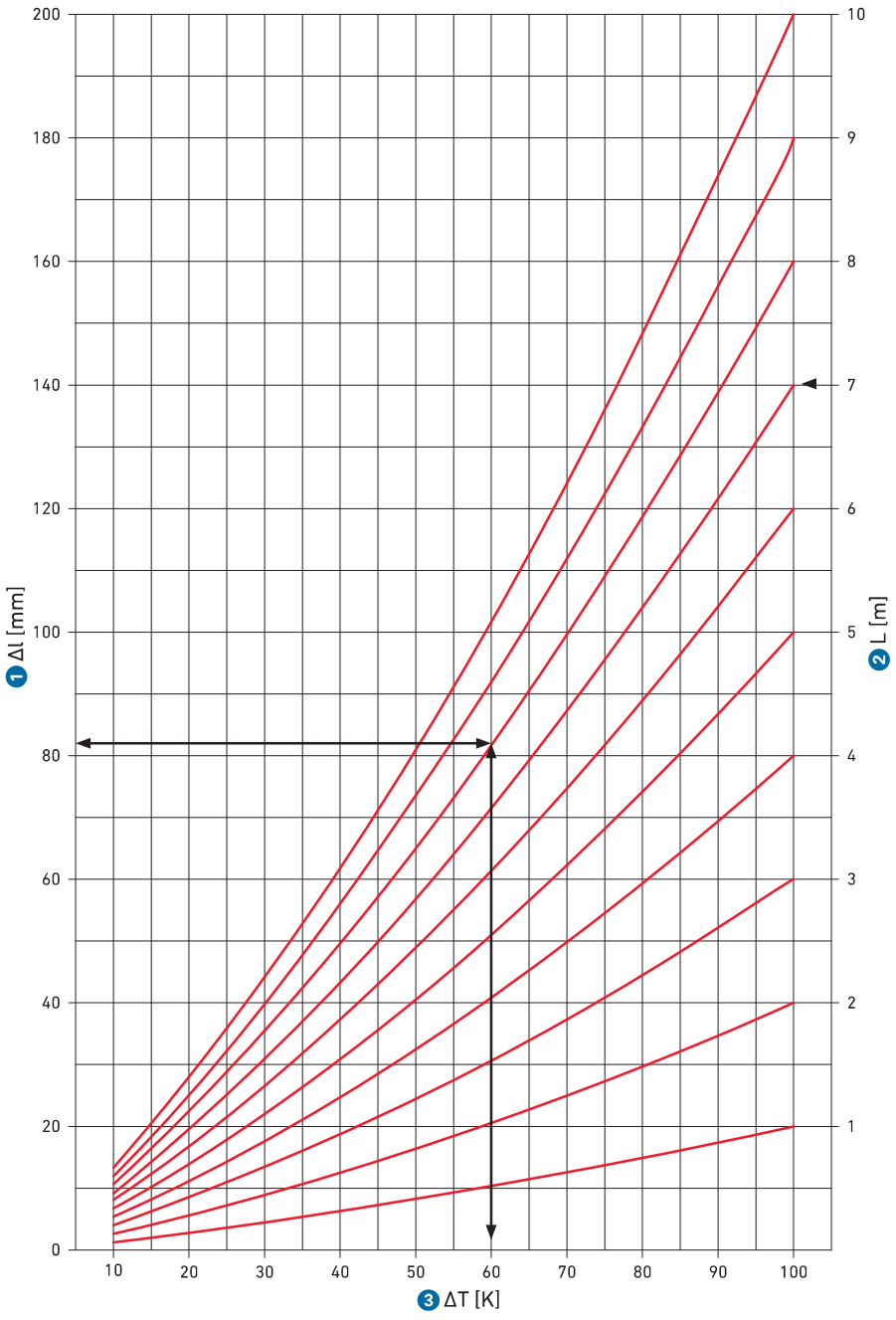
The diagram shows the length expansion of JRG Sanipex pipes as a function of the temperature and length of the pipe, if installed without resistance.

How to read the table

- with non-linear coefficient of thermal expansion

Plastic pipe, PE-X, Dimension	d40
Length of pipeline L	7.0 m
Non-linear coefficient of thermal expansion α, at 20°	0.14 mm/(m·K)
Non-linear coefficient of thermal expansion α, at 100°	0.20 mm/(m·K)
Temperature difference ΔT	60 K

Δl = 81.6 mm (if α = 0.17 mm/(m·K)



GV.10
Change in length – JRG Sanipex pipe (PE-X)
with **non-linear** coefficient of thermal expansion
1 Change in length
2 Length of pipeline
3 Temperature difference

V

TV.17 **Thermally induced change in length (with linear coefficient of thermal expansion) – JRG Sanipex MT pipes (PE-X)**

Length of pipeline [m]	Temperature difference ΔT [K]						
	10	20	30	40	50	60 ▼	70
	Change in length [mm]						
1	2	4	6	8	10	12	14
2	4	8	12	16	20	24	28
3	6	12	18	24	30	36	42
4	8	16	24	32	40	48	56
5	10	20	30	40	50	60	70
6	12	24	36	48	60	72	84
7 ▶	14	28	42	56	70	84	98
8	16	32	48	64	80	96	112
9	18	36	54	72	90	108	126
10	20	40	60	80	100	120	140
20	40	80	120	160	200	240	280
30	60	120	180	240	300	360	420
40	80	160	240	320	400	480	560
50	100	200	300	400	500	600	700

▶ Example for L = 8 m and ΔT = 60 K

4.6.2 Length of flexible pipe leg

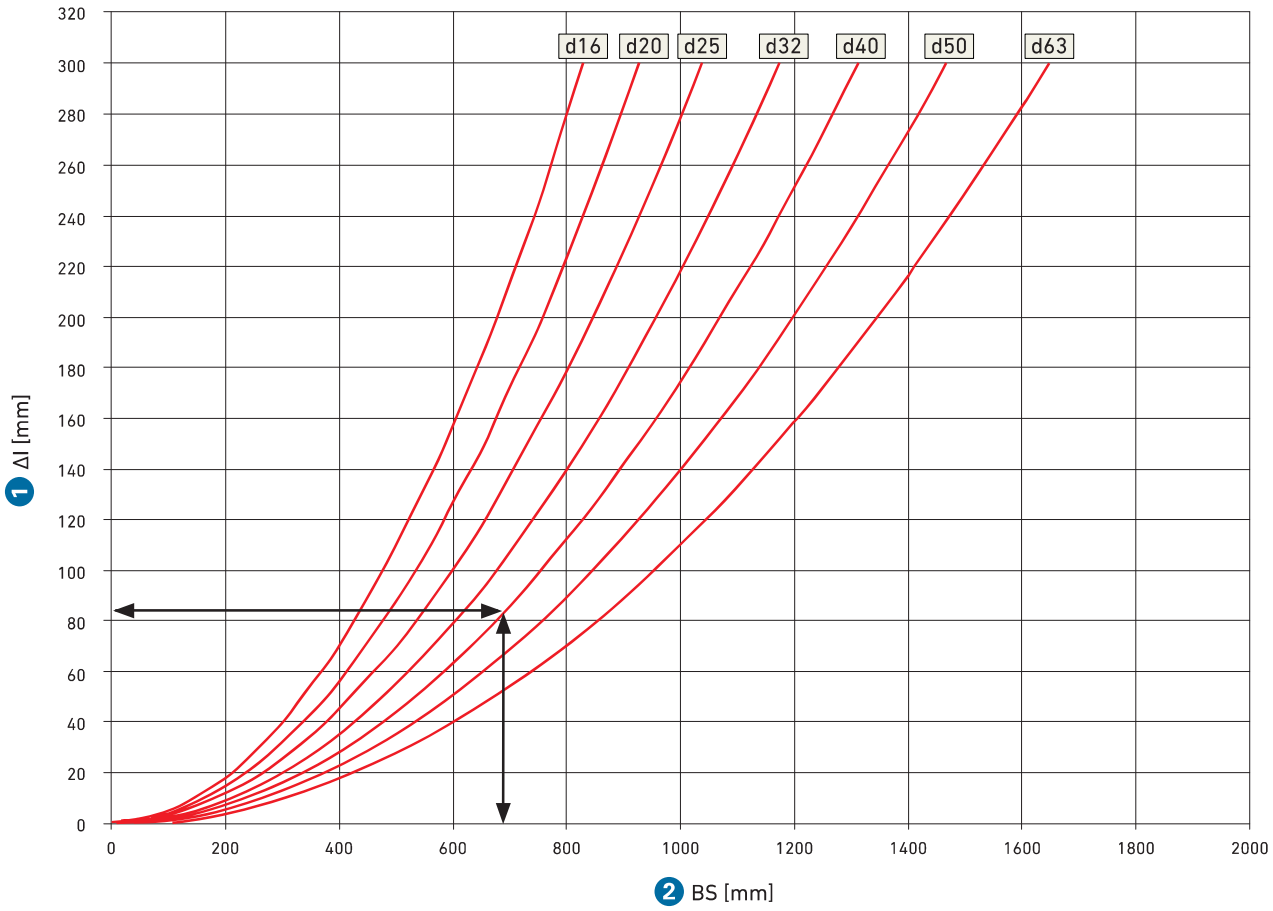
The length of the flexible pipe leg is derived from the pipe's change in length.

How to read the table

- with **linear** coefficient of thermal expansion α = 0.2 mm/(m·K)

Plastic pipe, PE-X, Dimension	d40
Material constant C	12
Change in length Δl	84 mm

BS = 696 mm



GV.11
Length of flexible pipe leg

1. Change in length of the pipe
2. Length of flexible pipe leg

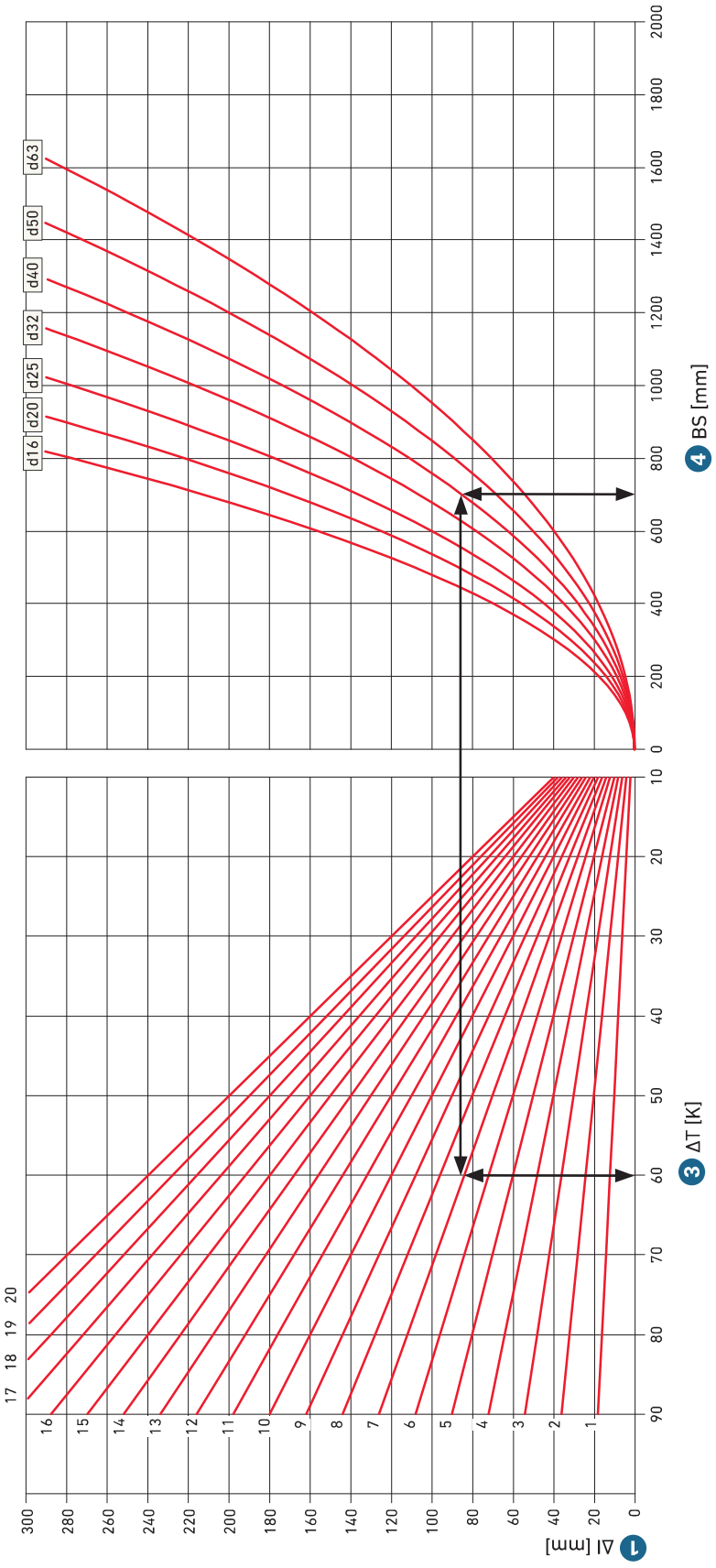
V

Graphic determination of the length of flexible pipe leg

The length of the flexible pipe leg can be determined with the two combined diagrams.

Determining the length of the flexible pipe leg

Change in length of JRG Sanipex pipes (PE-X)



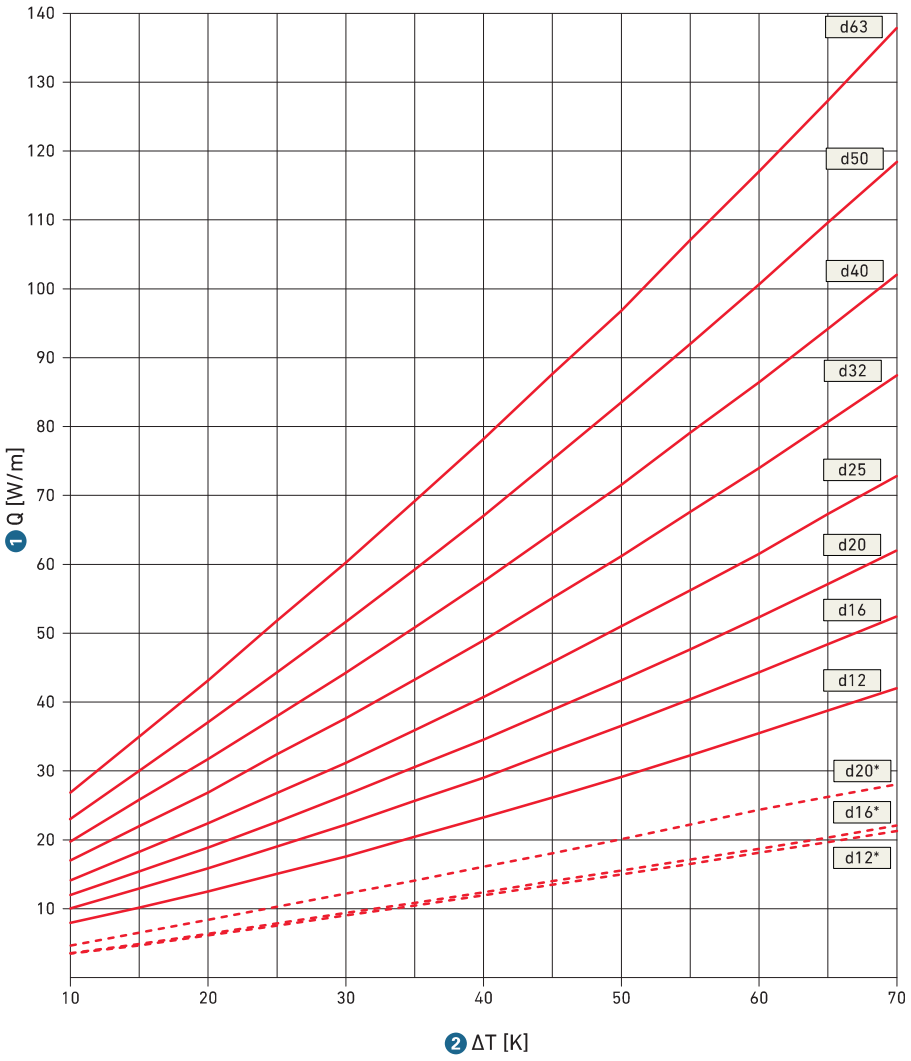
How to use the diagram

1. Read off temperature difference 3.
2. Select the length of pipeline 2.
3. Read change of length 1.
4. Read off the pipe dimension.
5. Read length of the flexible pipe leg 4.

1 Change in length
2 Length of pipeline
3 Temperature difference
4 Length of flexible pipe leg

4.7 Heat emission and insulation

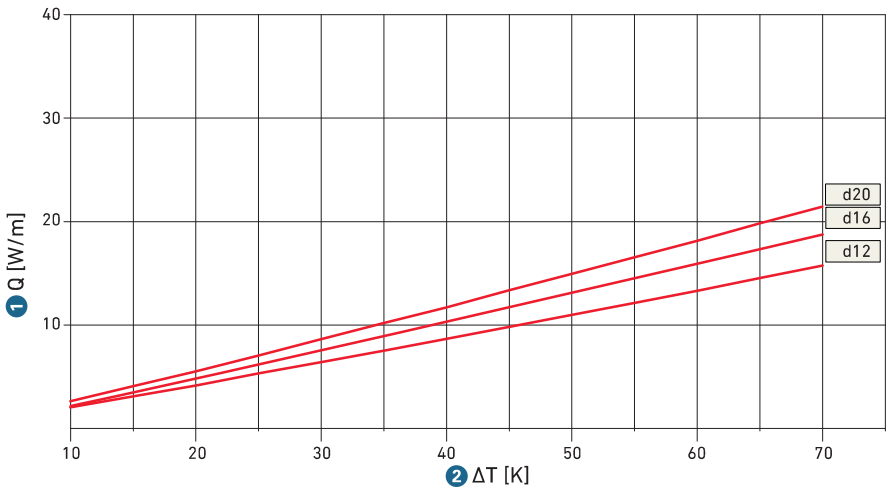
JRG Sanipex pipe (PE-X)



GV.12
Heat emission – JRG Sanipex pipe (PE-X)

1 Heat emission
2 Temperature difference
* inside the protective conduit

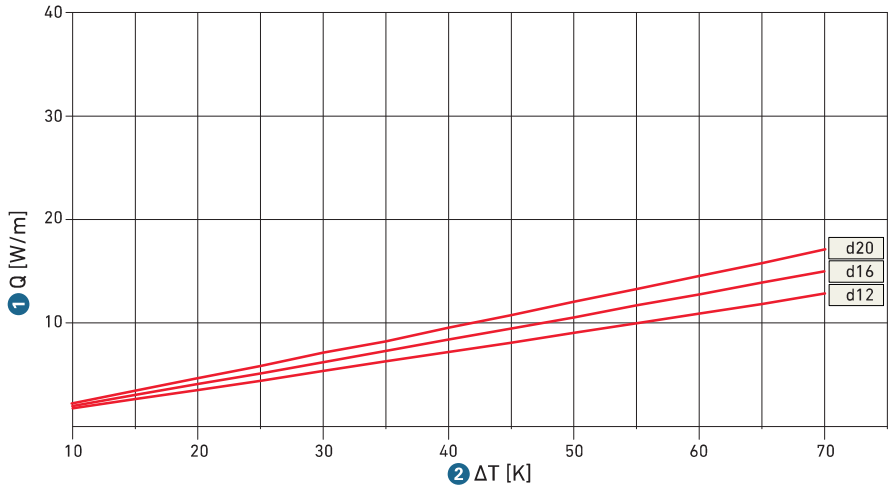
JRG Sanipex pipe, pre-insulated, 6 mm



GV.13
Heat emission – JRG Sanipex pipe, pre-insulated

Graph showing a 6 mm insulation with WLG 035
1 Heat emission
2 Temperature difference

JRG Sanipex pipe, pre-insulated, 10 mm

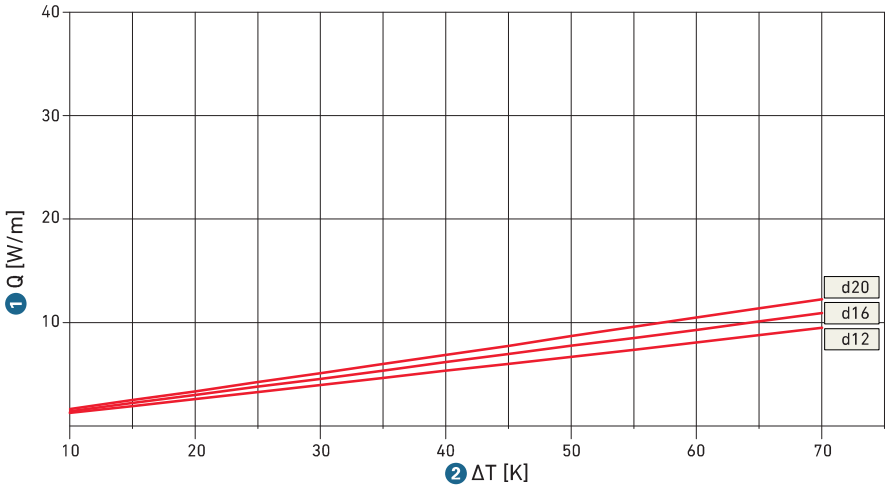


GV.14
Heat emission – JRG Sanipex pipe, pre-insulated

Graph showing a 10 mm insulation with WLG 035

1. Heat emission
2. Temperature difference

JRG Sanipex pipe, pre-insulated, 20 mm

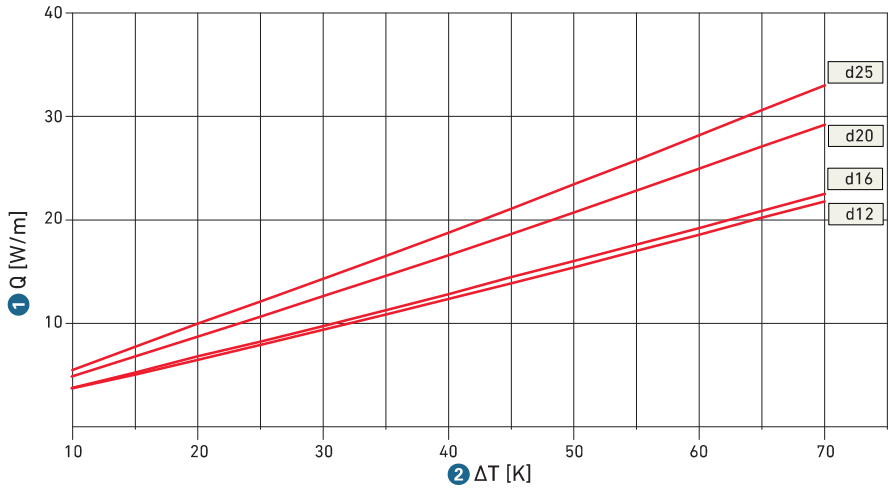


GV.15
Heat emission – JRG Sanipex pipe, pre-insulated

Graph showing a 20 mm insulation with WLG 035

1. Heat emission
2. Temperature difference

JRG Sanipex Calor pipe, in protective conduit



GV.16
Heat emission – JRG Sanipex Calor pipe, inside the protective conduit

1. Heat emission
2. Temperature difference

4.7.1 Application criteria applicable to pre-insulated JRG Sanipex pipes

Pipes d12 to d20 with 6 mm insulation

- Consisting of pipe and insulation
- Delivery in coils, 50 m long (100 m for dimension d12)
- Concentric pipe insulation made of polyethylene foam with closed-cell material structure
- Insulation thickness 6 mm, WLG 035
- With durable, seamless foil coating, colour grey
- Building material class E

Suitable for cold drinking water pipes according to DIN 1988-2 (Table 9) and for central heating pipes in the floor structure between heated rooms of different users according to EnEV 2014 (Annex 5, Table 1, Line 7) as well as cold distribution and cold water pipes according to EnEV 2014 (Annex 5, Table 1, Line 8). In addition, uninterrupted impact sound insulation is necessary.

Pipes d12 to d20 with 10 mm insulation (50% EnEV)

- Consisting of pipe and insulation
- Delivery in coils, 50 m long (100 m for dimension d12)
- Concentric pipe insulation made of polyethylene foam with closed-cell material structure
- Insulation thickness 10 mm, WLG 035
- With durable, seamless foil coating, colour grey
- Building material class E

Suitable for heating and hot water pipes with insulation requirements 50% according to EnEV 2014 (Annex 5, Table 1, Lines 5 and 6). In order to minimise the risk of legionella, the insulation thicknesses according to EnEV 2014 in conjunction with DVGW W551 and DVGW W553 are also recommended for cold water pipes. In addition, uninterrupted impact sound insulation is necessary.

Pipes d16 to d20 with 20 mm insulation (100% EnEV)

- Consisting of pipe and insulation
- Delivery in coils, 50 m long
- Concentric pipe insulation made of polyethylene foam with closed-cell material structure
- Insulation thickness 20 mm, WLG 035
- With durable, seamless foil coating, colour grey
- Building material class E

Suitable for heating and hot water pipes with insulation requirements 100% according to EnEV 2009 (Annex 5, Table 1, Line 1). In order to minimise the risk of legionella, the insulation thicknesses according to EnEV 2009 in conjunction with DVGW W551 and DVGW W553 are also recommended for cold water pipes. In addition, uninterrupted impact sound insulation is necessary.

5 Installation

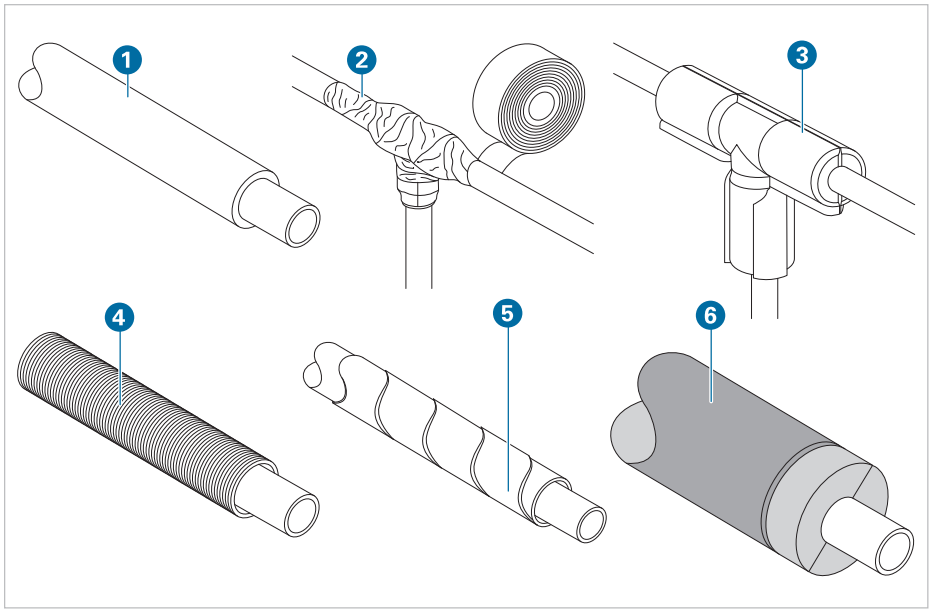
Installation of pipelines
General technical information on installation types:
➨ Part IV 'Plan', Section 'Drinking water installation', Chapter [13] 'Installation and attachment'
➨ Part V 'Build', Section 'Installation'

The JRG Sanipex System is suitable for the following types of installation:
- Surface or flush-mounted installations
- Installation in shafts and channels, on ceilings and on floors
- Installation in-wall, element, wood and lightweight constructions
- Installation in concrete (in the pipe-in-pipe system, with PE-X pipes)

5.1 Protection against environmental influences and building materials

System components flush-mounted or concealed behind a wall:
☑ In order to absorb thermally induced changes in length, to prevent the transmission of sound, to avoid the formation of condensation, to preclude heat dissipation, heat loss or to heat the medium and to protect from other building material influences, fittings or pipes must be covered with a suitable materials or they must be separated entirely from the structure of the building.

In permanently or periodically damp rooms, in areas subject to aggressive gases or other offensive environment and under uncontrollable environmental influences:
☑ Appropriate precautions must be taken to protect the installation, e.g. by using the following measures:
  - Use of suitable anti-corrosion tapes (e.g. supplied by KEBU, Gyso or DENSO)
  - Wrapping the pipe with heat-shrinkable materials
☑ Ensure that pipes and fittings are dry when mounting.
☑ All system components must be protected from direct contact with oils, greases, solvents, solvent-based adhesives (adhesive tapes), foams, bitumen (also bituminous membranes). Furthermore, the components must not contact building materials such as screed, concrete, mortar or plaster.
☑ Piping system and building structure must be separated from each other, for example, by using protective conduits made of PE, wrappings, insulating hoses or half shells with and without sheathing or a combination thereof.



GV.17
Safety measures
1 pre-insulated pipe
2 Pipe with wrapping
3 Half shells
4 Protective conduit
5 Wrapping
6 Sheathing

5.2 Installation flush with wall

☑ Compliance with the general requirements for installing pipes flush with the wall.
☑ Threaded connections installed flush with the wall must be protected from moisture and contamination.

5.3 Installation in concrete ceiling

JRG Sanipex pipes inside the protective conduit may be cast in solid structures.
☑ Compliance with the general requirements for installing pipes in concrete ceilings is mandatory.
☑ Do not install or pour threaded connections or fittings into the pipe.
If the JRG Sanipex installation accessories are used during the installation, the conditions can be met.
☑ Do not exceed 6 directional change for one 90° turn.
☑ Bending radius R ≥ 8 · d must be maintained.
☑ The protective conduits must cover the entire length of the pipe.
☑ If installing in a cavity: Pipes must be secured properly, especially in the areas where directional changes take place.
☑ Make sure to prevent dirt from settling between the protective conduit and the inner pipe.

5.4 Installation in a pipe shaft, basement distributor and riser pipes

☑ Compliance with the general requirements for installing pipes is mandatory.

Change in length, bending and 2D expansion loops, fixed and floating points
☑ When installing, observe the change in the length of the pipes, the resulting flexible pipe leg and 2D expansion loop, and the required fixed points.

5.5 Installation on top of a concrete ceiling

☑ Compliance with the general requirements for installing pipes on concrete ceilings is mandatory.

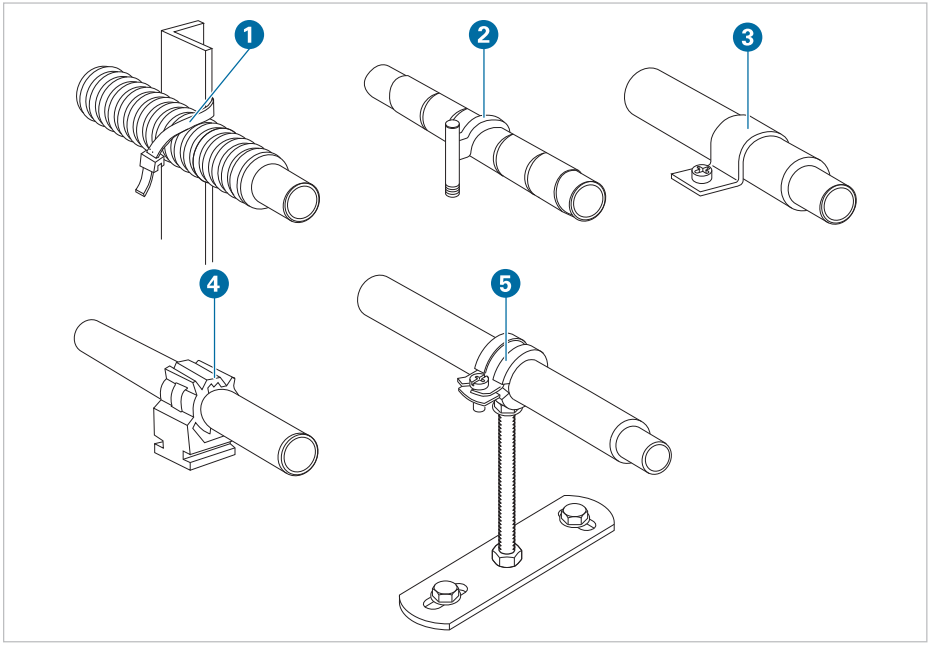
6 Attachment

Pipeline attachment

General information:
➨ Part IV 'Plan', Section 'Drinking water installation', Chapter [13] 'Installation and attachment'

6.1 Attachment components

JRG Sanipex installations can be installed using attachment components from our systems or with commercially available fasteners.



GV.18
Pipe attachments

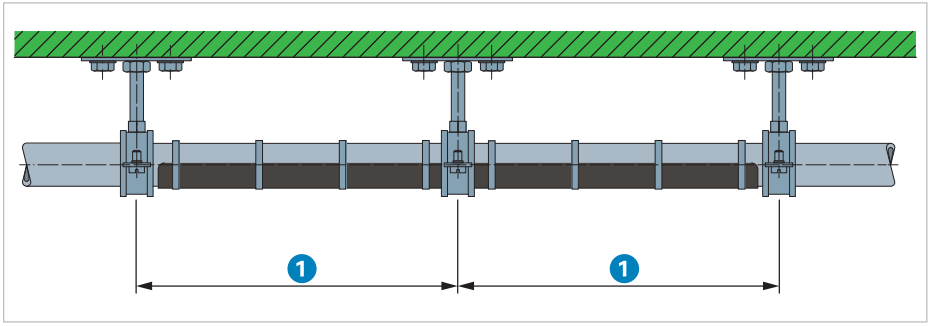
1. Pipe binders
2. Dowel hooks
3. Pipe clip
4. Pipe clips
5. Pipe clips

6.2 Attachment using pipe clips

In general, Sanipex pipelines **do not** require pipe saddles or protective conduits. However, when **PE-X pipes** are installed in **plain view**, it is recommended to use them.

NOTE! Damaged pipes due to eexcessively spaced mounting distances!
Excessive spacing between the attachments can lead to deformation and weakening of the material as well as vibrations (formation of noise).

☑ Mounting distances **(BA)** must be maintained.
☑ Observe the change in length and allow for appropriate expansion compensation.



GV.19
Mounting distances (BA)
1 Mounting distance

Pipe, Dimension		BA [m]	
d	DN	PE-X pipe	with pipe saddle
12	8	1.0	1.5
16	12	1.0	1.5
20	15	1.0	1.5
25	20	1.0	1.5
32	25	1.5	2.0

TV.18
Mounting distances (recommended)

Attachment when installing “pipe-in-pipe”

NOTE! Noise emissions due to pressure surges!
Pressure surges on quick-action fittings can cause noise emissions.
→ When using a “**pipe-to-pipe**” **installation** made of JRG Sanipex pipelines, appropriate precautions must be taken.

Recommendation for mounting distance
Moreover, we recommend a maximum mounting distance of 60 cm when installing with a protective conduit (“pipe-in-pipe” installation).

☑ Ensure the pipes do not kink.

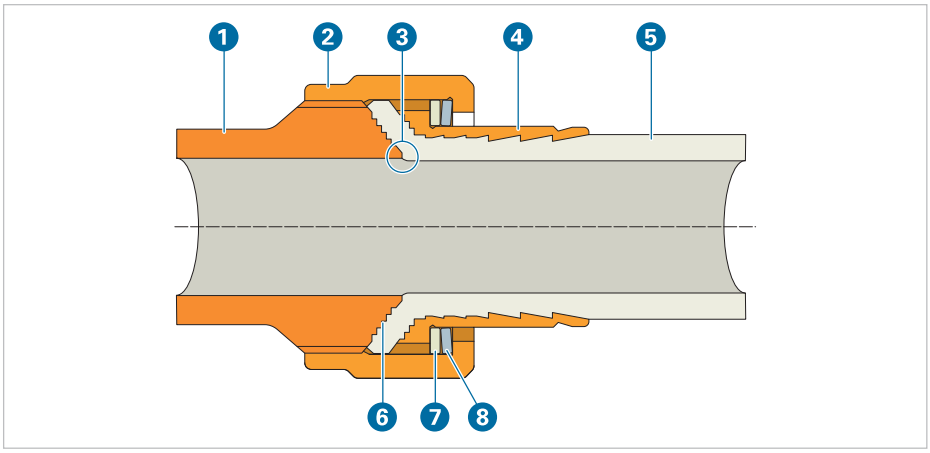
7 Connection

Jointing technology
General information:
➨ Part III 'The basics', Section 'Materials and jointing technology'

7.1 Crimped clamping connection

The JRG Sanipex crimped clamping connection is a secure, dead-space-free connection without stiffeners required at maximum flow. The connections can be released again at any time and do not require additional sealing material.

JRG Sanipex crimped clamping connection comprises the following components:



GV.20
JRG Sanipex crimped clamping connection

1. JRG Sanipex fitting (gunmetal)
2. Coupling nut (brass)
3. Without dead space
4. Clamping ring
5. PE-X pipe
6. Jointing face
7. Sliding washer
8. Belleville washer

The JRG Sanipex crimped clamping connector is mounted on the PE-X pipe with the circlip pliers and then bolted to the fitting with the ratchet torque wrench. The sliding washer prevents the inner pipe from rotating when tightened.

The Belleville washer ensures even pressure on the dead space-free jointing face.

8 Assembly

JRG Sanipex pipes (d12 – d20) can also be connected to JRG Sanipex fittings.

☑ Compliance with the tool's operating instruction is mandatory.

☑ Ensure the assembly tools are working properly.

WARNING! Risk of injury due to incorrect operation of the shears.

If operating the combination shears improperly, there is a risk of injury in the area of the shear's end stops.

→ Use tools only as shown in the operating instructions.

NOTE! Leaks in the pipe and water damage due to cutting to the incorrect length!

→ Ensure the pipe end is cut straight.

→ Ensure the pipe end is not out-of-round.

The individual assembly sequences for different dimensions are shown on the following pages.

8.1 Assembly – Pipes d12 – d20

The individual steps are illustrated on the next page.

Assemble pipes d12 – d20

Cutting the pipe

① → Use the combination shear to shorten the protective conduit and PE-X pipe.

② → Determine the length of the protective conduit that must be shortened.
The optimal length is about 5 cm of the pipe to be connected (distance × between the pin of the combination shear and the handle end).

③ → Cut protective conduit to length, using the pipe cutter integrated in the handle of the combi-scissors.
↳ The PE-X pipe is shortened.
→ Inspect pipe.
- "OK" = correct / "NO" = wrong

Installing the crimped clamping connector

④ → Open the clamping lever and the operating lever of the circlip pliers.
→ Push the crimped clamping connector over the mandrel of the circlip pliers so that the screw thread points in the direction of the mandrel (in the picture to the right). For this, note the illustration on the inside of the pliers.

⑤ → Guide the PE-X pipe up to the mandrel of the circlip pliers.
→ Close the clamp lever of the circlip pliers.
↳ The PE-X pipe is attached in place.

⑥ → Close the operating lever of the circlip pliers.
↳ The PE-X pipe is connected to the crimped clamping connector.

NOTE! After expanding JRG Sanipex pipes made of PE-X, the connection must be completed immediately.

⑦ → Open the operating lever of the circlip pliers.
↳ The crimping screw connection is released.
→ Remove PE-X pipe.
↳ The PE-X pipe can be mounted on a fitting with a JRG Sanipex connection.

Check crimped pipe end

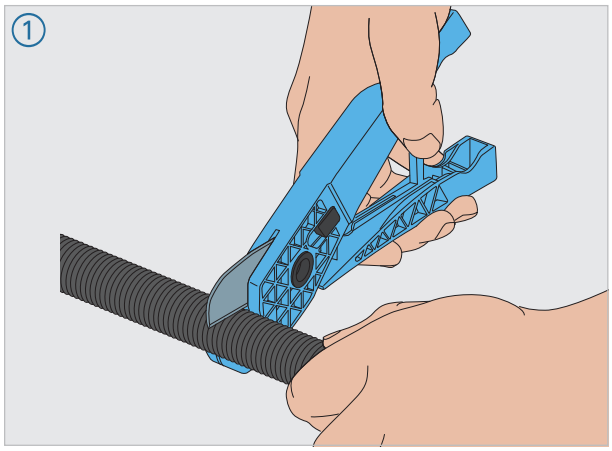
⑧ → Check dimension x.
The dimension of the established connection must not be less than ×.
- d12 × 1.7: 2.5 mm
- d16 × 2.2: 3.0 mm
- d20 × 2.8: 3.5 mm

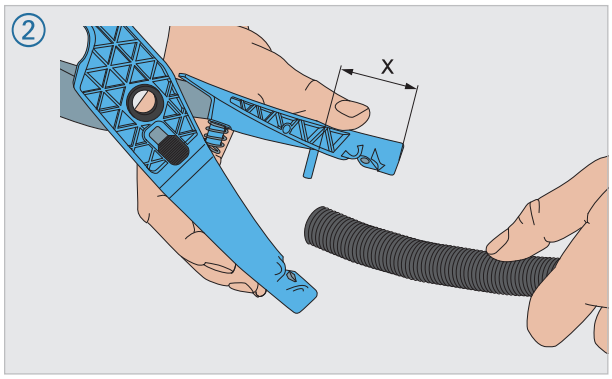
→ If the dimension x is too short: Check circlip pliers.

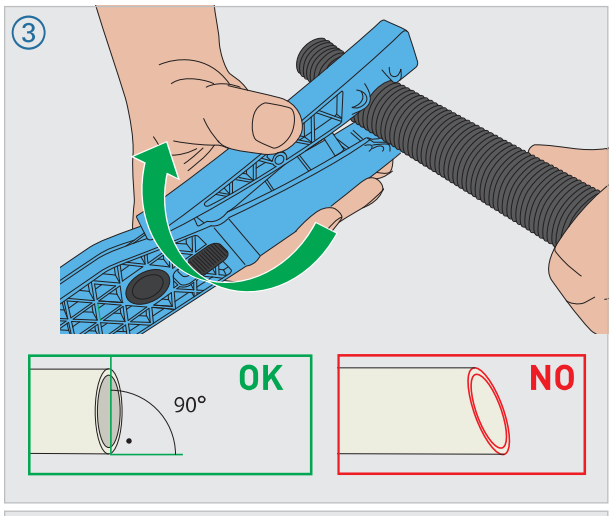
Assemble pipe to fitting

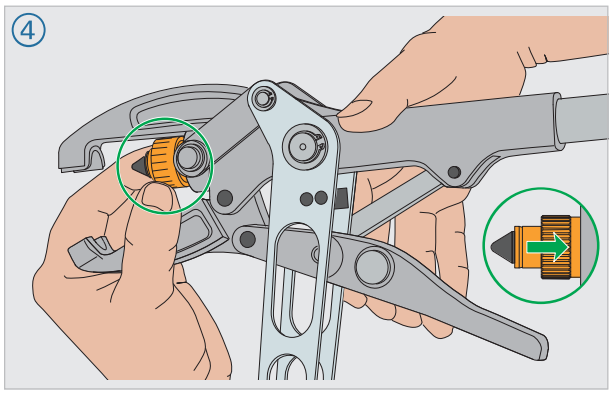
⑨ Der JRG Sanipex ratchet torque wrench is used exclusively for tightening JRG Sanipex crimped clamp connectors. The torques are permanently set at the factory.
→ Screw the crimped clamp connector onto the fitting manually.
→ Tighten the threaded connection using the ratchet torque wrench until a “click” can be felt and heard.
→ Mark finished connections with the marking pen.

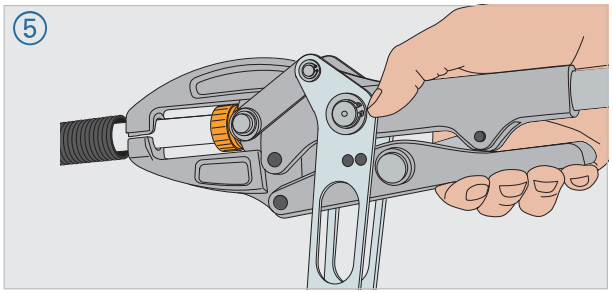
Assembly – Assembling pipes d12 – d20

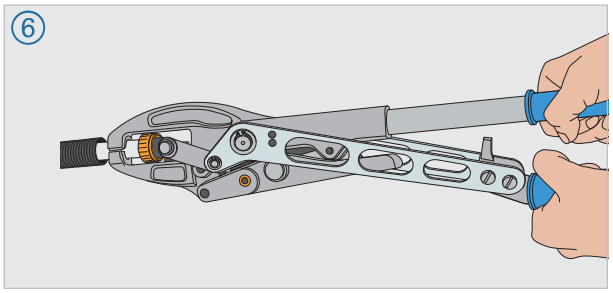


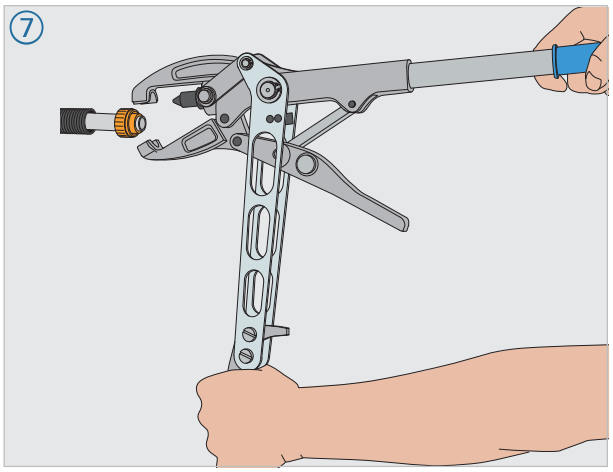


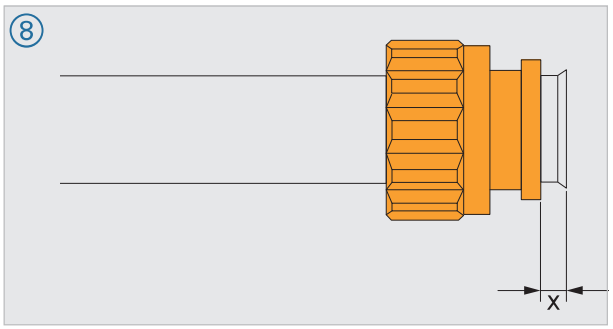


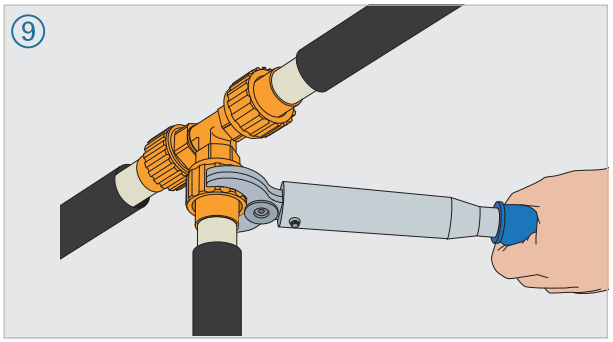












V

8.2 Assembly – Pipes d25 – d32

The individual steps are illustrated on the next page.

Assemble pipes d25 – d32

Cutting the pipe

① → Use pipe cutter to cut PE-X pipe.
→ Inspect pipe.
- "OK" = correct / "NO" = wrong

Installing the crimped clamping connector

② → Use the torque wrench to hold the JRG Sanipex crimped clamping connector.
→ Screw the turn up device into the crimping clamp connector.

③ → Use the L-key to hand-tighten the turn up device while canting it slightly.

④ → Hold the end of the pipe with pipe wrench.

⑤ → Use the turn up device to screw the JRG Sanipex crimping clamp connector as far as will go onto the cut pipe end (right-hand thread).
→ Use the L-key to unscrew the turn up device again.

⑥ → Rotate the turn up device and screw it into the crimping clamp connector manually.

⑦ → Use the torque wrench to hold the crimped clamping connector.
→ Use the L-key to tighten the turn up device again.

Check crimped pipe end

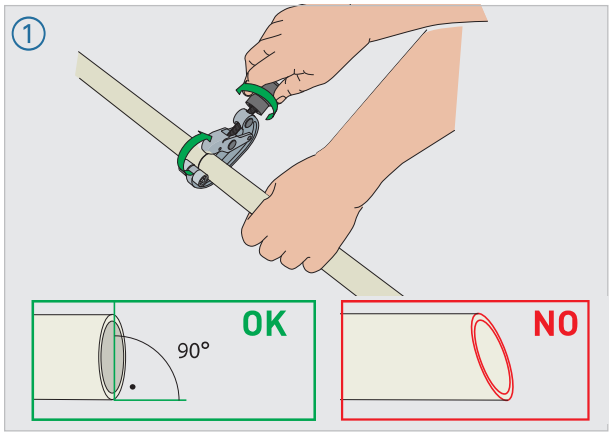
⑧ → Check dimension **x**.
The dimension **x** of the established connection must not be less than the value **×**.
- d25 × 3.5: 4.0 mm
- d32 × 4.4: 6.0 mm

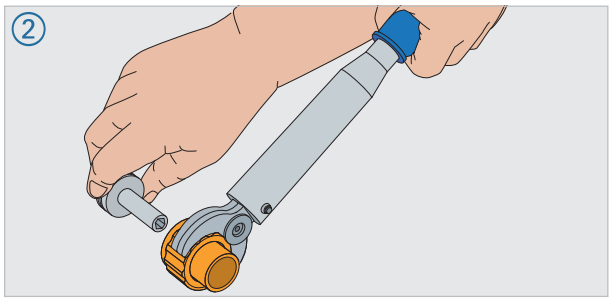
→ If the dimension **x** is too short: Check circlip pliers.

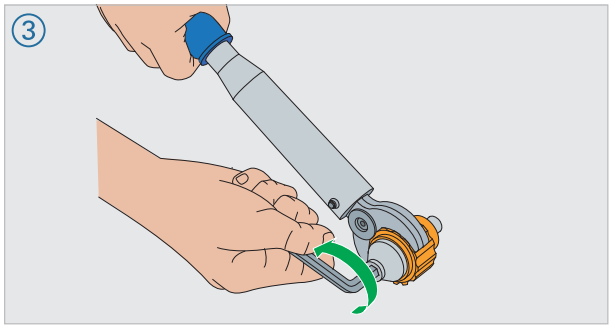
Assemble pipe to fitting

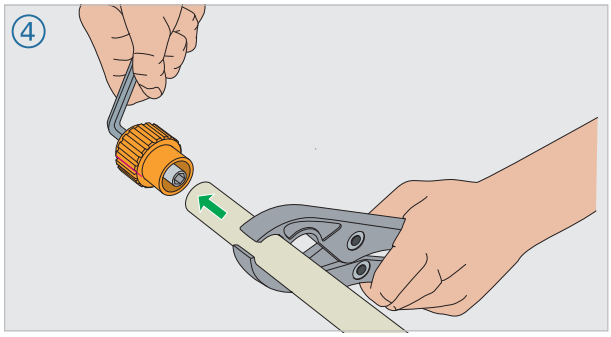
⑨ Der JRG Sanipex ratchet torque wrench is used exclusively for tightening JRG Sanipex crimped clamp connectors. The torques are permanently set at the factory.
→ Screw the crimping clamp connector onto the fitting manually.
→ Use the torque wrench and the open-end spanner to tighten the threaded connection until a “click” can be felt and heard.

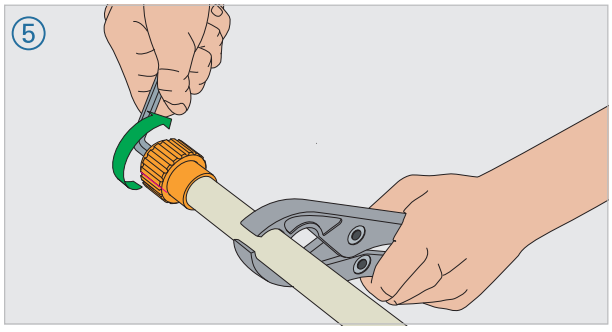
Assembly — Assembling pipes d25 – d32

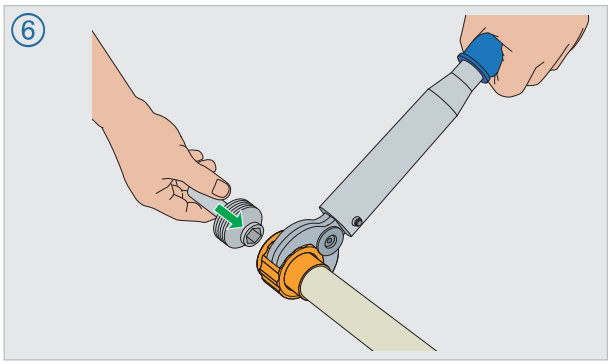


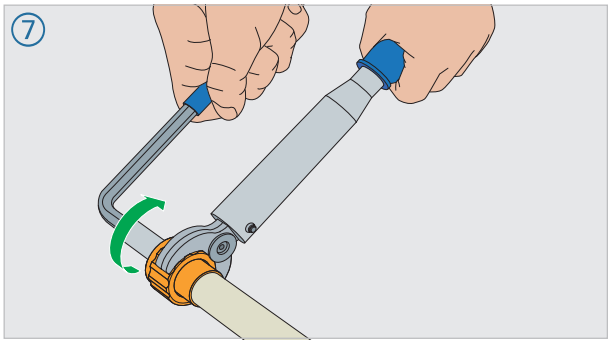


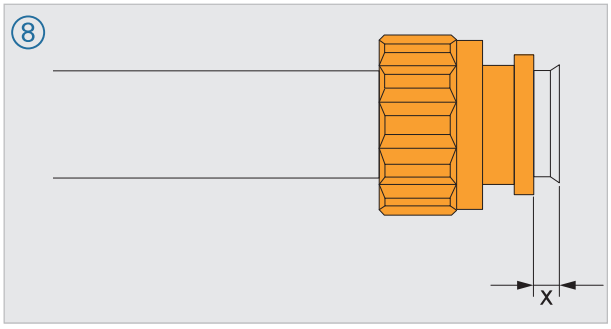


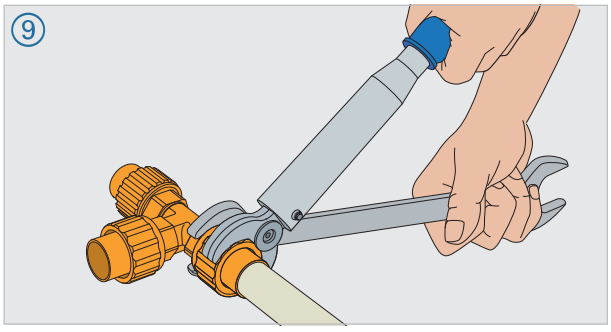












V

9 Bending

JRG Sanipex pipes can be bent by hand without the use of bending tools.

☑ Compliance with minimum bending radii listed to the table is mandatory.

TV.19 **Minimum bending radii**

Designation	PE-Xa, PE-Xc				
Nominal width DN [mm]	8	12	15	20	25
Outside diameter d_a [mm]	12	16	20	25	32
Bending radius R, not interchangeable: $5 \cdot d_a$ [mm]	60	80	100	125	160
Bending radius R, interchangeable: $8 \cdot d_a$ [mm]	96	128	160	200	256

NOTE! Risk of damaging the pipes due to improper bending!

→ Ensure the pipes do not kink when bending them.

10 Fittings – Combinations – Dimensions

Since the **z dimension method** is usually **not** used when working on the pipe-in-pipe installation, it is not necessary to specify the centre-to-centre distance for special fitting combinations.

The exact dimensions of the fittings are included in the delivery program.

11 Maintenance and Repair

11.1 Replacing the pipe

NOTE! Odour and taste might be adversely affected due to lubricants and anti-friction agents!

→ Do not use lubricants or anti-friction agents for replacement purposes.

The individual steps are illustrated on the next page.

Replacing the pipes

Removing the damaged pipe

① → Close shut-off valves upstream of distributor.
→ Disassemble discharge fitting.

② → Loosen the pipe end of the defective pipe from the distributor.
→ Remove crimping clamp from pipe end.
→ Use a pipe draw coupling to connect the new pipe to the pipe that must be replaced. When doing so, observe the direction of rotation of the thread.

③ → Use the mounting wrench to remove the fastening ring.

④ → Insert alignment gauge into box bend.

⑤ → Pull the pipe bend out of the wall box.

Replacing the pipe

⑥ → Proceed with the replacement of the pipe by using the alignment gauge to pull on the pipe that must be replaced and to strike the new pipe simultaneously.

If the pipe can not be replaced by striking and pulling it:
→ Pull out the old pipe.
→ Use a nylon string or wire rope and pull in the new pipe with the pipe draw coupling.

NOTE! Improvement of the sliding properties of the pipe.
If necessary, the sliding properties of the pipe can also be improved by using a silicone spray.
→ Be sure to contact Technical Support before using the method.
→ Spray silicone spray between protective conduit and carrier pipe and spread with compressed air.
→ Repeat step several times, if necessary.

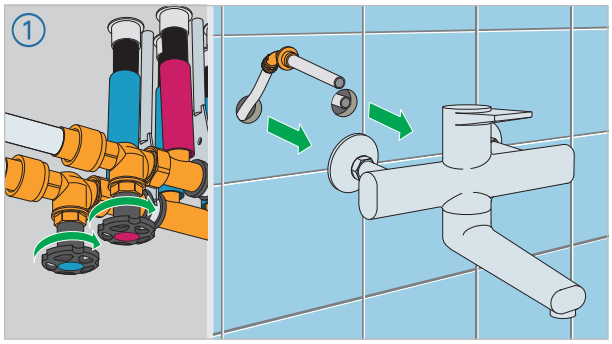
Installing the new pipe

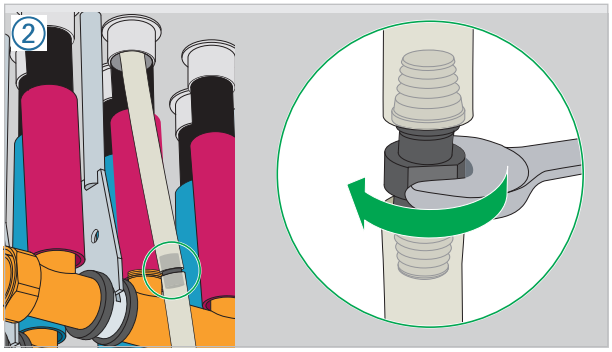
⑦ → Attach crimped clamp connectors on both sides of the new pipe.
→ Screw the pipe to the box bend.

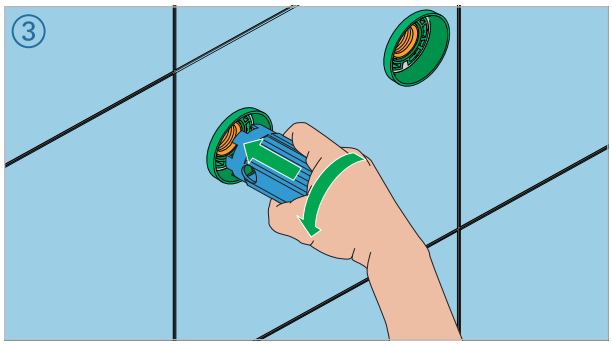
⑧ → Position the box bend in the box and use the fastening ring to secure it.
→ Install discharge fitting.

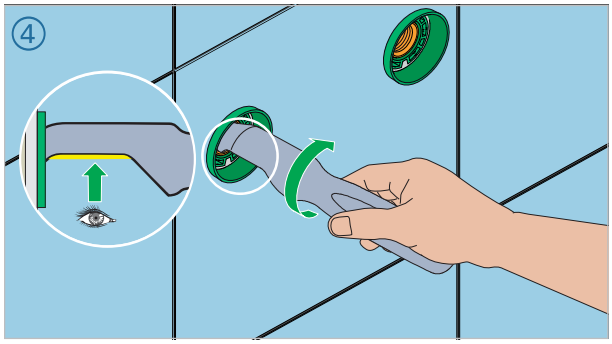
⑨ → Connect the pipe end to the distributor.
→ Open shut-off valves upstream of distributor.
→ Check for leaks.

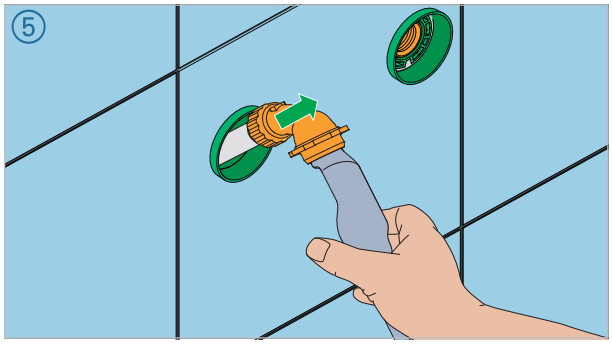
Replacing the pipe

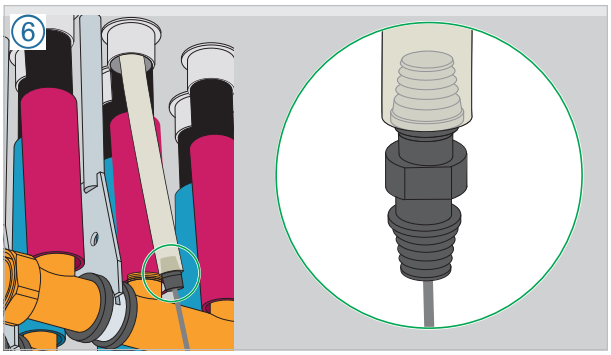


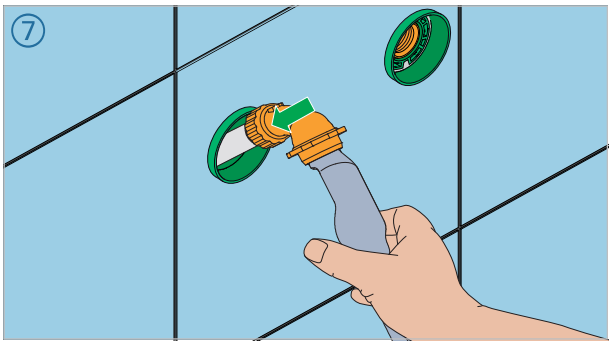


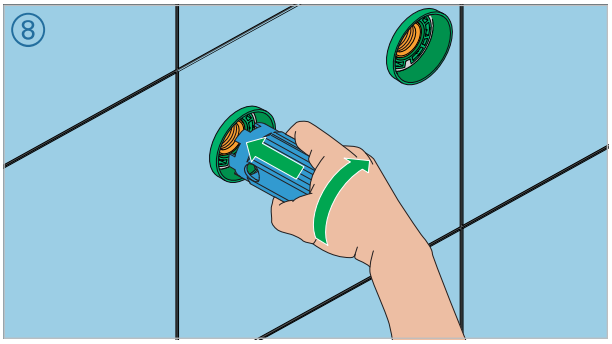


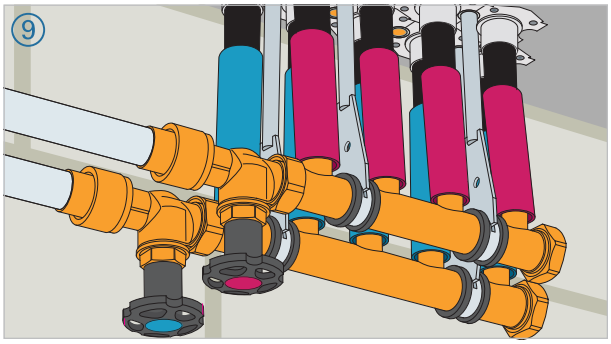












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