poloplast

Building drainage
International

Technical manual

Abbreviations

Art. no. ..... Article number
Fig. ..... Image of the product version
SSD ..... Sub-surface drainage
IL ..... Installation length in mm
do ..... Outer diameter
di ..... Inner diameter (outer diameter minus wall thickness)
DN ..... Outer diameter (Nominal diameter)
S ..... Stack
EJ, EJS ..... Expansion joint, expansion joint structure
H ..... Height
LEC ..... Linear expansion coefficient
mWS ..... Metre of water column
NP ..... Nominal pressure
PP ..... Polypropylene
MR PP ..... Mineral-reinforced polypropylene
CP ..... Cleaning piece
MF ..... Manifold/linear pipe
SW, BD ..... Surface water drainage, bridge drain
α ..... Angle

General information

The information provided in this technical manual is intended to help you find the right products for your application. We have taken great care in putting together our texts and images. However, errors can't be completely ruled out. POLOPLAST does not accept any liability for incorrect information and any related consequences. POLOPLAST welcomes suggestions and feedback. Contents are subject to technical changes.

Our technical sales team are happy to help should you require further information.
You can also contact our central office at: ,

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Many tasks. One solution. 10

Building drainage

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Company

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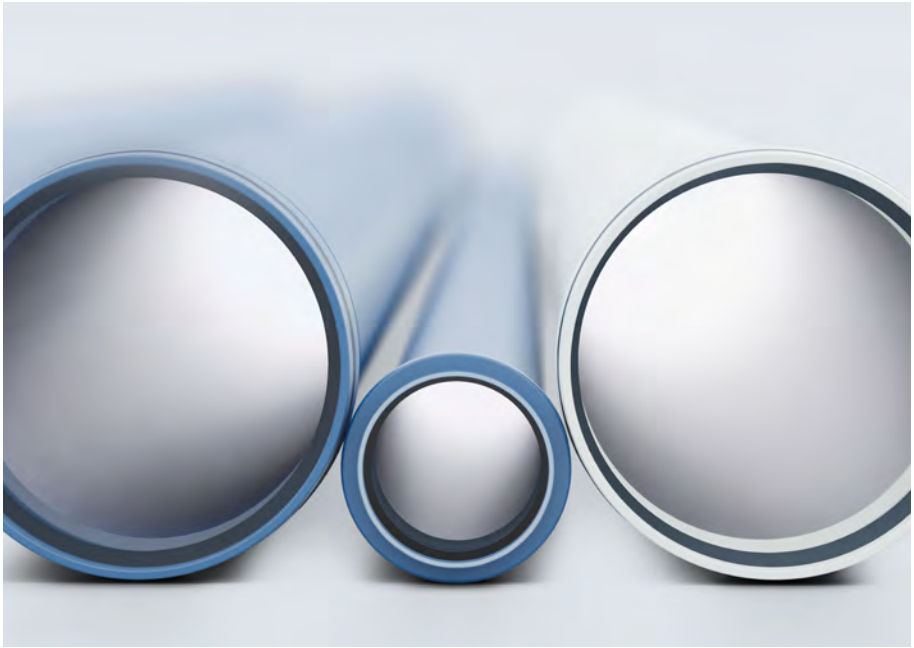


POLOPLAST specialises in the development, production and sale of reinforced, multi-layer plastic pipe systems. These innovative pipe systems have been proving their worth across diverse applications in the building services and civil engineering sectors for over 70 years.

We strive to meet the highest possible standards and never stop optimising: our development history and products reflect continuous progress. ‘Pure Progress’ is our mission and expresses our absolute commitment to embracing a culture of innovation.

POLOPLAST is known for modern and sustainable building drainage and ventilation systems. On a municipal level, our pipes are used in engineering applications including wastewater disposal and specialised bridge drainage. Our custom products are also used within marine and industrial environments.

POLOPLAST develops, produces and distributes innovative speciality compounds, consisting of polyolefins and engineering thermoplastics, for the plastics industry. These are an integral part of our pipe systems and have been so for years.

Decades of experience in multi-layer technology and its continuous further development ensure that POLOPLAST pipe systems deliver high performance. They meet the highest market and quality requirements and centre on safety, reliability, durability, recyclability, sustainability, and first-class service.

Sustainability

At POLOPLAST, sustainability is not just a buzzword, but an integral part of our corporate strategy and culture.

For us, taking responsibility means consistently considering ecological, economic and social aspects throughout the entire product life cycle. This begins with the resource-saving development and production of our pipe systems and extends to efficient water and energy management, comprehensive emissions monitoring and high work and safety standards, right through to the recyclability and recycling of our products. In an increasingly volatile, complex and dynamic environment, sustainable action provides orientation and stability. Our aim is not only to comply with legal requirements, but to exceed them on a regular basis. External certifications, such as the OCS certificate, underline this claim. With innovative technologies, continuous improvement and long-term thinking, we create the basis for sustainable corporate success.

OCS Europe
CERTIFIED FACILITY

Ownership structure

POLOPLAST is based in Leonding, Austria. Together with its subsidiaries, the company engages 393 employees.

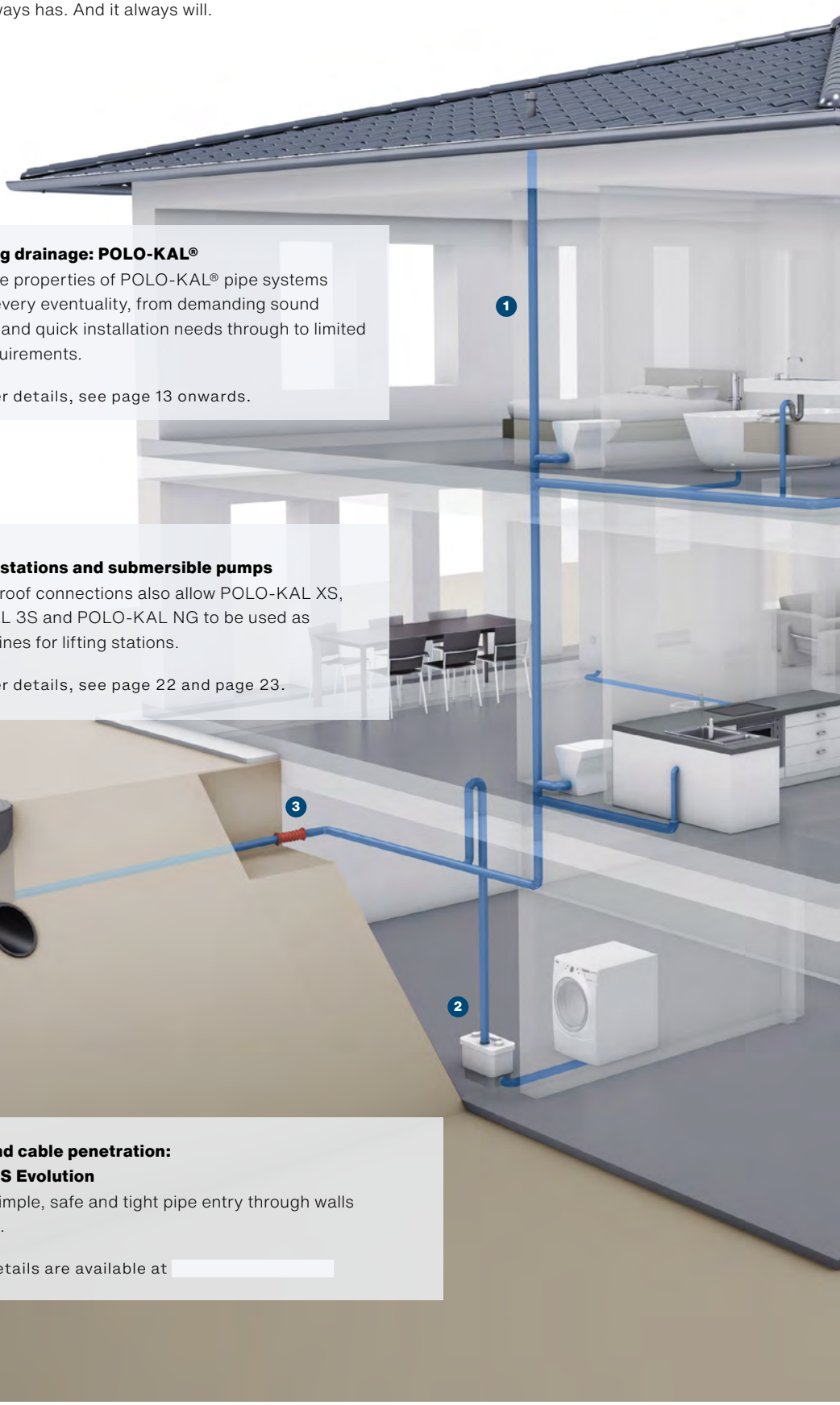
POLOPLAST is fully owned by WIG Wietersdorfer Holding GmbH, which has its headquarters in Klagenfurt, Austria. Wietersdorfer has been an Austrian family-owned business since its foundation in 1893 and brings together five business segments: Cement, Lime, GRP Pipe Systems, PP (polypropylene) Pipe Systems and Industrial Minerals. Today, Wietersdorfer has sales offices and production facilities in 22 countries in and outside of Europe. Worldwide, over 3,600 employees in more than 30 countries are committed to high product quality, innovation and customer benefit – while conserving resources and protecting the environment as much as possible.

building solutions since 1893 ★ building solutions since 1893 ★
Wietersdorfer

Many tasks. One solution.

POLOPLAST offers planners and property developers an efficient, high-performance system for the entire building, from basement to roof. Intelligent pipe systems and a range of high-performance components guarantee maximum convenience and safety throughout. In addition to this, we also offer effective wastewater disposal and bridge drainage solutions.

POLOPLAST stands for reliability. It always has. And it always will.



1 Building drainage: POLO-KAL®
The unique properties of POLO-KAL® pipe systems cater for every eventuality, from demanding sound insulation and quick installation needs through to limited space requirements.

For further details, see page 13 onwards.

2 Lifting stations and submersible pumps
Pull-out-proof connections also allow POLO-KAL XS, POLO-KAL 3S and POLO-KAL NG to be used as pressure lines for lifting stations.

For further details, see page 22 and page 23.

3 Pipe and cable penetration:
POLO-RDS Evolution
Ensures simple, safe and tight pipe entry through walls and floors.

Further details are available at

4 Central vacuum cleaning systems

POLO-KAL® can be used as air ducting for all common central vacuum cleaning systems.

For further details, see page 23 onwards.

POLO-KAL®

Building drainage

1. POLO-KAL® product overview

Multi-layer technology

POLO-KAL® pipe systems offer a range of unique product properties as a result of innovative multi-layer technology:

- **Effective sound insultation**
  Tested and certified by the Fraunhofer Institute Stuttgart
- **Excellent rigidity and stability**
  Generous clamp spacing, suitable for underground installation[1]
- **High chemical resistance**
  Suitable for laboratories, hospitals, etc.
- **High temperature resistance**
  Wide application range, from –20 °C to 97 °C
- **25-year warranty**
  Emphasises our outstanding quality based on 70 years of experience
- **Wide range of applications**
  Three pipe systems with an extensive range of products and a variety of special fittings

[1] for POLO-KAL XS and POLO-KAL NG

Monotec socket

The **POLOPLAST-Monotec socket for POLO-KAL XS and POLO-KAL 3S**, coupled with funTEC technology, is the key to fast, easy and safe fitting. The synergy of unique innovations enhances these pipe systems even further.

Quick

No need for lubricants
funTEC technology ensures minimal insertion force

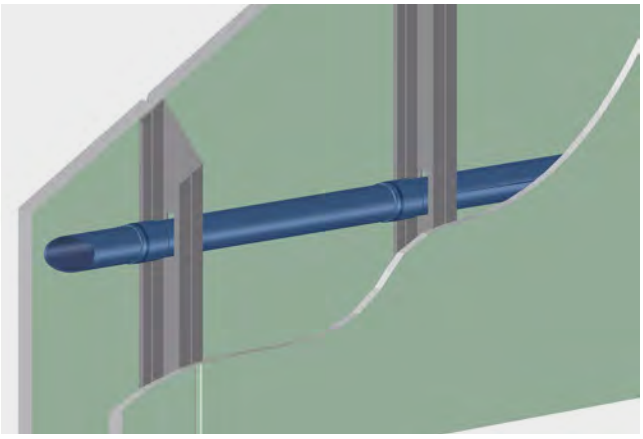
No need for chamfering
reduces the amount of time and work required: cut to length, deburr, done!

Measuring guide and ruler
for practical and quick fitting

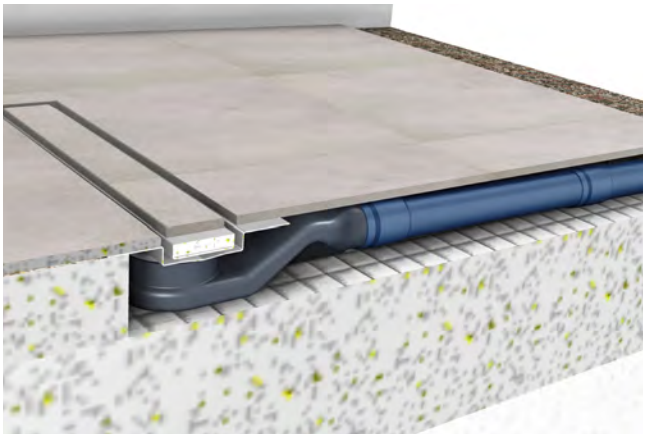
Easy to use

The extra slimline Monotec socket is perfect for when space is limited:

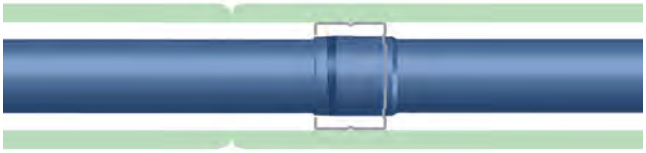
- Floor connection pipes
- Connection of level-access shower trays
- Renovations in tight spaces
- Thin floor structures
- Drywall construction applications
- Prefab house construction applications
- Use with insulating sleeves



Ideal for drywall construction thanks to easy bridging of stud profiles



Maximum space saving for level-access showers



Note: acoustic decoupling required for profiles

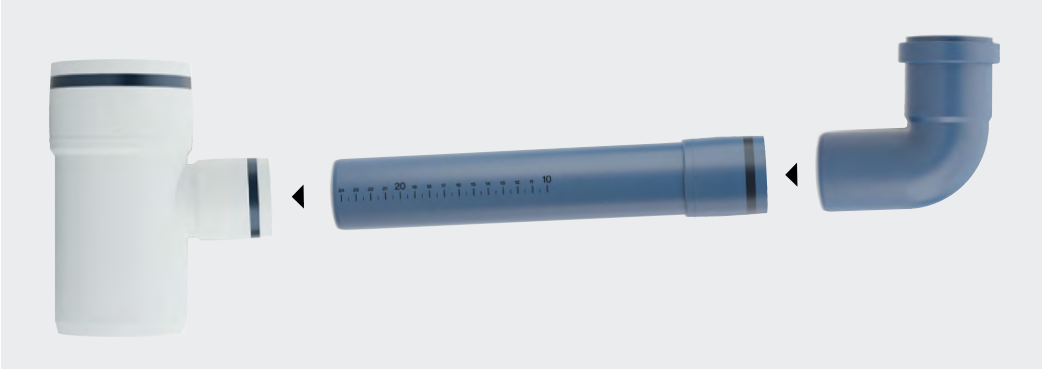
Ideal for insulating sleeves

Practical bendability up to 5 %

Optimum installation flexibility by bending the pipe up to 5 % near the socket (watertightness when angled verified by OFI no. 408.547-4).

Unrestricted compatibility

Compatible with all POLO-KAL® pipe systems



Safe

The Monotec socket guarantees fast and safe installation:

- No risk of the seal coming apart
- No risk of losing the seal during transport and storage
- No forgetting the seal during installation

1.1 POLO-KAL® pipe systems

All POLO-KAL® pipe systems meet the highest standards in terms of safety, installation, sound insulation and product range depth. However, each pipe system has its own specific stand-out feature.

POLO-KAL XS

POLO-KAL XS focuses on absolute safety and extremely quick installation. Our unique Monotec socket with funTEC technology makes it all possible. In addition, the POLO-KAL XS with its slim sleeve is the perfect solution for many installation situations and is available in DN 32 to DN 160 mm. A printed ruler together with the ability to insert without lubricant and cut to length without chamfering make the system quick and convenient to work with.

POLO-KAL NG

Available in DN 32 to 250, POLO-KAL NG offers the widest range of products, including an extensive selection of special fittings. As well as being suitable for building drainage, POLO-KAL NG can also be used for a variety of other applications. Innovative and solution-driven ideas, such as branches for tricky installation scenarios, transition fittings for other materials, and pull-out-proof connections make POLO-KAL NG the perfect problem solver.

POLO-KAL 3S

The new POLO-KAL 3S brings together the best of both worlds. Maximum safety and speed courtesy of the Monotec socket combined with the best sound-insulation properties thanks to proven three-layer technology featuring the viscoelastic material Porolen. Available in DN 50 to DN 160, the POLO-KAL 3S is the ideal all-round system for any building with high sound insulation and safety requirements, whatever the challenge.

POLO-KAL® pipe systems: comparison of application areas

	POLO-KAL XS	POLO-KAL NG	POLO-KAL 3S
Above-ground drainage: Connection lines, Stacks, Manifolds, Ventilation lines	✓	✓	✓
Internal rainwater pipes see page 22	✓ with POLO-KAL XS | 3S ASV	✓ with POLO-KAL NG ASV	✓ with POLO-KAL XS | 3S ASV
Pressure lines for lifting stations see page 22	✓ with POLO-KAL XS | 3S ASV	✓ with POLO-KAL NG ASV	✓ with POLO-KAL XS | 3S ASV
Central vacuum cleaning systems see page 23	✓	✓	✓
Siphonic roof drainage see page 24		✓ with POLO-KAL NG ASV	
Commercial and industrial kitchens see page 24	✓	✓ with NBR seals	✓
Greasy exhaust air see page 24	✓	✓ with NBR seals	✓
Condensing boiler condensate drains see page 25	✓	✓ with silicone seals	✓
Dental surgeries see page 25	✓	✓	✓
School laboratories see page 25	✓	✓	✓
Pipes encased in concrete see page 34	✓	✓	✓
Underground pipes see page 34	✓	✓	

1.2 POLO-KAL® system components

1.2.1 System enhancements

It is our wide range of innovative and well-designed additional components that transform a pipe system into a complete system.

Transitions, plug-in seals, cut-to-length siphon elbows, and a whole lot more enable simple and flexible adaptation to different requirements.

POLO-KAL® pipe systems are compatible with all other EN-1451-1 compliant plastic pipe systems. POLOPLAST also offers a range of specially developed fittings for transitions to other materials.

POLO-KAL® Branch

1.2.2 Cleaning

POLO-EHP Control cleaning pipes provide easy access to the POLO-KAL® pipe system for inspection, maintenance and cleaning tasks – no metal closure mechanism is required and the pipes are pressure-tight up to 1.5 bar.

As a result, a high level of safety is guaranteed and functionality is ensured throughout the pipe system's service life.

POLO-EHP Control
Cleaning pipe

1.2.3 Fastenings

Our fastening systems, which are specially adapted for POLO-KAL® pipe systems, offer optimum safety and excellent sound-insulating properties. Quick and easy assembly is guaranteed with the POLO-CLIP and POLO-CLIP HS clamps. POLO-KAL dB and POLO-KAL dB^{+} system clamps are ideal for situations requiring high levels of sound insulation.

POLO-CLIP HS

1.2.4 Fire protection

POLOPLAST stands for uncompromising safety, and especially when it comes to fire protection. The system-tested and approved **POLO-BSM** fire protection collars meet the highest requirements for effective fire protection.

When used together with POLO-KAL® pipe systems, the fire protection collars deliver a practical, space-saving solution for a wide range of installation scenarios. POLO-KAL® can even be installed in underground car parks due to its compliance with fire protection regulations.

POLO-BSM

Note:
Access the fire protection configurator here

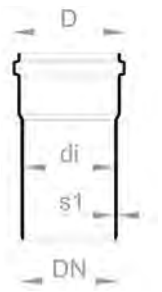
2. System properties

2.1 Technical data

	POLO-KAL XS	**POLO-KAL** NG	**POLO-KAL** 3S
Size range	DN 32–160	DN 32–250	DN 50–160
Material	Pipe: PP/PP-MR/PP; Fitting: MR PP Halogen-free, cadmium-free, heavy metal-free		
Approved fire protection solution	POLO-BSM		
Connection system	Push-fit socket with integrated seal	Push-fit socket with pre-fitted lip seal	Push-fit socket with integrated seal
Seal	Monotec socket	EPDM lip seal ring up to DN 200 From DN 200 made of NBR	Monotec socket
Colour	Pigeon blue RAL 5014		Light grey RAL 7035
Temperature resistance	Short-term 97 °C 30 sec/day = 152 hrs/50 years Long-term 95 °C 10 min/day = 3,000 hrs/50 years Long-term 60 °C 5 hrs/day = 87,600 hrs/50 years		
Application area code as per EN 1451-1	BD Inside buildings and buried in the ground within the building structure		B Inside buildings
Fire behaviour class as per DIN 4102	B2, Q1, TR1		B2, Q2, TR1
Fire behaviour as per EN 13501-1	D-s2, d0	D-s2, d1	
Ring stiffness of pipe as per EN ISO 9969	≥ 6.0 kN/m^2	≥ 6.0 kN/m^2 DN 32–160 ≥ 8.0 kN/m^2 DN 200–250	≥ 4.0 kN/m^2
Average linear expansion coefficient LEC	0.05 mm/mK		0.09 mm/mK
Low temperature resistance	Tested down to -20 °C		-
Leak tightness	Short-term to -900 mbar up to max. 30 °C		
Chemical resistance	PP pipes and pipe fittings as per DIN 8078, Supplement 1 Seals as per ISO TR7620 for domestic wastewater with a pH value of 2 to 13 (See page 21 onwards)		
Flexural modulus as per ISO 178	2.400–3.100 MPa		1.000 MPa
Drinking water suitability	Not approved for transporting drinking water		
UV resistance	2 years of outdoor storage		1 year of outdoor storage
Bendability	Up to 5 %	Up to 3.5 %	Up to 5 %
Maximum pipe clamp spacing for horizontal installation	15× outer diameter		
Pull-out-proof connection	Up to 2.5 bar (see page 42)		
Warranty	25 years		

Pipe geometry

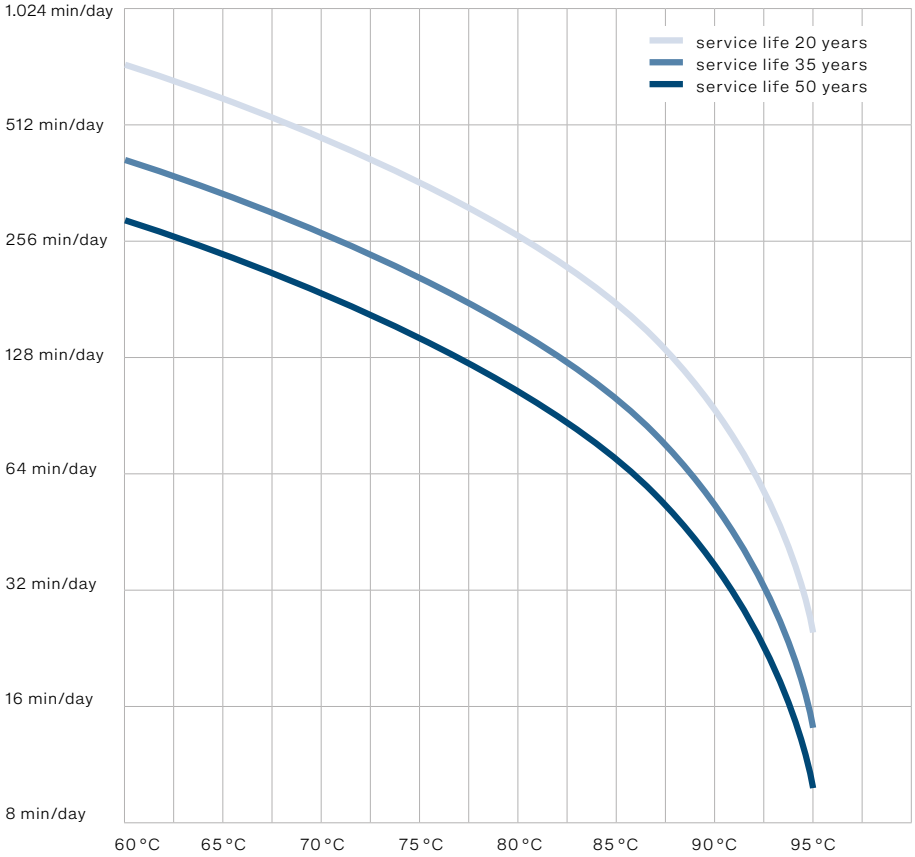
Dimensions in mm



DN	POLO-KAL XS				POLO-KAL NG				POLO-KAL 3S			
	s1	di	D	l/m	s1	di	D	l/m	s1	di	D	l/m
32	1.8	28.4	37.0	0.63	1.8	28.4	41.0	0.63	–	–	–	–
40	1.8	36.4	45.0	1.04	1.8	36.4	53.0	1.04	–	–	–	–
50	2.0	46.0	55.0	1.66	2.0	46.0	63.0	1.66	2.2	45.6	55.0	1.63
75	2.6	69.8	82.0	3.83	2.6	69.8	59.0	3.83	3.8	67.4	82.0	3.57
90	3.0	84.0	98.0	5.54	3.0	84.0	106.0	5.54	4.5	81.0	98.0	5.15
110	3.4	103.2	116.0	8.36	3.4	103.2	128.0	8.36	4.8	100.4	116.0	7.92
125	3.9	117.2	135.0	10.79	3.9	117.2	145.0	10.79	5.3	114.4	135.0	10.28
160	4.9	150.2	173.0	17.72	4.9	150.2	184.0	17.72	7.5	145.0	173.0	16.51
200	–	–	–	–	6.8	186.4	228.0	27.29	–	–	–	–
250	–	–	–	–	8.6	232.8	289.0	42.57	–	–	–	–

2.1.1 Temperature resistance

The diagram below shows service life in relation to temperature stress:



2.2 Chemical resistance

2.2.1 Drain cleaners

POLO-KAL® pipe systems can tolerate the infrequent use of drain cleaners containing the following main ingredients:

- Sodium hypochlorite
- Sodium hydroxide
- Hydrogen peroxide
- Potassium hydroxide

Note: The manufacturer's instructions for use must be observed when using drain cleaners.

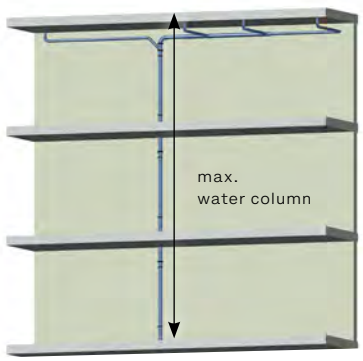
2.2.2 Other chemicals

POLO-KAL® pipe systems are suitable for wastewater with a pH value from 2 to 13. Chemical resistance at 20 °C is listed in the appendix 'Chemical resistance' from page 78. Any further information on resistance should be requested separately. The following details are required:

- Pipe system (e.g. POLO-KAL XS)
- Application
- Chemical substances (e.g. data sheets, safety data sheet)
- Concentration
- Temperature range
- Duration and frequency of use (e.g. 1 hr/day)

3. Applications

3.1 Internal rainwater pipes



Specific guidelines apply to internal rainwater pipes as backwater levels can often be high. A blockage in the lower section of the pipe network can cause rainwater to back up as far as the roof gullies. At a height difference of 10 metres, for example, this results in water pressure measuring 1 bar. Plug-in systems like POLO-KAL® pipe systems therefore need to be secured against coming apart, regardless of how pressure-tight they are.

POLO-KAL® pipe systems can be secured against separating by using the corresponding POLO-KAL XS | 3S ASV and POLO-KAL NG ASV pull-out-proof connections. Depending on their dimensions, pipes can be protected against backwater to a height of up to 25 metres (see table).

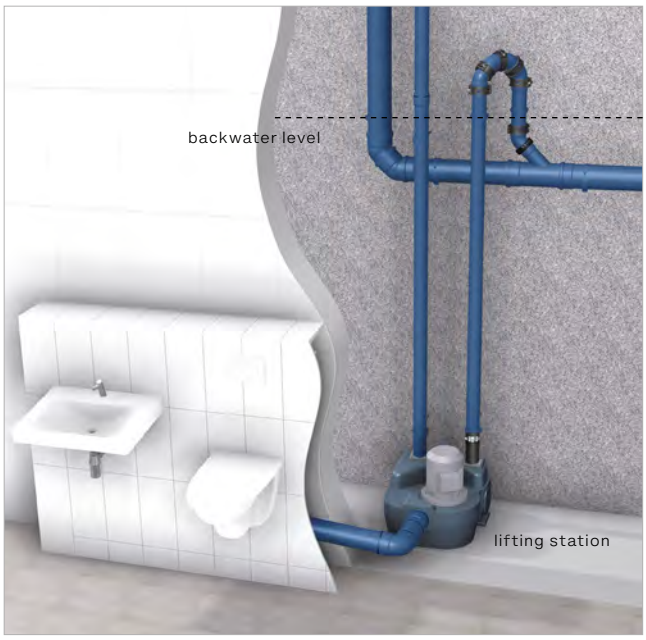
DN	max. water column
75	25 m
90	20 m
110	20 m
125	20 m
160	20 m
200	15 m
250	10 m

In cases where backwater heights exceed this, POLOPLAST can offer project-specific recommendations for additional measures (e.g. fastenings and pressure relief).
Internal rainwater pipes should also be insulated against condensation where necessary (see page 45).

3.2 Lifting stations and submersible pumps

The pipe systems POLO-KAL XS and POLO-KAL NG, together with their respective pull-out-proof connections POLO-KAL XS | 3S ASV and POLO-KAL NG ASV, are suitable for connecting lifting stations and submersible pumps used for grey and black water.

Advantages
- Quick installation using a simple push-fit system
- The pull-out-proof connection can be removed and reused as needed
- Minimal tool use required
- No restrictions on installation temperature
- Various connection fittings and flanges
- Anti-vibration couplers



Requirements
- Maximum connection size DN 90
- Not suitable for rainwater lifting stations (continuous operation, S1 continuous duty pumps) or industrial applications.
- Only use the pull-out-proof connection approved for the pipe system in question (POLO-KAL XS | 3S ASV and POLO-KAL NG ASV).
- The use of pull-out-proof connections in no way replaces the need for the pipework to be properly secured. The relevant installation guidelines must be observed (see page 53) onwards).
- Do not constrict pipes in the direction of flow.
- The maximum pump pressure must be clarified with the pump manufacturer in advance.

The pressure pipe must be able to withstand at least 1.5 times the maximum pump pressure of the system. The maximum pump pressure listed below applies to POLO-KAL XS | 3S ASV and POLO-KAL NG ASV

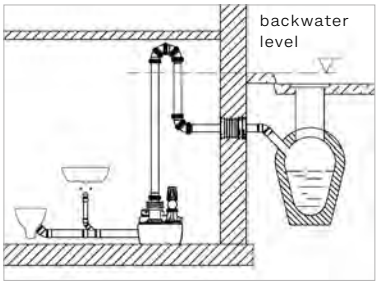
	DN 32 to DN 75	DN 90
Maximum permissible system pump pressure	1.65 bar	1.33 bar

Standard requirements as per EN 12056-4

Overloading, blockages or cross-sectional narrowing can lead to backwater in rainwater and wastewater systems. Drainage points below backwater level therefore need to be protected against wastewater backup. Wastewater lifting stations with backwater loops provide such protection. Only designs with a backwater loop offer a high degree of protection against backwater.

Standard specifications

- Standard specifications
- Use **decoupling** for wastewater lifting stations
- Take the gradient in account to ensure all pipework can drain
- Do not constrict pipes in the direction of flow
- Comply with the minimum nominal diameter as specified in EN 12056-4, Table 2
- Do not connect anything else to pressure lines
- Always connect pressure lines to ventilated underground pipes and manifolds but never to stacks.
- The pressure line must withstand at least 1.5 times the maximum pump pressure of the system
- Vent valves must not be fitted in the pressure line



Connecting lifting stations and submersible pumps

Spigot end	Screw connection		Decoupled screw connection		Flange connection
DN 32	1" Internal thread A. no. 01732	1" External thread A. no. 01733	1" Internal thread A. no. 01843	1" External thread A. no. 01840	
DN 40	1 1/4" Internal thread A. no. 01734	1 1/4" External thread A. no. 01735	1 1/4" Internal thread A. no. 01844	1 1/4" External thread A. no. 01841	
DN 50	1 1/2" Internal thread A. no. 01737	1 1/2" External thread A. no. 01736	1 1/2" Internal thread A. no. 01845	1 1/2" External thread A. no. 01842	
DN 75					PN 16 A. no. 01740 + 01741
DN 90					PN 16 A. no. 01742 + 01743

3.3 Central vacuum cleaning systems

Central vacuum cleaning systems are a convenient low-noise alternative to conventional vacuum cleaners. The vacuum unit is stored in a central location such as in the basement. A permanent pipe system connects the suction sockets throughout the building to the central unit. The vacuum hose is simply plugged into these sockets for vacuuming.

POLO-KAL® pipe systems can be used as air ducting for all common central vacuum cleaning systems.

Please consult the manufacturer of your central vacuum cleaning system for information on installation and planning.

Example: THOMAS CentraClean central vacuum cleaning system

3.4 Siphonic roof drainage

Siphonic roof drainage (pressure assisted drainage) allows large roof areas to be drained quickly. The system functions at full capacity. This offers a number of advantages: pipes can be smaller in size, there isn't a need for gradients and the system is largely self-cleaning.

The POLO-KAL NG pipe system with POLO-KAL NG ASV pull-out-proof connection can be used as drainage pipes for all common siphonic roof drainage systems.

3.5 Special applications

3.5.1 Commercial and industrial kitchens

Pipe systems need to fulfil special requirements in cases where wastewater is discharged through a grease separator. POLO-KAL® pipe systems can be used to transport grease-containing wastewater from commercial and industrial kitchens into a grease separator. The following requirements must be met:

- For POLO-KAL NG, the factory-fitted seal rings must be replaced with oil and grease-resistant NBR seals
- The integrated seal is sufficiently resistant for POLO-KAL XS and POLO-KAL 3S
- The pipe system's general temperature resistance must be taken into account (see page 19)
- A minimum gradient of 2 % must be maintained.
- POLO-KAL® pipe systems must not be used as pressure lines for the grease separator waste pipeline.

If trace heating is required, its surface temperature must not exceed 45 °C. The standard EN 1825-2 recommends thermostat control and a temperature between 25 °C and 40 °C. The user instructions issued by the trace heating cable manufacturer must be observed. Ideally, the trace heating cable should be attached in a 5 or 7 o'clock position and covered with aluminium tape.

The requirements set out in EN 1825 and the instructions supplied by the grease separator manufacturer apply to the supply lines and operation of the grease separator.

All POLO-KAL® pipe systems with factory-fitted can be used downstream of the grease separator.

3.5.2 Greasy exhaust air

POLO-KAL® pipe systems are suitable for use as exhaust air ducts for exhaust air containing grease. For POLO-KAL NG, the factory-fitted seal rings needs to be replaced with oil and grease-resistant NBR seals. All applicable fire protection regulations must be observed.

3.5.3 Heating oil tanks and wood fuels

POLO-KAL® pipe systems must not be used as fill or vent lines for oil tanks. Plastic pipes are generally unable to provide the required pressure resistance.

Due to the potential static charge and mechanical stress, POLO-KAL® pipe systems must not be used for feeding or conveying pellets, wood chips, or similar materials.

3.5.4 Condensing boiler condensate drains

POLO-KAL XS can be used for condensing boilers and smokestacks to drain condensate from the following fuels:

- Natural gas L+H
- Oil with sulphur content < 0.2 % (mass percentage)

When using POLO-KAL NG, factory-fitted seals must be replaced with temperature and acid-resistant silicone seals, which can be ordered separately from POLOPLAST (available from DN 50). POLO-KAL® screw transitions must not be used.

3.5.5 Dental surgeries

POLO-KAL® pipe systems are suitable for connecting suction systems in dental surgeries and are resistant to amalgam.

3.5.6 Swimming pools

POLO-KAL® pipe systems can be used for draining swimming pool water containing chlorine, bromine, and salt in accordance with ÖNORM M6215 and DIN 19643 (limit value for halogens max. 1 mg/l at max. 35 °C).

POLO-KAL® is not suitable for overflow and circulation pipes.

3.5.7 Outdoor areas

POLO-KAL® pipe systems are not intended for permanent outdoor use. POLO-KAL XS and POLO-KAL NG can be stored outdoors for up to two years, POLO-KAL 3S for up to one year.

Any further exposure to UV radiation beyond these periods bleaches the colour and reduces the mechanical strength of the pipe system.

3.5.8 Laboratories

Laboratories in schools don't typically use large quantities of hazardous aggressive substances. All POLO-KAL® pipe systems can be used for drainage and ventilation in school laboratories.

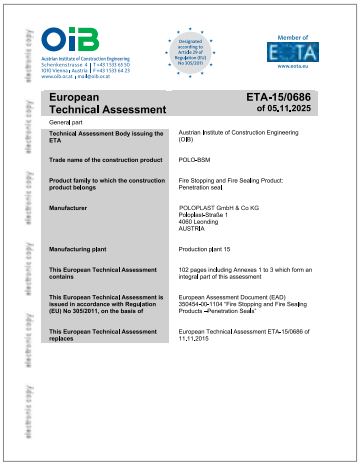
Other laboratory conditions and requirements must be verified separately, and the details of the discharged chemicals provided for this purpose (see page 78).

4. Approvals and certificates

4.1 Approval

	POLO-KAL XS	**POLO-KAL** NG	**POLO-KAL** 3S
AT	TGM VA-KU 25074	TGM KU 15.300	ÖKI 25764
DE	Z-42.1-506	Z-42.1-241	Z-42.1-341
FR	QB-286-2299 / ATec n°22/20-2299	QB-286-2298 / ATec n°22/20-2298	QB-286-2350 / ATec n°22/25-2350
DK	VA 2.14/20732	VA 2.14/20750	
NOR	SINTEF 3311	SINTEF 0396	
SWE	SC1221-16	0704/99	
CZK	23 0597 V/AO	23 0598 V/AO	23 0599 V/AO

4.1.1 POLO-BSM fire protection collar



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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
www.eota.eu

European Technical Assessment — **ETA-15/0686 of 05.11.2025**

General part

Technical Assessment Body issuing the ETA	Austrian Institute of Construction Engineering (OIB)
Trade name of the construction product	POLO-BSM
Product family to which the construction product belongs	Fire Stopping and Fire Sealing Product: Penetration seal
Manufacturer	POLOPLAST GmbH & Co KG Poloplast-Straße 1 4060 Leonding AUSTRIA
Manufacturing plant	Production plant 15
This European Technical Assessment contains	102 pages including Annexes 1 to 3 which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) 350454-00-1104 "Fire Stopping and Fire Sealing Products –Penetration Seals"
This European Technical Assessment replaces	European Technical Assessment ETA-15/0686 of 11.11.2015

POLO-BSM
ETA approval ETA-15/0686

Tip: All approvals are available for download at .

4.2 CE declaration of performance

Products must carry the CE mark in accordance with Regulation (EU) 305/2011 on harmonised conditions for the marketing of construction products, which came into force on 1 July 2013. Harmonised standards form the basis for this. However, such standards are not yet in force for above-ground drainage. CE marking is therefore not currently available for POLOPLAST above-ground drainage systems.

CE declarations of performance for individual components, such as fire protection collars, are available for download at , provided the corresponding standards exist.

Note: CE marking for above-ground drainage pipes is not currently possible as harmonised standards are not available.

4.3 Warranty

POLO-KAL XS . **POLO-KAL** NG . **POLO-KAL** 3S

Guarantee Declaration

poloplast

Applications	Product range		
	POLO-KAL XS	**POLO-KAL** NG	**POLO-KAL** 3S
Building drainage*	✓	✓	✓
Ventilation	✓	✓	
Central vacuum cleaning system	✓	✓	✓
Vacuum drainage in buildings**		✓	

* except shipbuilding
** using the POLO-KAL NG vacuum pipe system

Our promise to supply the highest quality pipes and fittings also includes the following guarantee for products manufactured by POLOPLAST within the POLO-KAL XS, POLO-KAL NG and POLO-KAL 3S product ranges. In addition to any statutory warranty claims and claims for damages, POLOPLAST provides the following guarantee subject to agreement of POLOPLAST's General Terms and Conditions.

Guarantee

POLOPLAST accepts liability worldwide (excluding the USA and Canada) for damage caused by the use of the products covered by this guarantee declaration. Such damage must be a result of manufacturing defects, material defects, instruction-related defects due to incorrect storage, laying and installation instructions, or the absence of properties expressly assured by POLOPLAST. **This liability is valid for 25 years from the date of manufacture** and includes:

1. free replacement delivery to the point of use of the parts required to rectify the damage as well as
2. the necessary removal and installation costs, including the costs of restoring the building to its original condition, up to an amount of € 2,000,000.00 per damage event.

POLOPLAST provides a guarantee to its contractual partners within the meaning of this declaration if:

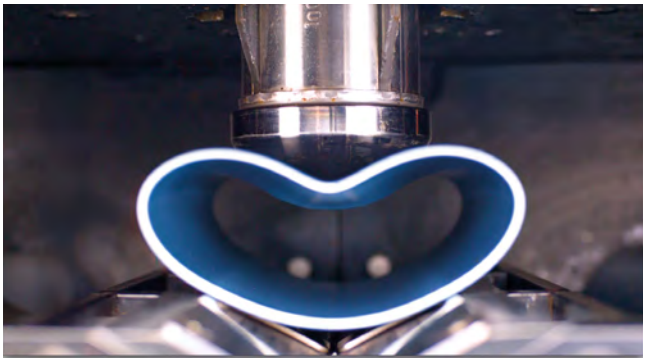
1. the installation has been carried out by trained professionals from a licensed sanitary installation company according to the intended specifications. All technical requirements applicable at the time of installation must also have been taken into account.
2. the contractual partner proves that only original POLOPLAST parts have been used and that these have not been combined with products from other manufacturers.
3. the contractual partner proves that the cause of the damage is not attributable to parts subject to natural wear and tear, external mechanical damage or other external influences.
4. it is proven that all storage, laying, installation and usage instructions valid at the time of installation have been followed in full.
5. all necessary measures to minimise damage have been taken without delay.
6. the damage is reported to POLOPLAST promptly, and in any case within 7 days of the damage being noticed, together with a statement of the circumstances.
7. POLOPLAST is given the opportunity to determine and inspect the damage itself or through third parties prior to the repair work.
8. all parts associated with the claim are retained for the purpose of investigating the damage and are made available to POLOPLAST on request.
9. the contractual partner submits suitable proof of the manufacture and installation date.
10. the contractual partner presents the corresponding delivery documents from POLOPLAST.

POLOPLAST GmbH & Co KG
Valid from December 1, 2025.

03/01.26_EN_wanted.co.at

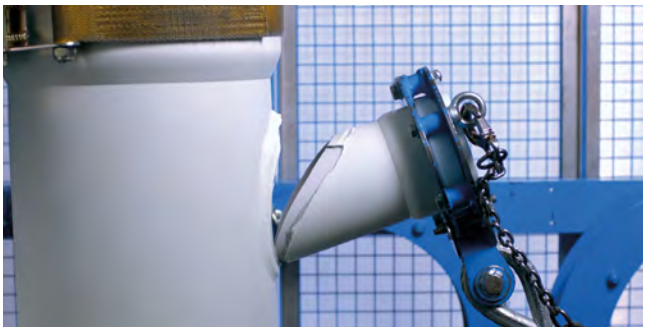
4.4 Quality management

Series products undergo regular laboratory testing to ensure POLO-KAL® pipes and fittings are of the highest quality.



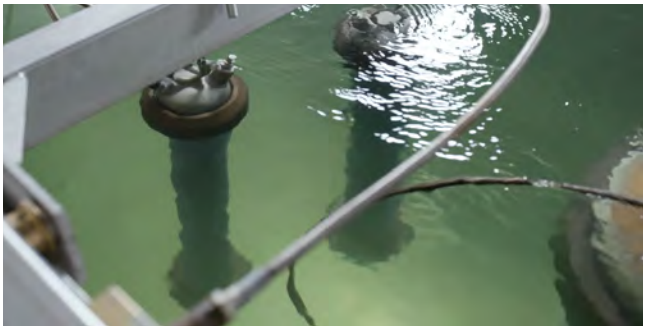
Ball drop test on POLO-KAL XS DN 110 as an example

In the **ball drop test**, the tensile strength of POLO-KAL® pipes at low temperatures is tested using a falling steel body. The pipes withstand a 10 kg impact at 4.4 m/s (DN 110) – compared to the standard requirement of only 1 kg.



Test on POLO-ECO plus Premium DN 400/160/45° as an example

The **strength of welded components** is tested until they break. A tensile force of up to 1,800 kg is applied until the component fails, which exceeds the normative requirement by a factor of 3.5.



Various POLO-KAL® pipes for the internal pressure creep rupture test

The **time-dependent internal pressure test** checks the material properties with regard to their service life. The pipes impress with a test duration of up to 1,000 hours.

POLO-KAL NG DN 200 during measurement

Optical 3d measurement of components is carried out using precision optical measurement accurate to a hundredth of a millimetre. This 3D measurement is based on the factory standard, thereby ensuring precise product geometry and practical pluggability.

5. Planning and layout

5.1 Dimensioning

Drainage systems are dimensioned in accordance with the European standard EN 12056-2.

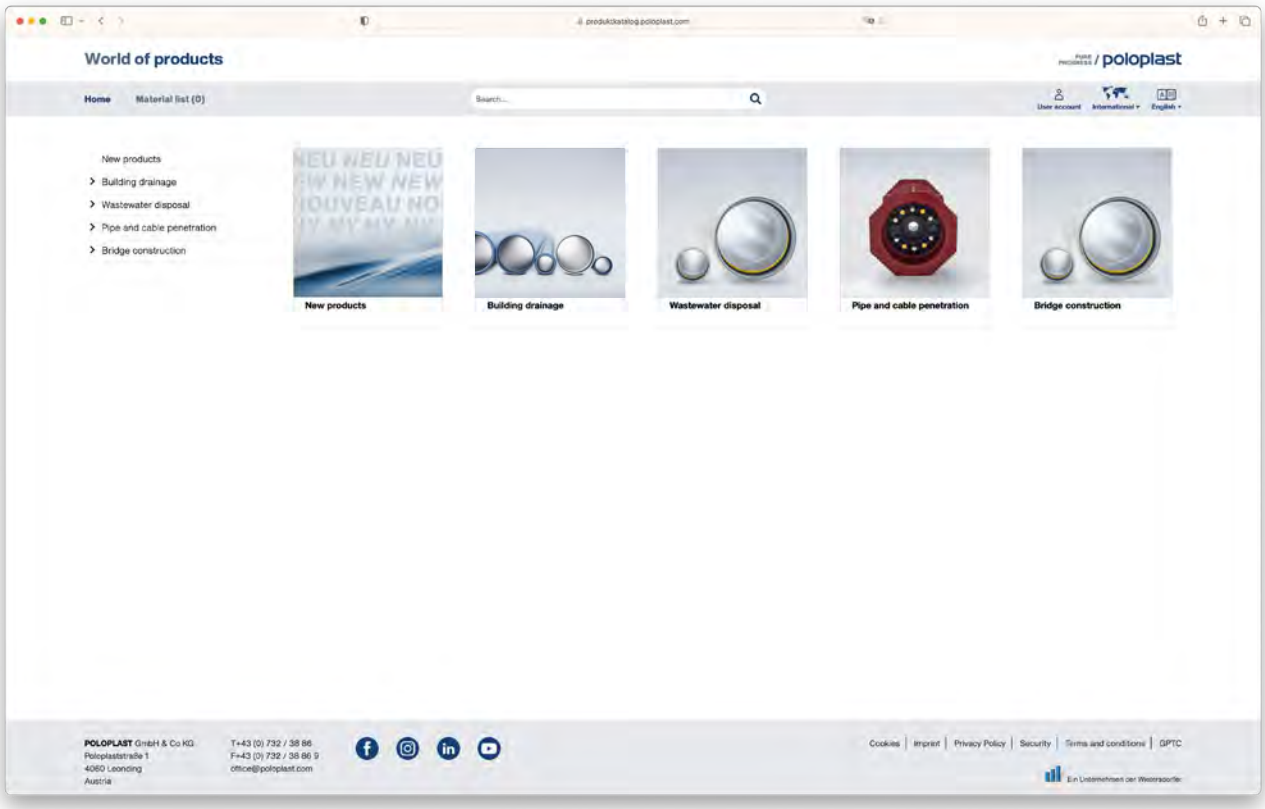
The practical online tool on our website offers quick, straightforward dimensioning.

Website:

5.2 Product data

The entire range of POLOPLAST products can be found in our **online product catalogue** 'World of Products'.

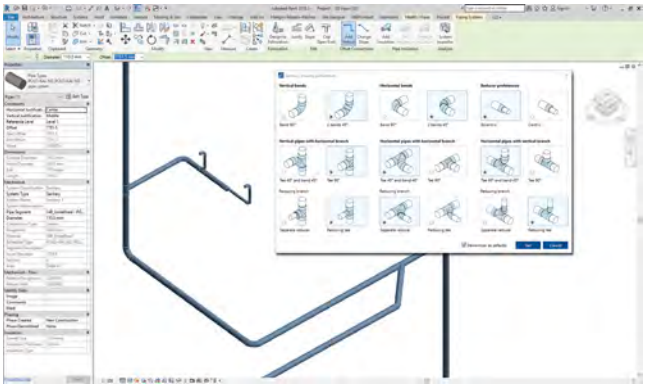
- Product range overview
- Images and dimensions sheets
- CAD data in various formats
- Tender texts
- Documents and videos
- Labels
- Creation of material lists



5.3 Planning software

POLOPLAST offers practical solutions for the virtual realisation of POLO-KAL® pipe systems in a variety of areas, from visualisation through to dimensioning.

5.3.1 Autodesk Revit (BIM)



The **POLOPLAST Product Line Placer, PLiP for short**, makes it possible to design all POLO-KAL® pipe systems in a matter of seconds. Pipe systems are quickly integrated into Revit using the app. When designing the pipe network, the autorouting function automatically positions all elbows, branches and transitions. The optimisation function perfects the pipe network with a single click. Connectors, flow direction, and alignment of fittings are automatically adjusted and corrected. Various versions of branches and elbows can be individually predefined for this purpose.
A concise material list of all POLOPLAST products used for the finished pipe network is then created.

Essentially, working with POLOPLAST PLiP is simpler and quicker than using Revit family packs alone. The free Autodesk Revit app makes BIM compliance significantly easier.

Advantages
- Up-to-date country-specific product data
- Easy designing thanks to autorouting function
- Automatic placing of fittings
- Optimisation function
- Creation of material lists
- Free to use

Download at

5.3.2 MagiCAD

MagiCAD for Revit: make creating BIM models faster, easier, and more flexible!
All POLO-KAL® pipe systems are available for download in the wastewater section.

5.3.3 MEPcontent for Revit

POLOPLAST fittings are available to download free of charge in one of the largest BIM libraries for Revit. A great addition to POLOPLAST PLiP.

5.3.4 liNear Building

liNear Building is professional design software provided by liNear. All POLO-KAL® pipe systems are available for the wasterwater module, for dimensioning and quality take-off.

5.3.5 Plancal nova

Plancal nova offers a comprehensive software platform for project management.
The plumbing module in the MEP section includes all POLO-KAL® pipe systems for dimensioning wastewater systems.

5.3.6 MH software

The MH software drinking water / wastewater module enables the planning of drainage pipe networks. POLO-KAL® pipe systems can be selected for dimensioning and material take-off.

5.4 Tender texts

POLOPLAST will provide you with tender texts on request. Please contact your POLOPLAST representative directly.

6. Installation

6.1 Linear expansion

6.1.1 Detached houses and multi-occupancy properties

Conventional residential buildings, e.g. detached houses and multi-occupancy properties, don't require measures for linear expansion for installation temperatures above 15 °C with straight pipe lengths of up 10 m.

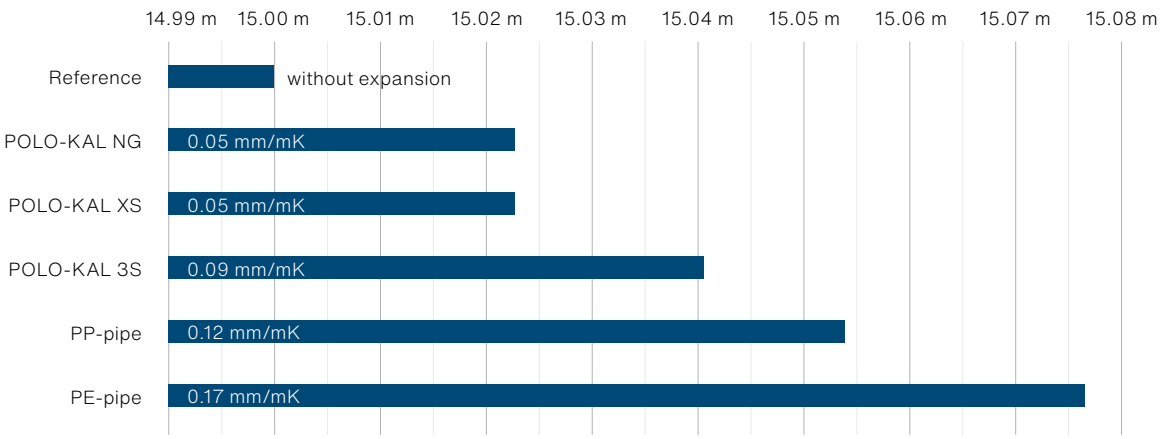
6.1.2 Commercial and industrial buildings

Linear expansion needs to be checked where necessary for pipe lengths over 10 m without a change of direction. For special applications with high wastewater temperatures (commercial, industrial), linear expansion can be determined as follows:

Linear expansion [mm] =
LEC [mm/mK] × temperature difference [Δt] × straight pipe length [m]

Pipe system	LEC
POLO-KAL XS	0.05 mm/mK
POLO-KAL NG	0.05 mm/mK
POLO-KAL 3S	0.09 mm/mK

Example: A 15 m long straight pipe is installed at 0 °C. A maximum of 30 °C can be expected when the pipe is in use. POLO-KAL NG will become approx. 2 cm longer due to linear expansion. Other pipe materials display a linear expansion of more than 7 cm.



6.1.3 Accounting for linear expansion

To correctly calculate linear expansion the following factors need to be taken into account in relation to installation temperature:

- Expected medium temperature
- Room temperature when in use
- Waste heat from machines or other pipes in the vicinity
- Sun exposure through windows or skylights

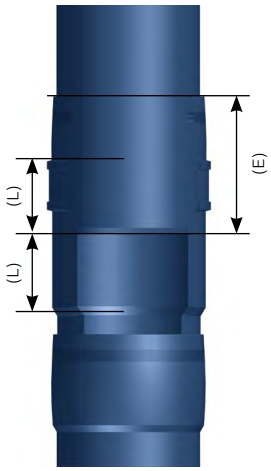
Linear expansions that only occur once (e.g. installation at 0 °C -> room temperature 20 °C) can very easily be compensated for by retracting the spigot ends up to 10 mm from the sockets during installation.

Recurring linear expansions (e.g. waste heat, sun exposure) or pipes with pull-out-proof connections need to be compensated for with long sockets where necessary.

6.1.4 Long socket installation

6.1.4.1 Insertion depth

The spigot end needs to be inserted approx. 2/3 of the way into the long socket. The relevant insertion depth (E) and maximum permissible length compensation (L) can be found in the table below.



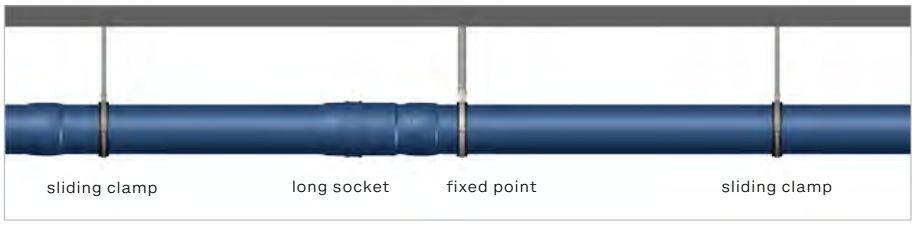
	POLO-KAL NG		POLO-KAL XS		POLO-KAL 3S	
DN	**E [mm]**	**L [mm]**	**E [mm]**	**L [mm]**	**E [mm]**	**L [mm]**
40	71	34	69	33		
50	79	38	79	38	79	38
75	91	43	89	43	89	43
90	95	46	95	45	95	45
110	110	53	110	53	110	53
125	125	60	125	60	125	60
160	143	70	143	70	143	70
200	187	91				
250	231	114				

6.1.4.2 Fastening to the long socket

Only sliding clamps should be used to allow for linear expansion of the pipework, with the exception of the fixed points defined below. Fixed points should be installed at least 10 cm away from the pipe sockets.

Long sockets must be secured by fixed points. The position of the fixed points differs for horizontal and vertical installation.

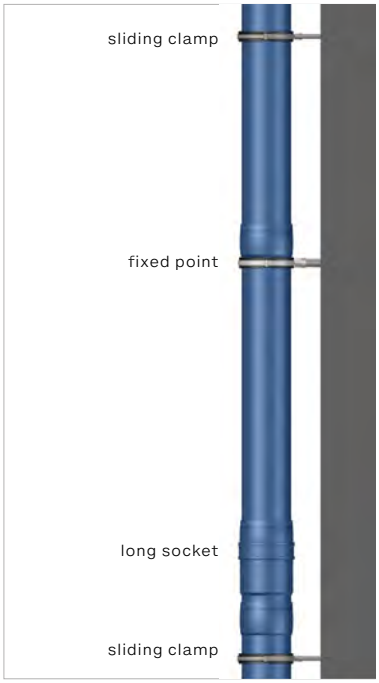
- **Horizontal installation** The fixed point is attached to the pipe into which the spigot end of the long socket is inserted. This means that the pipe section is inserted into the subsequent long socket starting from the fixed point.



Horizontal installation

- **Vertical installation** The fixed point is attached above the long socket, ideally directly to a socket. This prevents the pipe section from slipping back into the long socket.

The maximum fastening clearances listed in the pipe fastening section on page 47 must be observed.



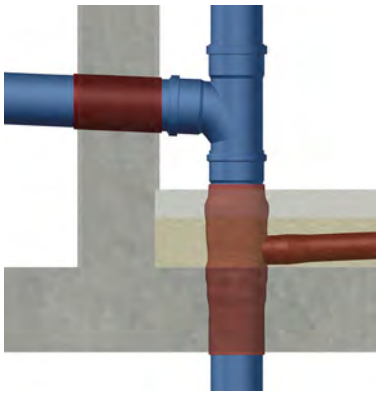
Vertical installation

6.1.4.3 Linear expansion with POLO-KAL NG ASV and POLO-KAL XS | 3S ASV

When installing pull-out-proof connections, the necessary linear compensation must always be ensured through the use of long sockets. It is important to make sure that pull-out-proof connections are not installed in the area where the long socket absorbs expansion.

6.2 Installation scenario

6.2.1 Wall and ceiling feed-throughs



In order to prevent the pipe from coming into contact with the building structure, we recommend decoupling the pipe with insulation (e.g. 3-5 mm PE insulating sleeve) where the pipe passes through walls and ceilings.

If floating screed is applied to floors, exposed pipe sections must be acoustically decoupled by wrapping with soft materials (e.g. glass wool).

6.2.2 Installation in brick

Recesses and wall channels are only permitted to the extent that they don't compromise the stability and load-bearing capacity of brick walls. Wall channels must be positioned in a way that allow the pipe run to be installed without any tension.

If the pipework is directly plastered in, the pipes and fittings first need to be fully sheathed in suitable materials e.g. a 3-5 mm PE insulating sleeve or 3-5 mm PE pipe wrap (structure-borne sound insulation).

6.2.3 Setting in concrete

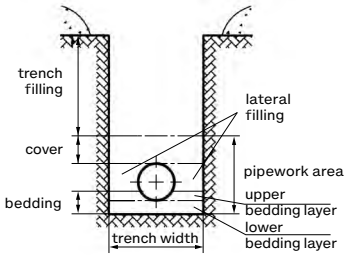
POLO-KAL® pipes and fittings can be set in concrete. The pipe sections need to be fastened in a way that prevents them from moving during concreting. The pipe also needs to be sheathed in an insulating sleeve (e.g. 3-5 mm PE insulating sleeve) to ensure sound insulation. Joints and openings must be wrapped in tape to prevent concrete from entering.

If an insulating sleeve isn't used, the joint gaps must be sealed with tape or wrapped in film to prevent cement slurry from entering during the concreting and setting process.

The linear expansion of the pipes must be accounted for as described above (see page 32).

6.2.4 Underground installation

POLO-KAL XS and POLO-KAL NG can be installed underground up to the property boundary. The corresponding standards, in particular EN 1610, must be observed during installation. Local conditions such as operating requirements, soil properties, static requirements and dynamic loads also need to be taken into consideration.

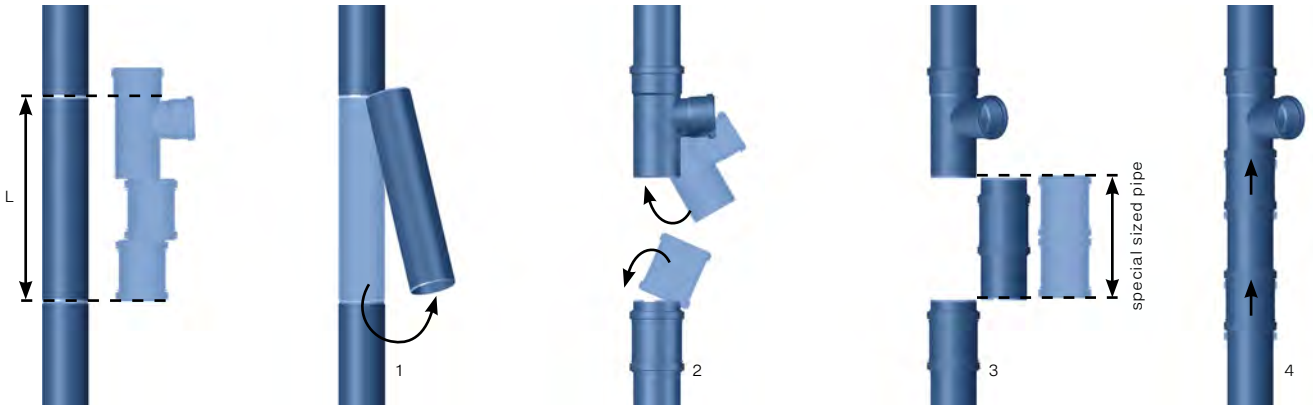


A minimum coverage of 80 cm is typically required. A minimum coverage of 1 m is required for live loads. Cover thicknesses less than 80 cm must be approved by POLOPLAST.

Suitable bedding materials primarily include sands, gravels and chips with a grain size of 0–8 mm or 4–8 mm.

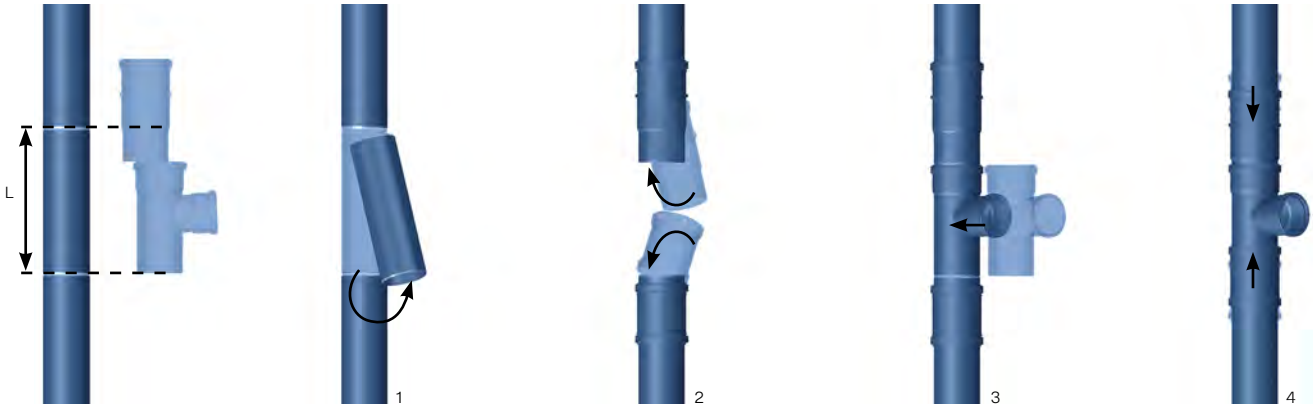
6.2.5 Retrofitting branches

Version with slip coupling



Cut a pipe section of the appropriate length from the pipework (1). Push the branch and slip coupling onto the pipe ends (2). Push the second slip coupling onto a pipe piece the length of two slip couplings (3). Insert the pipe piece and slide the two slip couplings over the ends (4).

Version with slip coupling and long socket

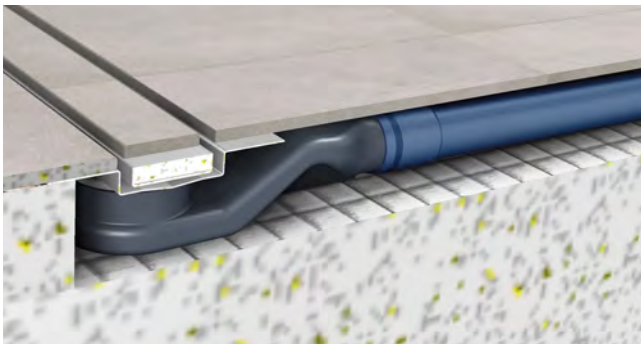


Cut a pipe section of the appropriate length from the pipework (1). Push the slip coupling and long socket onto the pipe ends (2). Insert the branch (3). Push back the long socket and slip coupling (4).

6.2.6 Thin floor structures

POLO-KAL XS

The slimline POLO-KAL XS Monotec socket saves space in floor structures. In the case of DN 40 and 50, the saving is already as much as 8 mm compared to conventional push-fit systems.



Corner double branch with aligned socket bases

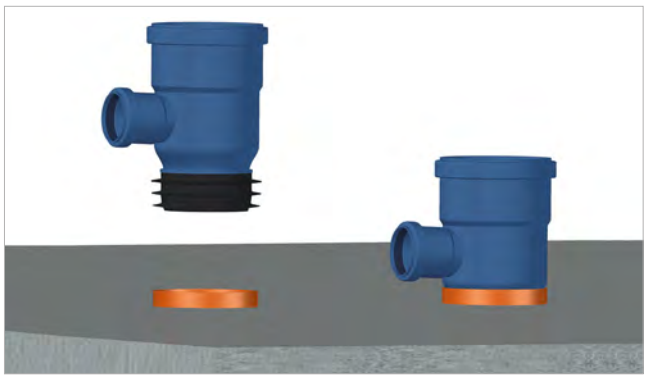
Using a corner double branch with aligned socket bases makes it possible to integrate showers and toilets, for example, into the stack at the lowest possible standard-compliant height.

6.2.7 Flush-to-floor pipe connection

POLO-KAL NG transitions and branches can be directly inserted into a smoothly cut pipe end.

Applications:

- Connections to flush-to-floor cut pipes set in concrete
- Solution for damaged sockets
- Integration into unfinished ceilings

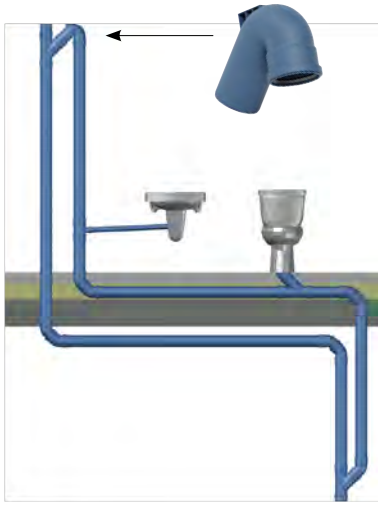


Transition	DN	Fig.	A. no.
a b	110/50	a	02369
	110/75	a	02370
	110/90	b	02367
	110/110	b	02381
	160/110	b	02366

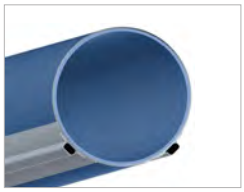
Branch	DN	A. no.
	110/50	01943
	110/110	01944

6.2.8 Ventilation

It might be necessary to install ventilation or bypass pipes to comply with relevant standards. The POLO-KAL® ventilation elbow DN 110/135° (A. no. 02145) enables space-saving integration of the ventilation pipe into the stack.



6.2.9 Use of trace heating cable



POLO-KAL® pipe systems can be heated with trace heating cable where these have a maximum surface temperature of 45 °C. The trace heating cable manufacturer's instructions for use must be observed.

We recommend fitting the trace heating cable in a 5 or 7 o'clock position and covering it with aluminium tape. Aluminium tape between the pipe and trace heating cable also improves heat transfer.

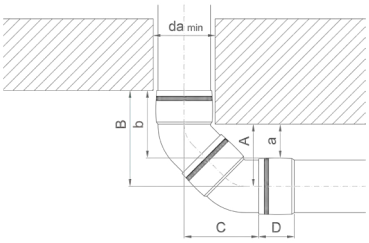
6.3 Space requirements

6.3.1 Redirection

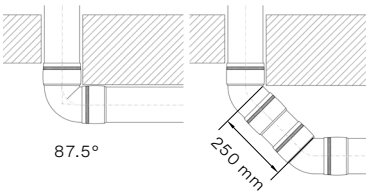
We offer dimensions for various fitting combinations. Detailed fitting dimensions can be found in the digital product catalogue at .

Dimensions in mm

POLO-KAL XS and POLO-KAL 3S



2 × 45°

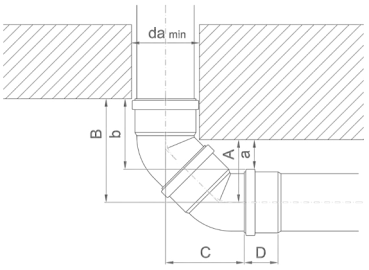


2 × 45° long

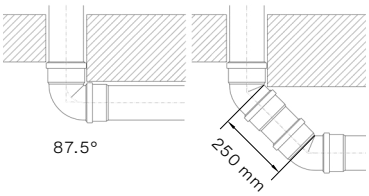
DN	Elbow	da_{min}	A	a	B	b	C	D
32 *	87.5°	42	21	3	65	46	16	41
40 *		50	25	3	72	50	24	45
50		60	30	3	87	54	30	47
75		87	44	3	98	58	47	53
90		103	52	3	105	59	50	59
110		124	62	3	127	69	62	65
125		146	71	3	136	73	70	82
160		176	88	3	173	88	90	96
32	2 × 45°	42	50	32	100	76	53	41
40		50	60	37	113	91	68	45
50		60	69	41	127	99	76	47
75		87	85	44	143	102	91	53
90		103	95	47	159	111	95	59
110		124	124	64	203	143	159	65
125		146	139	69	218	152	176	82
160		176	167	81	266	180	199	96
75	2 × 45° long	87	213	173	276	243	217	53
90		103	218	170	285	238	228	59
110		124	230	170	307	247	267	65
125		146	234	166	313	255	270	82
160		176	252	166	354	270	287	96

* only for POLO-KAL XS

POLO-KAL NG



2 × 45°

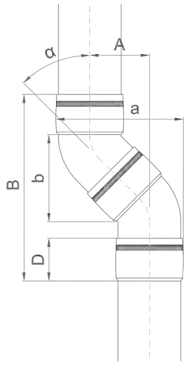


2 × 45° long

DN	Elbow	da_{min}	A	a	B	b	C	D
32	87.5°	43	23	3	63	42	17	41
40		55	29	3	73	46	23	45
50		65	35	3	82	50	29	47
75		91	49	3	94	55	45	53
90		108	57	3	105	52	50	57
110		130	68	3	130	66	64	62
125		147	77	3	143	72	53	67
160		186	95	3	174	84	70	77
200		230	119	3	234	122	85	122
250		291	188	45	442	297	227	156
32	2 × 45°	43	51	31	94	75	51	41
40		55	60	33	109	83	63	45
50		65	66	35	122	91	75	47
75		91	84	40	145	101	93	53
90		108	93	41	156	104	94	57
110		130	118	55	199	136	153	62
125		147	130	58	216	144	135	67
160		186	159	68	259	168	163	77
200		230	205	92	344	231	207	122
250		291	353	207	610	461	414	156
75	2 × 45° long	91	215	171	276	232	223	53
90		108	221	169	283	232	220	57
110		130	227	164	306	243	261	62
125		147	232	160	317	247	239	67
160		186	247	156	350	259	255	77
200		230	305	192	446	334	335	122
250		291	348	203	607	461	415	156

6.3.2 Stack offset

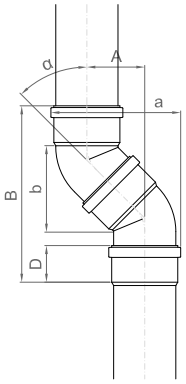
POLO-KAL XS and POLO-KAL 3S



DN	Angle	A	a	B	b	D
32 *	15°	14	50	158	57	41
	30°	30	65	160	60	41
	45°	45	82	159	61	41
	67°	67	104	149	53	41
	87.5°	81	118	136	40	41
40 *	15°	16	61	175	69	45
	30°	34	79	179	73	45
	45°	52	97	179	73	45
	67°	77	122	168	62	45
	87.5°	96	139	154	48	45
50	15°	17	72	188	76	47
	30°	38	92	196	82	47
	45°	58	112	195	83	47
	67°	85	139	187	73	47
	87.5°	111	165	173	59	47
75	15°	20	101	214	84	53
	30°	44	125	226	97	53
	45°	70	149	231	103	53
	67°	110	191	228	99	53
	87.5°	142	221	205	82	53
90	15°	22	118	234	94	59
	30°	47	145	246	107	59
	45°	78	174	253	115	59
	67°	124	221	252	112	59
	87.5°	158	254	232	93	59
110	15°	24	142	263	107	65
	30°	57	174	283	126	65
	45°	108	226	330	154	65
	67°	146	262	293	138	65
	87.5°	192	311	275	120	65
125	15°	27	161	284	117	82
	30°	60	193	306	136	82
	45°	116	251	358	168	82
	67°	155	288	317	147	82
	87.5°	208	343	299	128	82
160	15°	39	209	382	162	96
	30°	85	255	410	189	96
	45°	223	308	425	204	96
	87.5°	260	427	368	169	96

* only for POLO-KAL XS

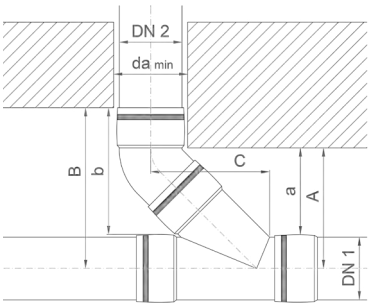
POLO-KAL NG



DN	Angle	A	a	B	b	D
32	15°	13	53	150	55	41
	30°	28	69	150	59	41
	45°	42	83	145	58	41
	67°	62	103	138	50	41
	87.5°	77	118	124	37	41
40	15°	15	68	163	66	45
	30°	33	85	168	71	45
	45°	50	103	168	71	45
	67°	75	126	160	63	45
	87.5°	93	146	145	47	45
50	15°	16	79	178	72	47
	30°	35	98	184	78	47
	45°	56	119	186	81	47
	67°	85	148	177	73	47
	87.5°	108	170	165	59	47
75	15°	19	109	204	83	53
	30°	42	131	215	95	53
	45°	67	157	221	101	53
	67°	107	196	218	97	53
	87.5°	139	227	203	84	53
90	15°	21	126	223	89	57
	30°	46	150	237	104	57
	45°	75	180	244	111	57
	67°	120	225	245	112	57
	87.5°	151	256	222	92	57
110	15°	24	151	254	106	62
	30°	54	181	276	124	62
	45°	102	229	321	147	62
	67°	142	269	288	133	62
	87.5°	187	314	270	118	62
125	15°	25	169	273	110	67
	30°	57	201	295	132	67
	45°	108	252	345	160	67
	67°	154	298	311	145	67
	87.5°	204	349	294	125	67
160	15°	35	217	363	152	77
	30°	80	263	389	180	77
	45°	131	313	406	195	77
	67°	190	372	375	183	77
	87.5°	254	436	361	160	77
200	15°	43	271	443	184	122
	30°	95	323	487	215	122
	45°	165	394	534	245	122
	87.5°	344	572	497	219	122
250	45°	193	485	646	310	156
	87.5°	665	955	873	618	156

6.3.3 Branch 45°

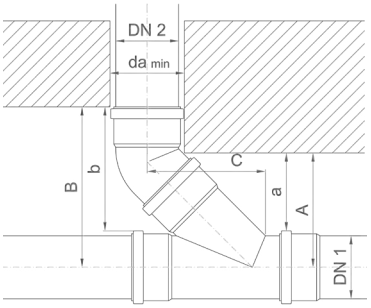
POLO-KAL XS and POLO-KAL 3S



DN 1	DN 2	da_{min}	A	a	B	b	C
32 *	32	42	77	59	125	109	76
40 *	32	42	81	59	129	109	75
	40	50	90	67	141	120	88
50	32	42	87	60	135	110	76
	40	50	94	67	145	120	88
	50	60	105	77	159	134	104
75	50	60	116	75	172	135	104
	75	87	138	97	201	163	140
90	50	60	125	77	179	134	103
	75	87	153	104	214	169	146
	90	103	162	113	224	180	162
110	50	60	133	73	190	134	104
	75	87	162	103	219	163	140
	90	103	175	116	238	183	168
	110	124	208	148	280	224	208
125	75	87	175	107	234	171	148
	110	124	219	151	292	229	212
	125	142	234	166	316	254	231
160	110	124	241	154	314	233	215
	125	142	263	177	345	265	246
	160	179	292	205	389	308	292

* only for POLO-KAL XS

POLO-KAL NG



DN 1	DN 2	da_{min}	A	a	B	b	C
32	32	43	73	53	118	102	72
40	32	43	77	51	122	102	72
	40	55	87	61	138	118	87
50	32	43	83	52	127	102	72
	40	55	92	61	143	118	87
	50	65	101	71	156	131	102
75	50	65	114	70	169	131	102
	75	91	140	96	197	160	137
90	50	65	120	68	175	130	101
	75	91	153	101	212	166	144
	90	108	157	105	219	174	157
110	40	55	127	64	178	123	92
	50	65	133	70	187	132	103
	75	91	156	93	214	159	138
	90	108	175	111	236	181	165
	110	130	199	135	279	224	206
125	75	91	170	99	226	163	141
	90	108	209	138	272	210	201
	110	130	206	134	286	223	204
	125	147	219	148	305	239	227
160	90	108	230	140	293	213	201
	110	130	225	135	308	228	208
	125	147	247	156	334	254	239
	160	186	274	184	375	295	282
200	160	186	306	192	407	307	294
	200	230	335	222	474	375	341
250	160	186	351	205	454	329	319
	250	291	456	310	623	498	461

6.4 Transitions for connecting other materials

POLO-KAL® pipe systems are compatible with all other EN-1451-1 compliant plastic pipe systems. POLOPLAST also offers a range of specially developed transition fittings for connecting POLO-KAL® pipe systems to pipes made of other materials.

Note: Maximum pressure tightness 0.3 bar with tension-free installation!

POLO-KAL® spigot end

Transition from FC socket to POLO-KAL® spigot end
PKUMAG

A. no.	DN	Sealing range
02860*	50	75–83 mm
02861	75	96–104 mm
02862	110	129–138 mm
02863	125	151–161 mm
02864	160	182–189 mm

Transition from cast socket to POLO-KAL® spigot end
PKUMAG

A. no.	Fig.	DN	Sealing range
02860*	a	50	75–83 mm
02861	a	75	96–104 mm
02865	b	110	120–131 mm
02863	a	125	151–161 mm
02867	b	160	176–179 mm

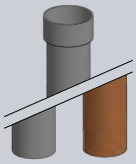
Transition from POLO-KAL® socket 'Generation prior to 1960' to POLO-KAL® spigot end
PKUMA

A. no.	DN	Socket
02880	50	53 mm
02881	100	100 mm

POLO-KAL® transition pipe inside + inside
PKRI

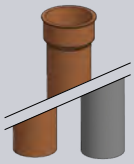
A. no.	Fig.	DN	Sealing range
02369	a	50	110 mm
02370	a	75	110 mm
02367	b	90	110 mm
02381	b	110	110 mm
02366*	b	110	160 mm
01943	c	110/50	110 mm
01944	c	110/110	110 mm

Fibre cement socket



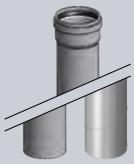
Fibre cement spigot end
Cast spigot end

Cast socket



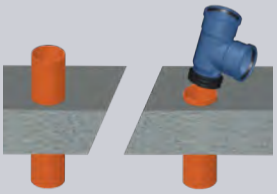
Cast spigot end
Fibre cement spigot end

Socket 'generation prior to 1960'



Spigot end 'generation prior to 1960'
Spiral pipe

Spigot end DN 110



Transition from cast spigot end or FC spigot end to POLO-KAL® spigot end
PKUSAG

A. no.	DN	Sealing range
02870	50	58–67 mm
02871	75	78–86 mm
02872	110	110–116 mm
02873	125	135–142 mm
02874	160	160–172 mm

Transition from FC spigot end or cast spigot end to POLO-KAL® socket
PKULSAG

A. no.	DN	Sealing range
02850	50	58–67 mm
02851	75	78–86 mm
02852	110	110–116 mm
02853	125	135–142 mm
02854	160	160–172 mm

Transition from spigot end 'generation prior to 1960' or spiral pipe to POLO-KAL® socket
PKUSS

A. no.	DN	Spigot end
02389	110	100 mm

POLO-KAL® spigot end

POLO-KAL® socket

* seal colour grey

6.5 Securing push-fit connections

Certain installation scenarios and applications require additional securing of push-fit connections:

- Securing of socket plugs
- Exposed pipes in areas where there is a risk of backflow and where increased pressure loads are possible
- Protection against sliding apart due to mechanical stress
- Lifting system pressure pipes (see page 22)
- Internal rainwater pipes (see 22)

POLO-KAL® pipe systems can be prevented from sliding apart through the use of pull-out-proof connections. These are designed to absorb temporary dynamic loads caused by overpressure, underpressure and/or vibration. However, permanent compressive stress is not permitted.

Note: The pull-out-proof connection approved for the specific pipe system must be used. Use with other pipe systems is not permitted.

POLO-KAL NG ASV
DN 32–250

POLO-KAL XS | 3S ASV
DN 32–160

Dimensions	Maximum permissible compressive stress	
DN 32	2.5 bar	25 mWs
DN 40	2.5 bar	25 mWs
DN 50	2.5 bar	25 mWs
DN 75	2.5 bar	25 mWs
DN 90	2.0 bar	20 mWs
DN 110	2.0 bar	20 mWs
DN 125	2.0 bar	20 mWs
DN 160	2.0 bar	20 mWs
DN 200	1.5 bar	15 mWs
DN 250	1.0 bar	10 mWs

6.5.1 POLO-EHP Control

Its large access opening make the **POLO-EHP Control** a practical solution for maintenance, inspection and cleaning:

- **Simple and secure locking mechanism**
  - Easy to open without tools
  - Free from metal fittings
  - Secure and tight resealing
- **Practical size of openable cover**
  300 × 100 mm, suitable for camera inspection and high pressure flushing
- **High internal pressure tightness**
  Long-term tightness up to 1.0 bar, short-term tightness up to 1.5 bar
- **Pressure release when opening**
  For safe use
- **No risk of obstruction**
  Thanks to constant flow cross section
- **Halogen-free**
  System and material compliant

DN	POLO-KAL NG	POLO-KAL 3S	Seal tightness	
	A. no.	A. no.	Short-term	Long-term
110	01900	06590	1.5 bar	1.0 bar
125	01901	06591	1.5 bar	1.0 bar
160	01902	06592	1.5 bar	1.0 bar
200	01903	–	1.5 bar	1.0 bar
250	01904	–	1.0 bar	0.5 bar

The POLO-EHP Control **security clamp** (A. no. 07818) prevents unauthorised opening of the cleaning pipe in public areas. See page 55 for installation instructions.

6.6 Rat protection

The POLO-KAL® Ratstop DN 110 (A. no. 03639) prevents rats from entering residential buildings via stacks. The special conical design prevents rats from gripping onto the sidewalls and entering living spaces.

Advantages:

- Space-saving, asymmetrical design
- Maintenance-free
- No electricity required
- No risk of obstruction

Note: The Ratstop only works when installed vertically.

6.7 Insulation

6.7.1 Frost protection

Thermal insulation isn't generally required, even in unheated rooms. Commercially available trace heating cable can be used for external pipes in exposed locations and low temperatures. Dimensioning and fastening take place according to the manufacturer's instructions. The maximum surface temperature of the cable must not exceed 45 °C.

6.7.2 Build-up of condensation

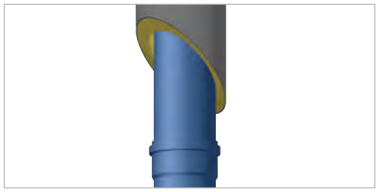
If the pipework cools significantly, moisture in the surrounding ambient air can cause condensation to build up on the surface of the pipe. As a result, droplets form on the pipe, which can lead to water damage. The dew point at which condensation forms can be determined using the table below:

Air °C	Dew point at relative humidity													
	30 %	35 %	40 %	45 %	50 %	55 %	60 %	65 %	70 %	75 %	80 %	85 %	90 %	95 %
30	10.5	12.9	14.9	16.8	18.4	20.0	21.4	22.7	23.9	25.1	26.2	27.2	28.2	29.1
29	9.7	12.0	14.0	15.9	17.5	19.0	20.4	21.7	23.0	24.1	25.2	26.2	27.2	28.1
28	8.8	11.1	13.1	15.0	16.6	18.1	19.5	20.8	22.0	23.1	24.2	25.2	26.2	27.1
27	8.0	10.2	12.3	14.1	15.7	17.2	18.6	19.9	21.1	22.2	23.2	24.3	25.2	26.1
26	7.1	9.4	11.4	13.2	14.8	16.3	17.6	18.9	20.1	21.2	22.3	23.3	24.2	25.1
25	6.2	8.5	10.5	12.3	13.9	15.3	16.7	18.0	19.1	20.3	21.3	22.3	23.2	24.1
24	5.4	7.6	9.6	11.3	12.9	14.4	15.8	17.0	18.2	19.3	20.3	21.3	22.3	23.1
23	4.5	6.7	8.7	10.4	12.0	13.5	14.8	16.1	17.2	18.3	19.4	20.3	21.3	22.2
22	3.7	5.9	7.8	9.5	11.1	12.6	13.9	15.1	16.3	17.4	18.4	19.4	20.3	21.2
21	2.8	5.0	6.9	8.6	10.2	11.6	12.9	14.2	15.3	16.4	17.4	18.4	19.3	20.2
20	1.9	4.1	6.0	7.7	9.3	10.7	12.0	13.2	14.4	15.4	16.4	17.4	18.3	19.2
19	1.1	3.2	5.1	6.8	8.4	9.8	11.1	12.3	13.4	14.5	15.5	16.4	17.3	18.2
18	0.2	2.3	4.2	5.9	7.4	8.8	10.1	11.3	12.5	13.5	14.5	15.4	16.3	17.2
17	-0.6	1.5	3.3	5.0	6.5	7.9	9.2	10.4	11.5	12.5	13.5	14.5	15.3	16.2
16	-1.3	0.6	2.4	4.1	5.6	7.0	8.3	9.4	10.5	11.6	12.6	13.5	14.4	15.2
15	-2.1	-0.3	1.5	3.2	4.7	6.1	7.3	8.5	9.6	10.6	11.6	12.5	13.4	14.2
14	-2.9	-1.0	0.6	2.3	3.8	5.1	6.4	7.5	8.6	9.6	10.6	11.5	12.4	13.2
13	-3.7	-1.8	-0.2	1.4	2.8	4.2	5.4	6.6	7.7	8.7	9.6	10.5	11.4	12.2
12	-4.4	-2.6	-1.0	0.5	1.9	3.3	4.5	5.6	6.7	7.7	8.7	9.6	10.4	11.2
11	-5.2	-3.4	-1.8	-0.4	1.1	2.3	3.6	4.7	5.8	6.8	7.7	8.6	9.4	10.2
10	-6.0	-4.2	-2.6	-1.2	0.1	1.4	2.6	3.7	4.8	5.8	6.7	7.6	8.4	9.2
9	-6.8	-5.0	-3.4	-2.0	-0.7	0.5	1.7	2.8	3.8	4.8	5.7	6.6	7.5	8.2
8	-7.5	-5.8	-4.2	-2.8	-1.6	-0.4	0.7	1.8	2.9	3.9	4.8	5.6	6.5	7.3
7	-8.3	-6.6	-5.0	-3.6	-2.4	-1.2	-0.2	0.9	1.9	2.9	3.8	4.7	5.5	6.3
6	-9.1	-7.4	-5.8	-4.4	-3.2	-2.1	-1.0	0.0	1.0	1.9	2.8	3.7	4.5	5.3
5	-9.9	-8.2	-6.6	-5.3	-4.0	-2.9	-1.9	-0.9	0.0	1.0	1.9	2.7	3.5	4.3
4	-10.7	-9.0	-7.4	-6.1	-4.8	-3.7	-2.7	-1.7	-0.8	0.0	0.9	1.7	2.5	3.3
3	-11.5	-9.8	-8.2	-6.9	-5.7	-4.6	-3.5	-2.6	-1.7	-0.9	-0.1	0.7	1.5	2.3
2	-12.3	-10.6	-9.1	-7.7	-6.5	-5.4	-4.4	-3.4	-2.5	-1.7	-0.9	-0.2	0.5	1.3
1	-13.1	-11.4	-9.9	-8.5	-7.3	-6.2	-5.2	-4.3	-3.4	-2.6	-1.8	-1.1	-0.4	0.3
0	-13.9	-12.2	-10.7	-9.4	-8.2	-7.1	-6.1	-5.1	-4.3	-3.4	-2.7	-2.0	-1.3	-0.6

Example: A rainwater pipe is installed in a heated room. The maximum temperature of the room is 25 °C and the maximum humidity is 50 %. Condensation begins to form when the pipe surface temperature falls below 13.9 °C. As the rainwater temperature can theoretically drop to 0 °C, pipe insulation is recommended in this scenario.

Possible insulation uses to prevent condensation build-up:
- Internal rainwater pipes
- The first 3 m below a roof hatch

As a rule, suitable insulation material with diffusion-tight outer skin or flexible elastomeric foam (FEF) with a thickness of 2–3 cm is sufficient.

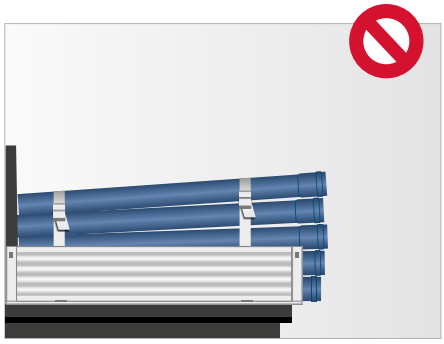


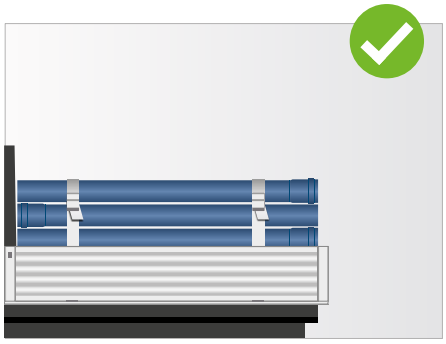
7. Fitting

7.1 Transport and storage

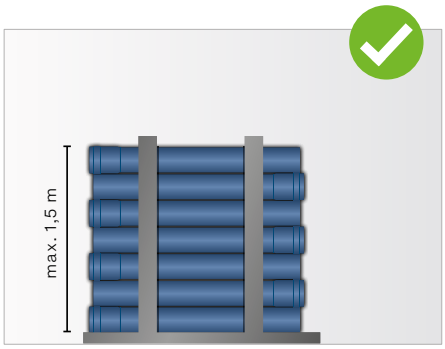
Loading and transport
Care must be taken to ensure that no transport damage occurs when loading pipes and fittings.

If the pipes are no longer in their original packaging, they should be laid flat across their entire length during transport to prevent bending. The sockets should be arranged in a staggered position at the spigot end. Impact stresses on the pipes and fittings must be avoided, especially in freezing temperatures.





Unloading and storage
Reasonable care must be taken when unloading the pipes. Do not drop the pipes or allow them to drag along the floor. Care must also be taken to ensure pipes are not pulled over sharp edges (e.g. dropside of vehicle).



The pipe must be stored in such a way that no permanent deformation or damage takes place. Pipes that are not on pallets should not be stacked higher than 1.5 metres. Individual pipe layers can be almost fully supported by staggering the sockets at the spigot end. Pipe stacks must be secured to prevent them from rolling apart.

Short lengths of pipe (150, 250 and 500 mm) and fittings are packaged in boxes. Pipes and fittings packaged in boxes must be protected from moisture.

Outdoor exposure to weather
POLO-KAL® pipes and fittings are suitable for outdoor storage as follows:
- POLO-KAL XS: 2 years
- POLO-KAL NG: 2 years
- POLO-KAL 3S: 1 year

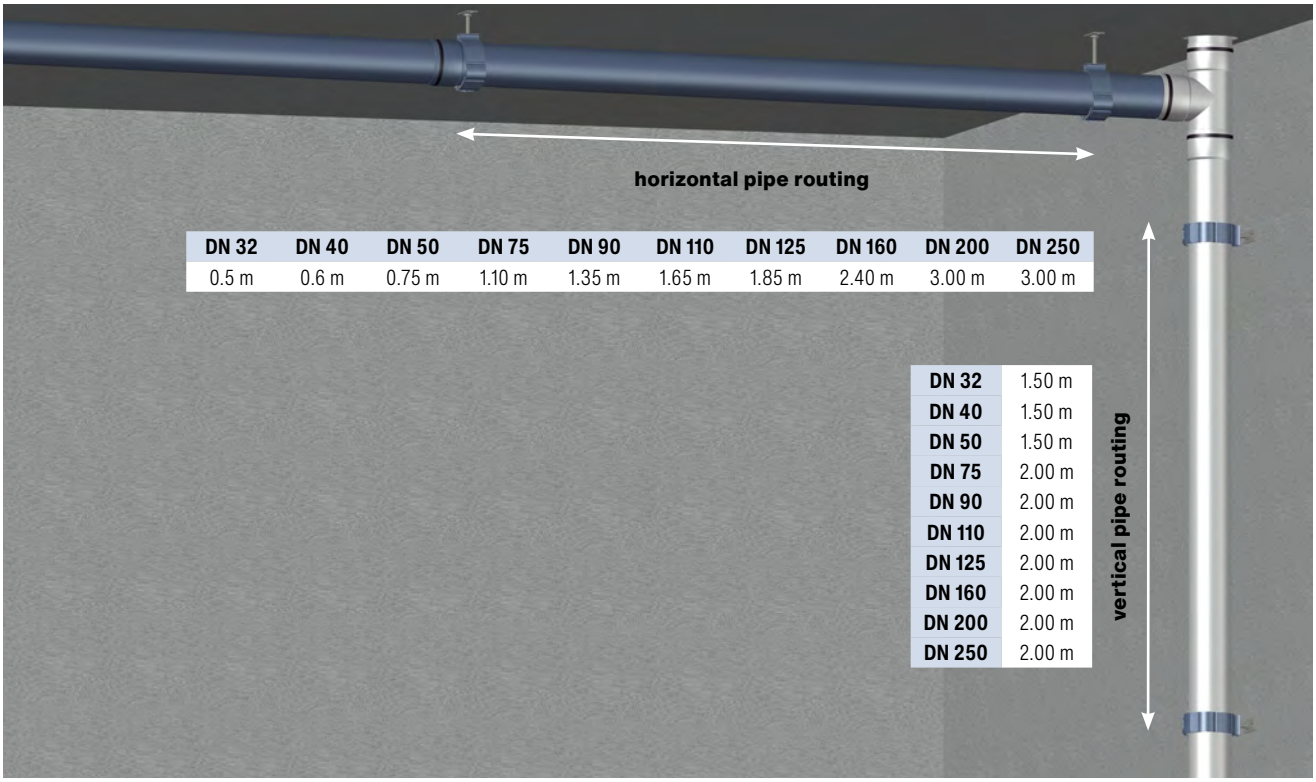
Storage exceeding these periods with intensive exposure to sunlight can lead to surface discolouration and impact mechanical properties.

7.2 Pipe fastenings

7.2.1 Arrangement

POLO-KAL® pipe systems need to be fastened in a way that prevents the push-fit connections from sliding apart during use. Directional changes in particular must be secured against lateral and axial movement. In addition to POLOPLAST clamps, commercially available clamps with a suitable diameter can also be used for fastening. If necessary, accommodate for linear expansion by using suitable sliding clamps (see page 32). In the case of stacks, two clamps need to be used for each floor. Other support fastenings are not required.

The maximum clamp spacing must be observed:



DN 32	DN 40	DN 50	DN 75	DN 90	DN 110	DN 125	DN 160	DN 200	DN 250
0.5 m	0.6 m	0.75 m	1.10 m	1.35 m	1.65 m	1.85 m	2.40 m	3.00 m	3.00 m

DN 32	1.50 m
DN 40	1.50 m
DN 50	1.50 m
DN 75	2.00 m
DN 90	2.00 m
DN 110	2.00 m
DN 125	2.00 m
DN 160	2.00 m
DN 200	2.00 m
DN 250	2.00 m

7.2.2 Pipe clamps

All commercially available clamps with a range matching the outer diameter of the pipe system can be used to fasten POLO-KAL® pipe systems.

Steel clamps with rubber insert
Standard pipe clamps with rubber inserts have different clamping ranges based on their use for different types of pipe material.

Steel pipe clamps for DN 110, for example, can have a clamping range of 108 to 114 mm. It is therefore important to only tighten them until they firmly enclose the pipe during installation, as compressing the rubber insert leads to greater structure-borne sound transmission.

POLOPLAST pipe fastening systems
POLOPLAST offers a range of fastening clamps for easy assembly.

The high-performance sound-insulating system clamps **POLO-KAL dB** and **POLO-KAL dB⁺** offer two excellent sound-insulating fastening solutions. These clamps are specially adapted to the acoustic properties of the POLO-KAL 3S pipe system.

POLO-KAL dB

POLO-KAL dB⁺

Available dimensions for POLO-KAL dB:
- DN 75 to DN 160

Available dimensions for POLO-KAL dB⁺:
- DN 90 to DN 160

The POLO-KAL dB system clamp is a one-piece steel clamp with a rubber insert that can be used in all assembly scenarios.

The POLO-KAL dB⁺ system clamp is a two-part steel clamp with rubber insert that has excellent sound-insulating properties. It is designed for stacks and consists of a support clamp and a fastening clamp.
The fastening clamp is attached to the pipe. The support clamp is mounted fully closed underneath and is the only part connected to the building structure.

POLO-KAL dB

POLO-KAL dB⁺

The **POLO-CLIP HS** pipe clip is a high-performance sound-insulating fastening system for three standard pipe sizes: DN 75, 90 and 110. The clip features special designs regarding connection, ribs and closure:
- Reinforced connector with M8 or M10 nut
- Angled ribs made of technical elastomer, optimised for above-ground drainage pipes in accordance with EN 1451-1
- Tool-free closure thanks to simple clip system for secure, effective pipe retention
- Ensures perfect sound decoupling through optimal closure and retention

POLO-CLIP HS

The **POLO-CLIP** and **POLO-KAL® screw clamp** are specifically designed for POLO-KAL® pipe systems and make installation quick and easy. POLO-CLIP is suitable for a range of dimensions.

POLO-CLIP

POLO-KAL®
screw clamp

The **POLOPLAST sound insulation set** (A. no. 01915)) enables the decoupled attachment of POLO-CLIP and of standard clamps with a baseplate.

Two sound insultation sets are required for use with a baseplate.

One sound insultation set is required for use with POLO-CLIP.

7.2.3 Floor fitting

Connection lines are typically laid directly on unfinished concrete floor.

The following should be kept in mind:

- Make sure the pipes are properly fastened to ensure the push-fit connection remains secure during construction and use
- Observe the minimum gradient
- Use a soft, damping underlay material. Hard, sharp-edged brick and mortar residues are not suitable as they increase the transmission of structure-borne sound and can damage the pipe long-term.

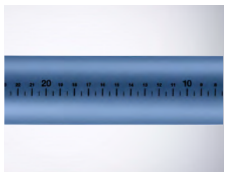
7.3 Installation instructions

7.3.1 Push-fit connection

POLO-KAL XS and POLO-KAL 3S

1. Find the required length using the pipe

- The ruler printed on the pipe shows the distance from the insertion depth of the socket.
- The insertion depth for the pipe socket is marked on the outside (arrow).

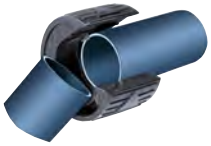


2. Cutting the pipe

Cut the pipe perpendicular to the pipe axis. The following tools are suitable:

- POLO-KAL XS pipe cutter (DN 32 to 50)
- Fine tooth saw
- Angle grinder
- Reciprocating saw
- Appropriate pipe cutter

Fittings must not be shortened.



3. 3. Deburr the cut edge

Use a pipe deburrer or knife to cleanly deburr the inside and outside of the cut edge (remove chips and round off edges). Deburring is not necessary with the POLO-KAL XS pipe cutter. Chamfering is not required.

4. Visual check

Check that the components are clean and intact. If necessary, remove any dirt from the socket, seal ring, and spigot end.

5. Lubricant (optional)

No lubricant is required thanks to the funTEC technology!
In complex installation scenarios, using lubricant on the insertion end or socket can make pushing in easier.

6. Assemble

Push the insertion end in with a slight twist up to the end of the socket.

POLO-KAL NG

1. Marking the desired length on the pipe
Take the socket dimensions into account if necessary.

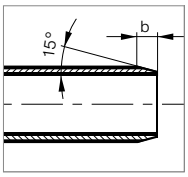
2. Cutting the pipe
Cut the pipe perpendicular to the pipe axis.
The following tools are suitable:

- Fine tooth saw
- Angle grinder
- Reciprocating saw
- Appropriate pipe cutter

Fittings must not be shortened.

3. Chamfer the cut edge
Chamfer the pipe end at an angle of approx. 15° using a chamfering tool or rasp.

DN	32	40	50	75	90	110	125	160	200	250
At approx. mm	4	4	4	4	5	6	6	7	8	10

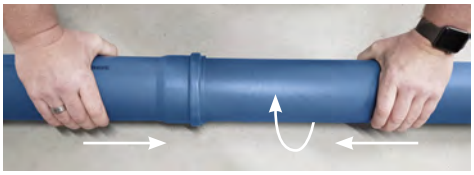


4. Deburr the cut edge
Use a pipe deburrer or knife to cleanly deburr the inside and outside of the cut edge (remove chips and round off edges).

5. Visual check
Check that the components are clean and intact. If necessary, remove any dirt from the socket, seal, and spigot end.
Check the position of the lip seal in the socket bead.

6. Lubricant
Apply a thin, even layer of POLOPLAST lubricant on the insertion end.

7. Assemble
Push the insertion end in with a slight twist to the end of the socket.



7.3.2 POLO-KAL XS pipe cutter

For quick, clean and perpendicular cutting of POLO-KAL® pipes.
The POLO-KAL XS pipe cutter is available for dimensions DN 32–50.

POLO-KAL XS pipe cutter

DN 32 – A. no. 100096
DN 40 – A. no. 100097
DN 50 – A. no. 100098

Cutting pipes

1.
Clip the pipe cutter onto the pipe.
Use the arrows for precise positioning.

2.
Gently press the pipe cutter together and turn.
The arrows indicate the correct direction of rotation.

Replacing the blade

1.
Undo the two screws and open the housing.

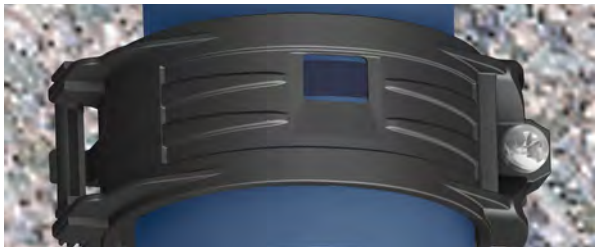
2.
The blade can either be flipped once or replaced completely.
The housing contains two replacement blades.

Replacement blades can be ordered separately (A. no. 100099).

7.3.3 Pull-out-proof connection

POLO-KAL XS | 3S ASV

Only for use with POLO-KAL XS and POLO-KAL 3S. Not suitable for other pipe systems.

1. Establish the socket connection. If using a transition pipe, socket plug or fitting with a short spigot end, retract approx. 5 mm from the socket. This is necessary to create enough space for the pull-out-proof connection.	
2. Fit the pull-out-proof connection over the socket connection. The pull-out-proof connection will not close if it is fitted the wrong way round.	
3. Check the position of the pull-out-proof connection. The seal must be within the viewing window.	
4. Secure the screws (alternating in the case of two screws). Observe the tightening torque: DN 32–90: 5 Nm DN 110–125: 6 Nm DN 160: 7 Nm	

POLO-KAL NG ASV

Only for use with POLO-KAL NG. Not suitable for other pipe systems.

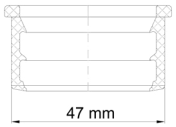
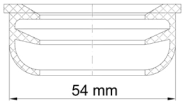
1. Completely dismantle the POLO-KAL NG ASV before fitting it over the socket.	
2. Establish the socket connection. If using a transition pipe, socket plug or fittings with a short spigot end, retract approx. 5 mm from the socket. This is necessary to create enough space for the pull-out-proof connection. Push the two halves of the clamp together around the socket connection.	
3. Secure the screw. Observe the tightening torque: DN 32–110: 5 Nm DN 125–250: 7 Nm	

7.3.4 Siphon connection

Various fittings are available for connecting drainage components.

Siphon connection	Siphon connection piece			Siphon connection bend			Long siphon elbow can be shortened in length		Cuttable siphon elbow easy to shorten
	DN 32	**DN 40**	**DN 50**	**DN 32**	**DN 40**	**DN 50**	**DN 40**	**DN 50**	**DN 50**
32 mm / 1 1/4"	02350	02351	02353	02360	02361	02363	02250		without seal, compatible with 01552 and 01553
40 mm / 1 1/2"	–	02352	02354	–	02362	02364	02251		
50 mm / 2"	–	–	02355	–	–	02365	–	02252	

Replacement seals are available for all siphon connection pieces.

Siphon connection	Plug-in seal after 2018	Plug-in seal before 2018
		
32 mm / 1 1/4"	01552	02378
40 mm / 1 1/2"	01553	02379
50 mm / 2"	02380	

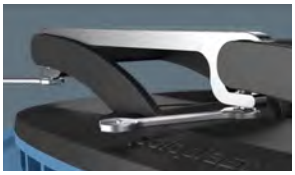
7.3.5 POLO-EHP Control security clamp

1.
Turn the screws until flush.

2.
Insert the clamp at an angle.

3.
Slide to the edge of the handle.

4.
Screw in the screws by hand and tighten using a jaw spanner (8 mm).



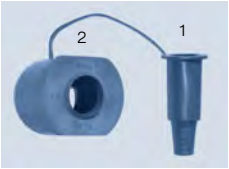
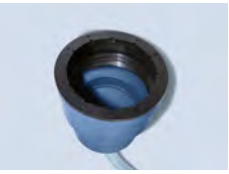
Tip: POLO-EHP Control offers a standard-compliant cleaning opening and well-designed, practical features.

Click here to watch the video:

7.3.6 Condensate drainage

The POLO-KAL NG condensate drain fittings are used for connecting to ventilation systems, condensing boilers, and air conditioning units. The two-part fittings are easy to install without tools:

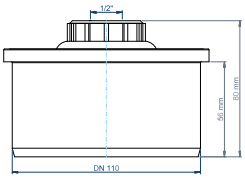
DN	Connection	A. no.
32	8 mm	02356
40	1/2"	02357
50	1/2"	02358
100	1/2"	02388
110	1/2"	02387

DN	DN 32–50	DN 100	DN 110
Individual parts: 1. Grommet 2. Clamping element 3. Seal ring (for A. no. 02388)			
1. Push the hose through the clamping element.			
2. Push the grommet as far as possible into the end of the hose.			
3. Insert the grommet and hose into the clamping element. Clamp the hose, pulling on the hose from below if necessary.			
4. For A. no. 02388: Push the seal ring into the clamping element.			
5. Install the condensate drain fitting in the pipe.			

7.3.7 Condensate transition fitting

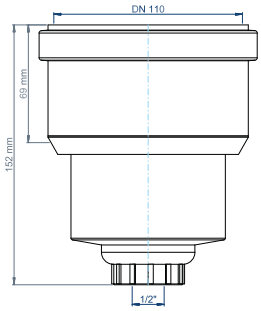
The ½" brass thread in the condensate transition fitting makes the transition to many commercially available pipe systems (e.g. aluminium composite pipe) possible. These transitions ensure a professional connection and can be used for e.g. air conditioning systems, cooling systems, and ventilation ducts.
The pull-out and twist-proof nature of the ½" metal thread ensures an optimal connection. However, the brass thread means that the condensate transition fitting is not suitable for the condensate drainage of condensing boilers.

POLO-KAL NG condensate transition 1/2"
PKKO



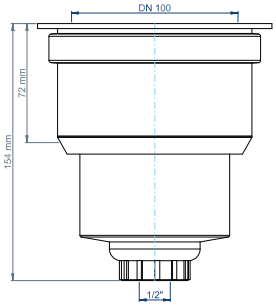
DN	Thr	L	t	g/pc.	A. no.
32	1/2"	46.5	38.5	62	03710
40	1/2"	62.7	35.5	60	03711
50	1/2“	67.3	40.2	66	03712
75	1/2“	68.5	45.3	100	03713
110	1/2“	79.5	55.5	180	03715
125	1/2“	101.5	77.5	245	03718

POLO-KAL NG condensate transition 1/2" socket
PKKO



DN	Thr	L	g/pc.	A. no.
110	1/2"	151.5	270	03716

POLO-KAL NG condensate transition 1/2" flexible hoses
PKKO



DN	Thr	L	g/pc.	A. no.
100	1/2"	154.4	360	03717

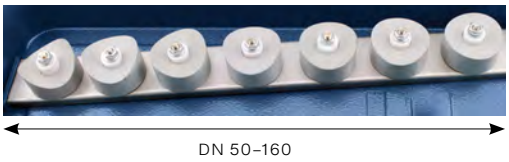
7.3.8 Welding tool for repairs

Holes up to 15 mm can be welded using a repairs welding tool.
The tool can be hired from the POLOPLAST sales team.

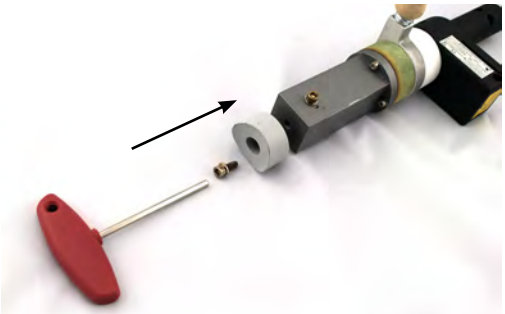
Contents of the welding kit:

- Heating element 220 V, 600 W, with wooden handle
- Fastening bracket for table assembly
- Welding saddle for DN 50–160
- Wood block for pressing PP welding plugs
- Fastening screw and Allen key
- PP welding plug

1.
Select the welding element according to the pipe diameter.

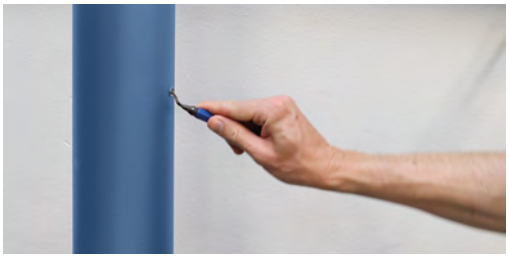


2.
Attach the welding element at the front or side.



3.
Switch on the tool and heat up until the indicator light goes out.

4.
Deburr the drill hole.



5.
Clean the repair area, making sure it is free from grease and dry.

6.
Position the PP welding plug and heat up.

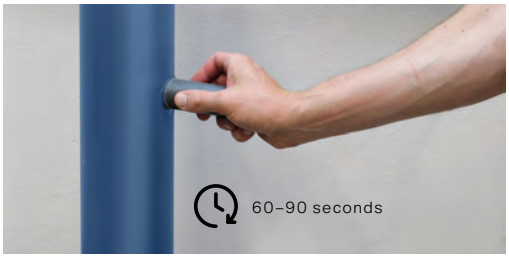
DN 50	DN 75	DN 90	DN 110	DN 125	DN 160
120 secs	110 secs	100 secs	90 secs	80 secs	70 secs

7.
Press the heater with the welding plug in place onto the drill hole and continue to heat up.

DN 50	DN 75	DN 90	DN 110	DN 125	DN 160
60 secs	70 secs	80 secs	90 secs	100 secs	110 secs

8.
Remove the welding plug from the heating element (radius side) using the wooden block.

9.
Press the wooden block with the welding plug onto the repair area by applying light pressure.



10.
After allowing 10 minutes to cool, cut off the protruding end (peg).

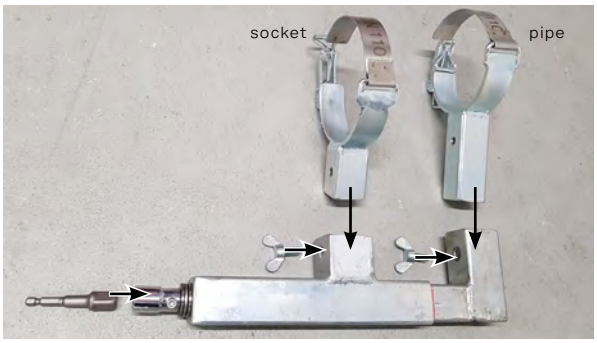
7.3.9 Push-fit tool for POLO- KAL NG

Establishing push-fit connections by hand can prove difficult when working with large components or in difficult to access spaces.

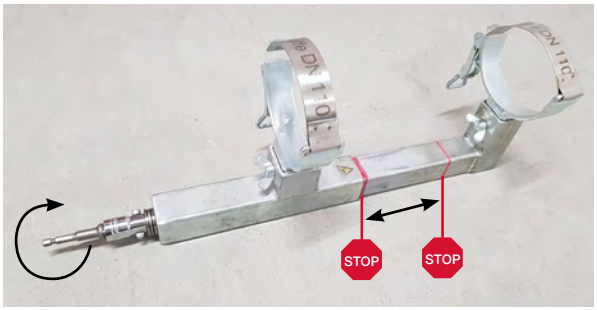
The push-fit tool provides assistance when socket connections need to be pushed together or pulled apart. The pipe and socket are pushed / pulled using a cordless screwdriver or drill. The push-fit tool is compatible with all POLO-KAL NG pipes and fittings.

Tip: Two versions of the tool are available to hire from the POLOPLAST sales team: DN 110–160 and DN 160–250.

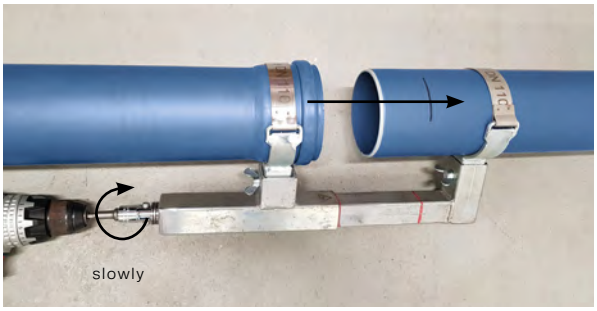
1.
Insert the clamps into the tool body and screw into place. Insert the bit socket adapter. A ratchet can also be used directly as an alternative.



2.
Turning the adapter opens and closes the tool. The tool must only be moved within the red markings.



3.
Clamp the pipe and socket in the corresponding clamps. Mark the insertion depth on the spigot end. Use a cordless screwdriver, drill or ratchet to slowly close the tool until the marked insertion depth is reached. Change the direction of rotation to pull apart.



Observe the installation instructions for creating a push-fit connection (see page 50).

8. Sound insulation

8.1 Basic information

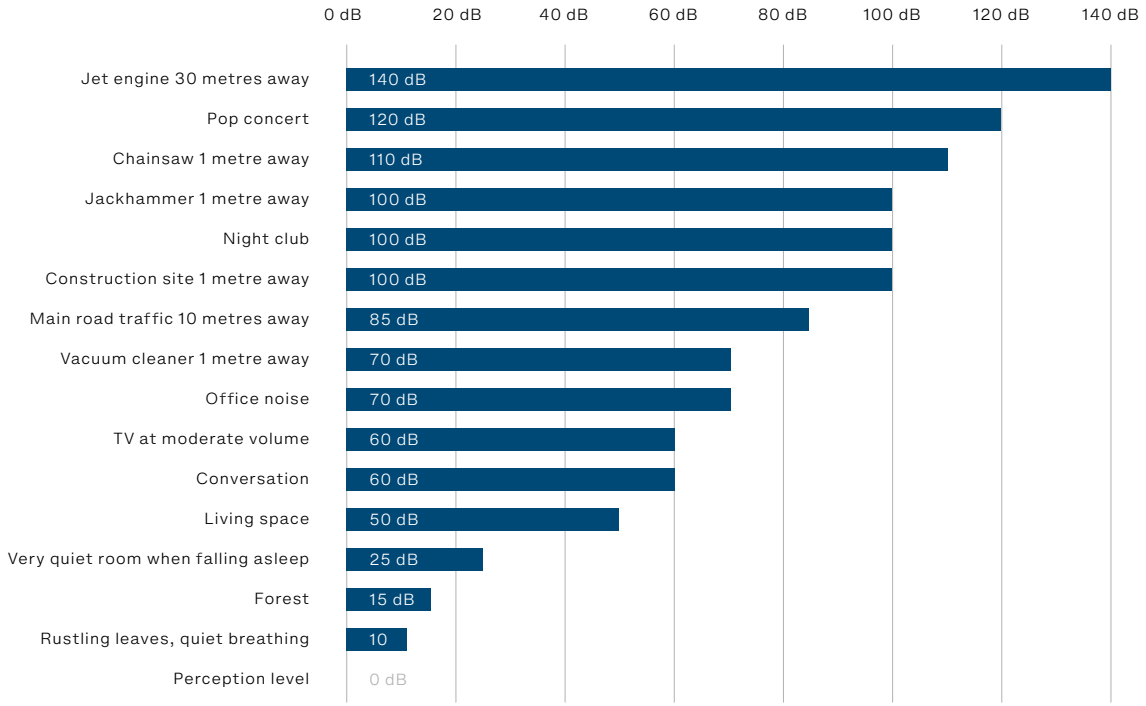
8.1.1 Perception

The subjective perception of noise depends on a number of factors, including:
- Volume
- Frequency
- Duration
- Personal response to the source of noise
- Current state of mind

So, whether a noise is perceived as annoying or pleasant depends on more than its volume. A mosquito buzzing by your ear when you're trying to get to sleep is far more irritating than much louder background traffic noise while you work. The noise produced by a construction site nearby is more of a disturbance than a concert at the same volume.

Volume (sound pressure level) is exponential. In other words, twice the sound level does not mean twice as loud. Doubling sound power increases the noise by approx. 3 dB(A). However, an increase between 6 and 10 dB(A) is required for the sound to be perceived as twice as loud.

8.1.2 Sources of noise



Plumbing installations cause a number of noises, for example:
- Noise from the outlet and control fitting
- Activation noise from the cistern
- Flushing noise from the cistern and toilet ceramics
- Flow noise from the pipes and fittings
- Inflow noise when wastewater flows from the connection pipe into the stack
- Impact noise when wastewater flows from the stack into the manifold or underground pipes

8.1.3 Addition of sound sources

Sound levels are not simply added together when they overlap.
Instead, the resulting sound level is calculated using logarithms:

Overlapping of sound levels with different intensities:

$$L_{ges} = 10 \cdot \log (10^{0,1 \cdot L1} + 10^{0,1 \cdot L2} + ...10^{0,1 \cdot Ln}) = 10 \cdot \log \sum_{i=1}^{n} 10^{\frac{Li}{10}}$$

L_{ges}	Total sound level in dB
L1, L2, ... Ln	Individual sound level in dB
L	Sound pressure level in dB
x	Number of equal sound levels

Overlapping of sound levels with the same intensity:

$$L_{ges} = L + 10 \cdot \log(x)$$

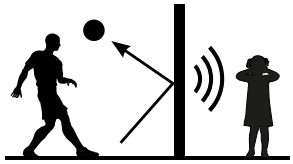
Examples

- Different sound levels of 40 dB, 35 dB and 25 dB produce a total sound level of 41 dB.
- The total sound level for three individual sound levels at 28 dB each is 33 dB.

8.1.4 Sound transmission

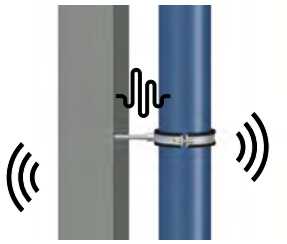
Sound is a form of pressure wave. When it is transmitted, a distinction is made between airborne sound and structure-borne sound:

With **airborne sound**, the sound waves travel through the air. Spoken communication and listening to music primarily rely on the perception of airborne sound waves. Airborne sound can be dampened and consequently reduced with the help of heavy materials or composite materials with sound-insulating properties.



Structure-borne sound waves travel within solid structures. Examples of this include footsteps and the sound of doors and windows being closed. Structure-borne sound causes the solid structure to vibrate, which allows sound waves to travel throughout the building. It is mainly the airborne sound emitted by the vibrating solid structure that is audible. Structure-borne sound can be dampened through consistent sound decoupling.

A **combination of airborne and structure-borne sound** usually occurs in practice.
For example, if a pipe starts to vibrate due to flowing water, it emits airborne sound waves into the surrounding area. This vibration is then transmitted to the building structure as structure-borne sound through the fastenings.



Both transmission routes therefore need to be taken into account during planning and implementation stages.

8.1.5 Sound insulation

The production, prevention, and reduction of disruptive noise from building services systems is influenced by a number of complex, interacting factors. Professional sound insulation therefore concerns all trades, right from the planning stage onwards.
The most important factors are:

- Type of sound source
  - Strength
  - Sound frequency
  - Duration
  - Noise peaks
- Type of sound transmission
  - Airborne
  - Structure-borne
- Location of wet rooms in relation to rooms requiring sound insulation (floor plan layout)
- Installation wall and adjacent wall properties:
  - Area density of solid walls
  - Structure of formwork and cavity sound insulation
  - Decoupling between installation wall and adjacent components, particularly between dry walls and solid components
- Layout of installation wall in relation to partition wall
- Drop heights and changes in direction of pipework
- Securing of pipework (fitting conditions, installation scenario)
- Material properties and structure of pipework
- Volumes and acoustic properties of the space (e.g. reverberation time)
- Basic sound level

8.2 Planning

Ensuring consistent sound insulation begins during the planning stage. This is also stipulated in the sound insulation standard ÖNORM B8115. Planning that doesn't incorporate adequate sound insulation can typically only be compensated for to a limited extent.
Any additional sound insulation measures that become necessary must be factored in as early as possible, e.g. in relation to increased space requirements.

8.2.1 Floor plan

The position of individual rooms in relation to each other is crucial when drafting a floor plan. Rooms in need of sound insulation, such as living rooms and bedrooms, should
- face away from traffic areas.
- be separated from the stairwell, lift, or similar by a corridor or adjacent room if possible.
- not be located next to a loud room like the kitchen or bathroom in another apartment.
- not have plumbing installed in a false ceiling.
- not have plumbing installed in the wall; if this can't be avoided, plumbing should be housed in a pre-wall installation with sound decoupling.

Ideally, rooms used for similar purposes should be positioned next to or on top of each other.

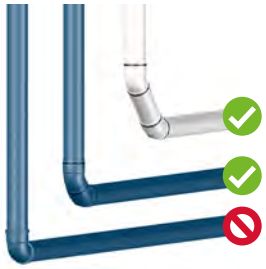
8.2.2 Pipe routing

Drop height, redirections, and branches have a significant impact on the level of noise produced by pipes. Pipework should therefore be routed as straight as possible. High flow velocity, changes in direction, and turbulence in the pipe system generate sound energy, which requires extensive insulation. It is therefore a good idea to keep potential sources of noise in mind when deciding on pipe routing.

Living rooms
Avoid routing pipes through living rooms and bedrooms. The same applies to pipework in false ceilings or wall channels. The level of sound directly emitted from pipe systems into the surrounding air (airborne sound) is generally relatively high. Extensive insulation measures are usually required to bring this noise level down to the levels specified in relevant standards.

Redirection
Changes in pipe direction cause considerable flow noise, which travels through the pipe system. Redirections should therefore always be implemented with 45° elbows. An intermediate pipe can be used to stabilise the system if necessary. 90° elbows should be avoided.

Country-specific standards also need to be observed for redirections from stacks to manifolds.



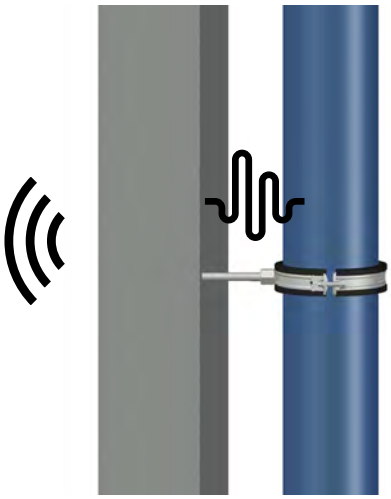
Stack offset
Changes in direction also generate flow noise when a stack is offset.
A stack offset of 30° is capable of increasing the sound level by 10–15 dB(A).

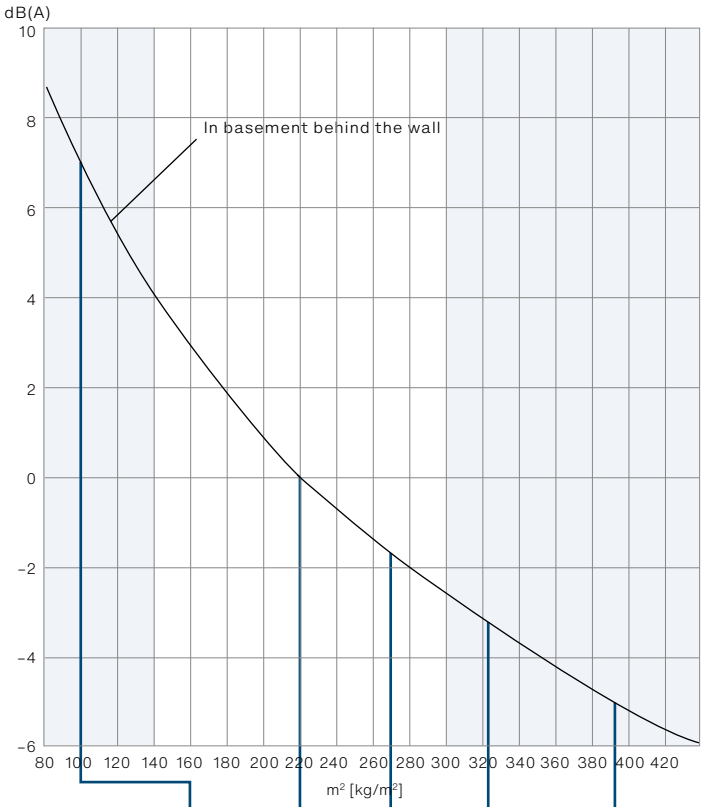
Stack offsets should therefore be avoided.

8.2.3 Solid walls

Walls are designed to prevent noise from spreading into neighbouring rooms or apartments. Solid walls with substantial mass should ideally be used for this purpose.

This also ties in with the standards for installing drainage systems. If a stack is attached to the wall of a living room or bedroom, the wall should be at least 350 kg/m² in line with the relevant standard. Reducing the weight of the wall increases the amount of noise transmitted:





Component	Weight
Interior wall (brick 10 cm), plastered	approx. 100 kg/m²
Interior wall (brick 25 cm), plastered	approx. 220 kg/m²
Exterior wall (brick 25 cm, insulation 15 cm)	approx. 270 kg/m²
Exterior wall (brick 30 cm, insulation 20 cm)	approx. 320 kg/m²
Reinforced concrete 15 cm	approx. 380 kg/m²

The above dimensions are for guidance only. In each individual case, the weight of components should be taken from the manufacturer's specifications for the materials used.

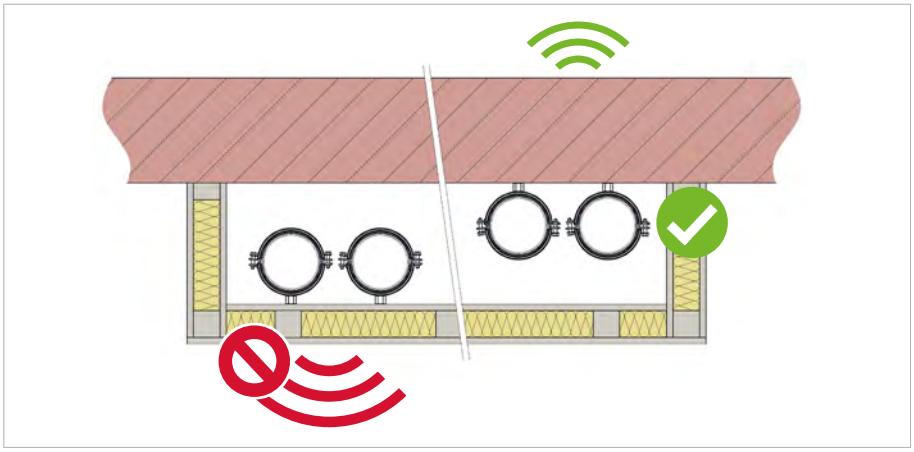
The difference in sound level is plotted against an installation wall with an area density of 220 kg/m2. The shown calculation results refer to the conditions at the installation test facility at the Fraunhofer Institute for Building Physics and cannot be readily applied to other building scenarios. If the area density of the wall is less than 140 kg/m² or above 300 kg/m² (shaded area), the sound level of the installation is subject to a higher degree of uncertainty.

If drywall construction is used, it must be ensured that it has an equivalent level of sound insulation. Suitability should be verified by the relevant manufacturer.

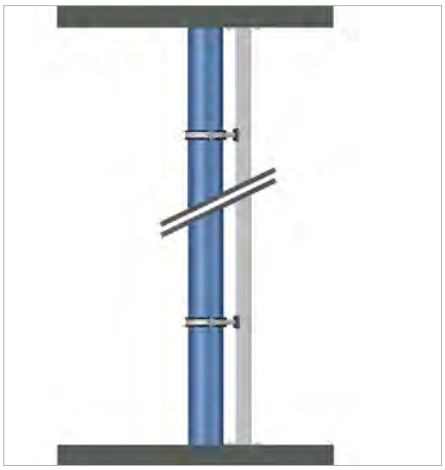
8.2.4 Installation shaft

Noise transmission into neighbouring rooms largely depends on the design of the installation shaft. Influencing factors include wall thickness, material properties, layer structure, airtightness, and pipe fixation.

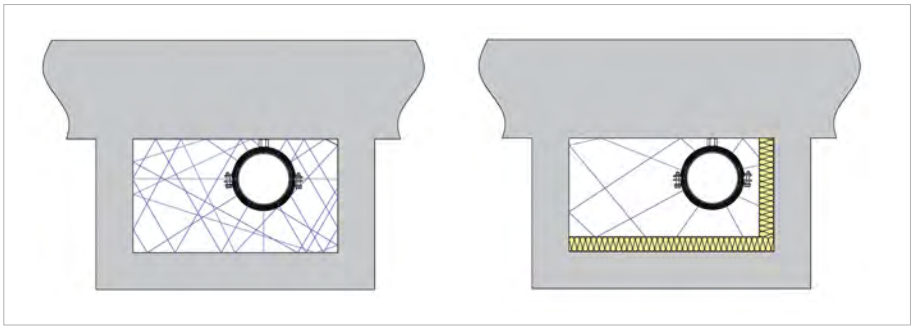
Securing
Pipes must be fixed to solid walls as they are less likely to vibrate than lightweight partition walls.



If a solid wall isn't available for securing, a separate auxiliary structure with wall decoupling should be used for fixing the pipes in place. Pipes can also be fixed to solid ceilings or the floor using brackets. Direct attachment to lightweight partition walls or their substructure should be avoided at all costs as this can increase the sound level by at least 10 dB(A).



Reflection
Solid shafts should be lined on two sides with e.g. 30 mm mineral wool. Hard inner shaft walls can cause sound reflections, which are capable of increasing the sound level by up to 3 dB(A). Soft surfaces like mineral wool absorb sound energy and thereby dampen the reflections.

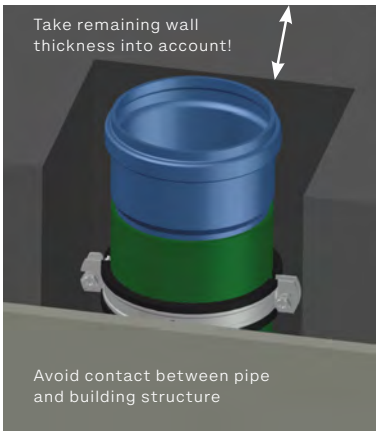


8.2.5 Wall channels

Running pipes through a recess or wall channel in living rooms and bedrooms is not recommended.

Doing so compromises wall thickness, resulting in increased sound transmission to neighbouring rooms. The remaining wall thickness in relation to neighbouring living rooms and bedrooms must be taken into account during planning.

There is usually little space for insulation in wall channels. As a result of the typically minimal coverage, sound radiation into the room is relatively high. Care must be taken to ensure that no structure-borne sound bridges are created between the pipe and building structure when the recess or channel is covered. Pipes and fittings must be fully encased in decoupled insulating material (e.g. 3–5 mm PE sleeve).



8.2.6 Pre-wall installation

Proper decoupling from the building structure must be ensured if pre-wall installations are used. This limits the transmission of sounds from pipes, fixtures, and fittings into neighbouring rooms.

Due to a range of influencing factors (wall structure, fixing points, geometry, etc.), the acoustic properties of a pre-wall installation can't be defined in general terms. The following aspects should always be taken into consideration:

- Fitting elements (toilet, washbasin) with decoupling fastenings
- Avoidance of structure-borne sound bridges
- Airtight seal towards room

The installation shaft instructions also apply to pre-wall installations.

8.2.7 Ceiling installation

Pipes should ideally not be installed in ceilings of living rooms and bedrooms as the standardised sound insulation requirements cannot be met without additional insulation measures.

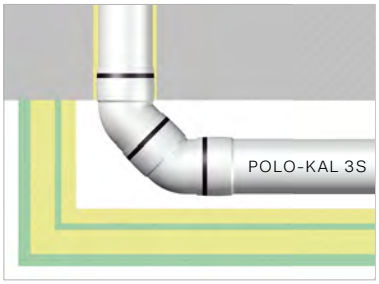
This applies in particular for:

- Redirection of a stack into a manifold in a false ceiling
- Bathroom manifolds housed in the false ceiling of the room below

Design

If ceiling installation in a living room or bedroom can't be avoided, special attention must be paid to its design. Suitable housing must be used to ensure the installation meets the minimum standardised requirements. An example of how standard requirements can be met is shown here. The inner layer of insulation is not required if an appropriate sound insulation mat is used (see page 68).

Redirections from vertical pipes into horizontal ones should always be implemented with 45° elbows.



Living room or bedroom

8.3 Fitting

Along with sound-optimised planning and the use of high-performance sound-insulating products, careful installation is also crucial for achieving good sound insulation.

8.3.1 Fastening

Fasteners should transfer as little structure-borne sound as possible into the building structure. Steel clamps with rubber inserts are generally used for this purpose.

Universal steel clamps are designed for a range of pipe diameters. For example, a clamp with a clamping range of 108 to 114 mm is used for a DN 110 pipe. The clamp must only be tightened as far as the outer diameter of the pipe, 110 mm in this case.

If the clamp is tightened too much and the rubber insert is compressed, decoupling can no longer take place.
The transmission of structure-borne sound also increases and more flow noise travels to neighbouring rooms.

8.3.2 Contact with building structure

All contact between the pipe system and building structure is to be avoided. Sheathing the pipework in a 3–5 mm thick insulating sleeve can help with this.

Application areas:
- Wall and ceiling feed-throughs that are subsequently grouted
- Floor-based pipes with contact to raw concrete floor or screed
- Pipes mortared into wall channels
- Pipes set in concrete
- Stacks to protect against the impact of subsequent trades (masonry, drywall construction)

Damage to insulation must be avoided. Lightweight insulating sleeves are not suitable for airborne sound insulation.

Example: Thermaflex insulation sleeve

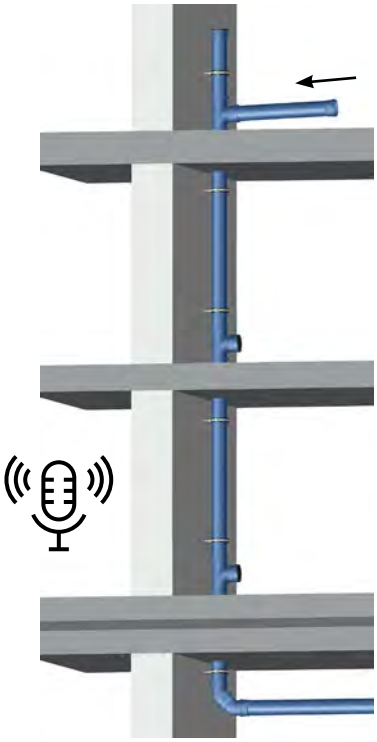
8.3.3 Sound insulation mats

Special sound insulation mats reduce the direct sound radiation from pipes into the air (airborne sound). These mats are heavy in weight (min. 4 kg/m^2) and feature porous materials in a multi-layer structure.

Alufonik PB from Alujet is a highly effective mat. The 15 mm-thick insulation mat can reduce the airborne sound level by an average of 15 dB(A). A comparable insulating effect is, for example, achieved with 100 mm thick mineral wool insulation. Sound insulation mats are therefore the ideal solution wherever a high level of sound insulation is required and space is limited. When redirecting from a stack to a manifold, insulation needs to be fitted from the ceiling breakthrough to 2 m after the redirection. Effective sound insulation requires the pipe system to be completely encased. Damage to the insulation must be avoided.

Sound insulating mat

8.4 Acoustic assessment of wastewater systems

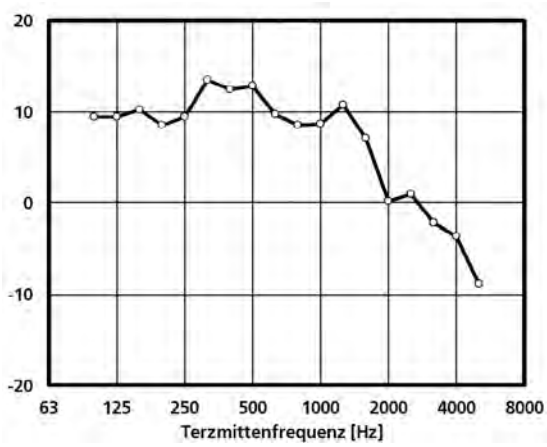


8.4.1 Testing according to EN 14366-1

EN 14366-1 provides the basis for testing the acoustic properties of a wastewater pipe system. The results as per EN 14366-1 enable a direct comparison of pipe systems. Use of other test methods would neither be standardised or practical (see page 71).

EN 14366-1 intentionally omits additional influencing factors such as the cistern, ceramics, and fittings. The drop height and position of fittings as well as fastenings are precisely defined. To obtain reproducible values, the pipe system is operated at a constant flow rate of 0.5 l/s to 4 l/s. A solid wall weighing 220 kg/m^2 forms the partition wall to the room requiring protection. The type of clamp fastening documented in the test report plays a decisive role.

During test bed measurement, a sound value is measured for each 1/3rd octave band. The frequency values are then compiled to form a single value, accounting for influencing factors such as reverberation time, background sound, and absorption surfaces. Assessment is carried out on the basis of DIN 4109.



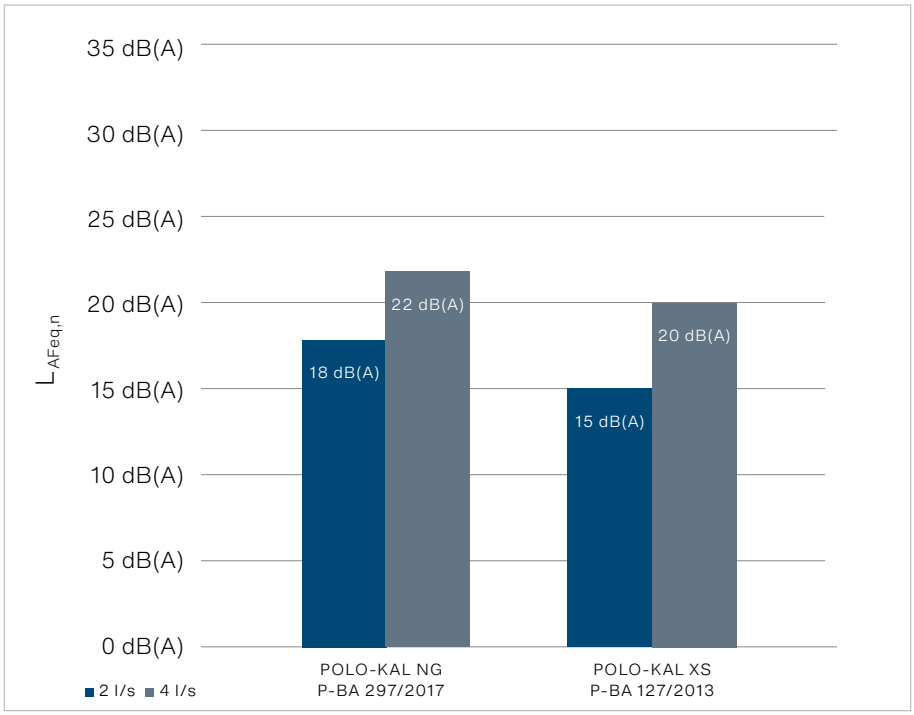
8.4.2 Testing according to DIN 4109

DIN 4109 does not contain any specifications for verifying acoustic properties of wastewater pipes. According to DIN 4109-36:2016, Section 6.2.4, EN 14366-1 must be used for this purpose.

8.4.3 Acoustic properties of POLO-KAL XS and POLO-KAL NG

All POLO-KAL® pipe systems have undergone acoustic testing in accordance with EN 14366-1. POLO-KAL XS and POLO-KAL NG are practically fastened using commercially available steel clamps with rubber inserts (Walraven Bismat 2000).

EN 14366-1 sound values assessed in accordance with **DIN 4109:**



Fraunhofer

Prüfbericht P-BA 127/2013

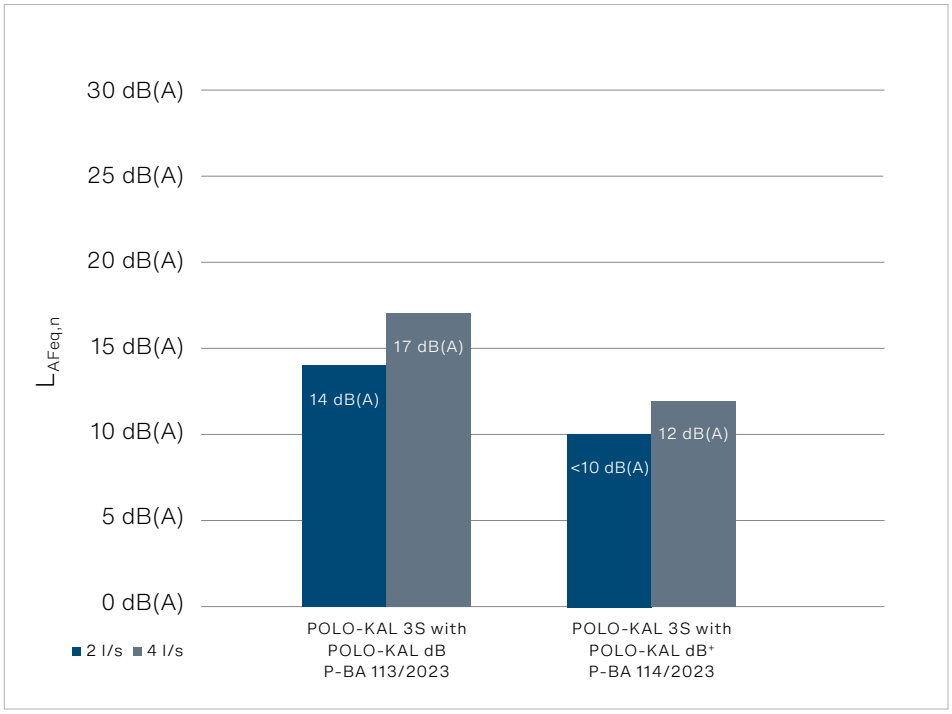
Geräuschverhalten eines Abwassersystems im Prüfstand

Test report POLO-KAL XS
P-BA 127/2013

8.4.4 Acoustic properties of POLO- KAL 3S

All POLO-KAL® pipe systems have undergone acoustic testing in accordance with EN 14366-1. POLO-KAL 3S is fastened using the system clamps POLO-KAL dB and POLO-KAL dB⁺.

EN 14366-1 sound values assessed in accordance with **DIN 4109**:



Fraunhofer

Prüfbericht P-BA 113/2023

Messung der Geräusche von Abwasserinstallationen im Prüfstand nach DIN EN 14366

Test report POLO-KAL 3S with
POLO-KAL dB
P-BA 113/2023

8.4.5 Comparability of pipe systems

Tests carried out in accordance with EN 14366-1 make it possible to objectively compare pipe systems in terms of their sound insulation properties. The following framework conditions need to be upheld to ensure the measurement results can be compared:

- Equivalent **fastening system**
  Steel clamps with rubber inserts, e.g. Bismat 2000, are recommended
  Note: POLO-KAL® pipe systems can be fastened with all commercially available fastening clamps.

- Set comparable **evaluations** in relation to each other
  $L_{AFeq,n}$ according to DIN 4109 (same as previous L_{In})

- Same **volume flow**
  4 l/s or 2 l/s

- Setup and measurement carried out by an **independent testing institute**
  The Fraunhofer Institute for Building Physics IBP is one of the most recognised testing facilities.

8.4.6 Applying measurement results in practice

Directly applying key findings from the acoustic testing of pipe systems as per EN 14366-1 to individual installation scenarios on site can be problematic. As things stand, calculation and simulation methods are not available for determining all the complex influencing factors in a completed building (see also DIN 4109-36). Even the framework conditions for 'practical testing' often differ significantly from the actual installation scenario.

These include:
- Pipe network geometry, e.g. drop height, redirections, and branches
- Water volume and time intervals
- Flushing (in and out) behaviours of ceramics, cisterns and siphons
- Structure-borne sound transmission through e.g. fastenings and component feed-throughs
- Quality of the installation in terms of structure-borne sound decoupling
- Sound insulation of shaft and ceiling constructions, flanking transmission paths to neighbouring components, and dispersal in the building
- Absorption surfaces in the shaft and ceiling
- Reverberation time in living spaces, which is largely influenced by floor covering, furnishings, and room size
- User behaviour in terms of operating noises
- Relationship between the sound level produced by the building services system and the existing background sound level

Note: If example sound level tests are used for practical verification, the mentioned influencing factors must be taken into account. If the sound test deviates from the actual installation scenario in even one of the points listed, the test can no longer be considered representative.

Given the large number of influences, many of which can't be planned for, the actual sound level can only be determined once the building is complete. But to still be able to comply with standard requirements in practice, it is important to carefully select sound-insulating materials, plan with sound insulation in mind, and ensure high-quality installation (see section 'Planning and layout', page 29 onwards).

The acoustic properties of wastewater pipes tested in accordance with EN 14366-1 can be referred to when selecting products. As a general rule, pipe systems with better test values in line with EN 14366-1 are also quieter when installed in practice.

Equivalent vs. maximum sound level
There are two ways to determine the sound level: as an average value (L_{AFeq}) or as a maximum value (LAF_{max}). Sound tests for determining systems such as specified in EN 14366-1 always take the average value as a basis.

The maximum value is used for compliance with standardised requirements in the finished building.

This is another reason why sound level measurements cannot be directly translated into practice.

9. Fire protection

9.1 General information

Fire protection essentially centres on:

Protection of people: protection of life and health
Protection of material assets: protection of property
Protection of the environment: protection of air, water and soil from pollution

Preventing the start and spread of fire is essential to achieving these aims.
The rescue of people and animals and effective extinguishing of fire all have to be ensured.

There are three types of fire protection:

- **Organisational fire protection**
  (escape route plan, etc.)
- **Preventive fire protection**
  (fire protection collars, fire extinguishers, etc.)
- **Reactive fire protection**
  (fire service, sprinkler system, etc.)

If pipes penetrate components that form fire compartments, appropriate fire protection measures must be taken. System-tested and approved fire protection collars can be used in the case of flammable above-ground drainage pipe systems. Metal above-ground drainage pipes must also be protected against the spread of fire through heat transfer, smoke transmission, and mechanical damage caused by the application of forces.

9.2 Fire protection collar

POLOPLAST offers a market-compliant, practical and approved fire protection solution for all POLO-KAL® pipe systems. The collar allows fire seals to be created on components forming fire compartments. The fire seals are impermeable to fire and hot gases for up to 90 minutes in the event of a fire.

9.2.1 How it works

When exposed to fire and heat, the plastic pipe become malleable and deforms. Starting at a temperature of approx. 150 °C, the special fire protection layer expands multiple times in volume. The resulting expansion pressure of more than 9 bar cuts the plastic pipe off completely. This creates a reliable seal impermeable to fire and hot gas between the fire compartments. As a result, fire and smoke can no longer spread through the pipe or opening into the neighbouring fire compartment.

Seal impermeable to fire and hot gas after the fire protection collar is activated.

9.3 Key terms

Construction product
Describes an individual component for construction works.

Kit
Provided by a manufacturer with at least two separate components that need to be joined together.

Construction works
Describes the installation scenario of the fire seal along with all its components (e.g. collar, building structure, insulation, pipe).

Fire protection concept
Detailed concept covering the practical, protection-oriented, building-specific measures required to achieve the fire protection objectives set out in laws, regulations, and standards governing fire protection. It outlines components that form fire compartments, which must be secured by suitable means if they are penetrated.
The fire protection concept must be tailored to the individual scenario and use of the building and should ideally be drawn up early on in the planning stage.
A fire protection concept usually includes a risk analysis, a definition of relevant protection objectives and a fire hazard assessment. Organisational, preventive, and reactive fire protection measures are then derived from this.

Construction Products Regulation
According to the EU Construction Products Regulation 305/2011, which entered into force on 1 July 2013, fire protection is an essential requirement for buildings. The document states that in the event of an outbreak of fire:
- the load-bearing capacity of the construction can be assumed for a specific period of time;
- the generation and spread of fire and smoke within the construction works are limited;
- the spread of fire to neighbouring construction works is limited;
- occupants can leave the construction works or be rescued by other means and the safety of rescue teams is taken into consideration.

Fire compartments
Fire compartments are sections in buildings bordered on all sides by building components with a defined fire resistance and/or fire protection zones.

Fire compartment-forming components
Fire compartment-forming components are components that border fire compartments. They can be located both inside the building (fire partitions) and on the site boundary (fire walls).

ETA, European Technical Assessment
A general technical assessment of the technical suitability of a construction product as defined by the EU Construction Products Regulation. In Germany, the ETA verifies that the product can be marketed.

CR, classification report
A report issued by a certified testing institute, which serves as the basis for the European Technical Assessment (ETA).

CE declaration of performance
A declaration drawn up by the distributor of the product at their own discretion, stating that they are aware of the specific requirements for the product they are distributing and that the product satisfies these requirements. This declaration of performance is based on the ETA.

9.4 Laws and technical regulations

9.4.1 European Technical Approval (ETA)

Construction products for which a European Technical Assessment (ETA) has been issued belong to the so-called ‘harmonised area’. For such construction products, the manufacturer must draw up a declaration of performance. An ETA is issued by a Technical Assessment Body on the basis of a European Assessment Document at the request of a manufacturer. The ETA contains the product performance according to levels or classes or in a description relating to the essential product characteristics.
It also contains the necessary technical information for the application for assessment and verification of constancy of performance. On the basis of an ETA, a manufacturer must draw up its CE declaration of performance in order to place the product on the market in the EU and the European Economic Area. Where necessary, product characteristics described in an ETA should also include safety and health requirements for proof of product safety.

9.5 POLO-BSM

The POLO-BSM fire protection collar has ETA approval (ETA-15-0686) and can be used throughout Europe.

The POLO-BSM is supplied as a set containing the following components:
- Fire protection collar
- Fastening set for solid walls/ceilings
- Sound insulation wrap
- Installation instructions incl. declaration of conformity form
- Identification plate

9.5.1 Application areas

The POLO-BSM fire protection collar has been tested for fire resistance classes up to EI120 and can be used for the following above-ground drainage systems:
- POLO-KAL XS from DN 32 to 160
- POLO-KAL NG from DN 32 to 250
- POLO-KAL 3S from DN 50 to 160

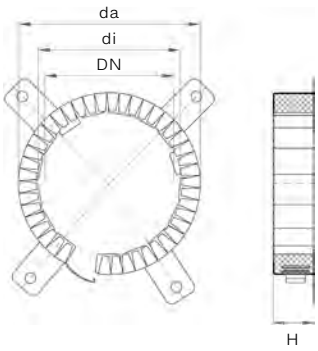
9.5.2 Approval

The POLOPLAST POLO-BSM fire protection collar offers a system-tested and approved solution for the POLO-KAL XS, POLO-KAL NG and POLO-KAL 3S above-ground drainage systems. POLO-BSM has been tested for fire resistance classes up to EI120 – U/U for Austria in accordance with EN1366-3, classified in accordance with EN 13501-2, and approved in accordance with ETA – 15/0686. A corresponding CE declaration of performance is also available based on ETA approval.

9.5.3 Product overview

Dimensions in mm

POLO-BSM set
incl. accessories



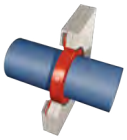
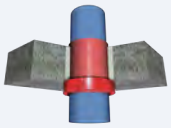
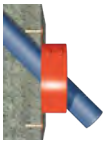
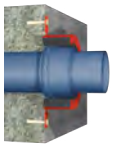
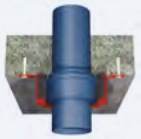
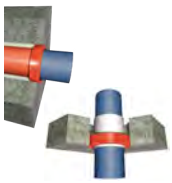
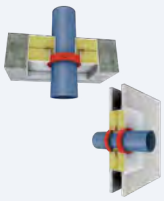
A. no.	H	di	do	Brackets	kg/pc.
02802	60	71	88	3	0.20
02806	60	85	108	3	0.27
02807	60	100	123	4	0.38
02808	60	120	144	4	0.44
02809	60	135	158	5	0.48
02810	60	170	205	5	0.81
02811	60	146	175	4	0.63
02813	30	40	52	2	0.05
02814	30	48	65	3	0.07
02815	30	60	78	3	0.09
02818	30	85	108	3	0.14
02819	30	100	123	4	0.21
02820	30	120	144	4	0.23
02821	30	135	158	4	0.26
02822	30	170	205	5	0.43
02823	60	210	244	5	0.95
02824	60	260	320	6	1.82

9.5.4 Selection of fire protection collar

The following general conditions need to be taken into account when selecting an approved protection collar to create a fire seal:
- Fire compartment-forming component (e.g. solid ceiling)
- Pipe system to be sealed against fire (e.g. POLO-KAL XS)
- Nominal diameter of the pipe (e.g. DN 110)
- Installation position of the pipe (e.g. at an angle with socket in the seal)
- Distance from neighbouring fire seals
- Pipe sheathing (e.g. sound insulation wrap)
- Collar fastening (e.g. screwed or mortared in)

The following options are available for selecting the approved fire seal for a POLO-KAL® pipe system with POLO-BSM:

- Easy and convenient selection online at (QR code)
- Use the **POLOPLAST app** for Android and iOS
- Find the corresponding **approvals** available for download at
- Use the **table** below:

	Installation	DN 32	DN 40	DN 50	DN 75	DN 90	DN 110	DN 125	DN 160	DN 200	DN 250
	**In solid and lightweight walls on smooth pipe**	PK-XS PK-NG 02813	PK-XS PK-NG 02814	PK-XS PK-NG 02815	PK-XS PK-NG PK-3S 02818	PK-XS PK-NG PK-3S 02819	PK-XS PK-NG PK-3S 02820	PK-XS PK-NG PK-3S 02821	PK-XS PK-NG PK-3S 02822	PK-NG 02823	PK-NG 02824
	**In solid ceilings, mounted on smooth pipe**	PK-XS PK-NG 02813	PK-XS PK-NG 02814	PK-XS PK-NG 02815	PK-XS PK-NG PK-3S 02818	PK-XS PK-NG PK-3S 02819	PK-XS PK-NG PK-3S 02820	PK-XS PK-NG PK-3S 02821	PK-XS PK-NG PK-3S 02822	PK-NG 02823	PK-NG 02824
	**Inclined through solid walls, on smooth pipe**	PK-XS PK-NG 02802	PK-XS PK-NG 02802	PK-XS PK-NG 02806	PK-XS PK-NG PK-3S 02808	PK-XS PK-NG PK-3S 02809	PK-XS PK-NG PK-3S 02811	PK-XS PK-NG PK-3S 02810	-	-	-
	Inclined through solid ceilings, on smooth pipe	PK-XS PK-NG 02802	PK-XS PK-NG 02802	PK-XS PK-NG 02806	PK-XS PK-NG PK-3S 02808	PK-XS PK-NG PK-3S 02809	PK-XS PK-NG PK-3S 02811	PK-XS PK-NG PK-3S 02810	-	-	-
	**In solid walls on socket**	-	-	PK-XS PK-NG 02802	PK-XS PK-NG PK-3S 02807	PK-XS PK-NG PK-3S 02808	PK-XS PK-NG PK-3S 02809	PK-XS PK-NG PK-3S 02810	-	-	-
	**In solid ceilings on socket**	-	-	PK-XS PK-NG 02802	PK-XS PK-NG PK-3S 02807	PK-XS PK-NG PK-3S 02808	PK-XS PK-NG PK-3S 02809	PK-XS PK-NG PK-3S 02810	-	-	-
	**In solid walls and ceilings, mortared in. Collar must protrude 10 mm**	PK-XS PK-NG 02813	PK-XS PK-NG 02814	PK-XS PK-NG 02815	PK-XS PK-NG PK-3S 02818	PK-XS PK-NG PK-3S 02819	PK-XS PK-NG PK-3S 02820	PK-XS PK-NG PK-3S 02821	PK-XS PK-NG PK-3S 02822	PK-NG 02823	PK-NG 02824
	**In solid ceilings and lightweight walls, with Promastop CC water-based fire stop coating, on smooth pipe**	PK-XS PK-NG 02813	PK-XS PK-NG 02814	PK-XS PK-NG 02815	PK-XS PK-NG PK-3S 02818	PK-XS PK-NG PK-3S 02819	PK-XS PK-NG PK-3S 02820	PK-XS PK-NG PK-3S 02821	PK-XS PK-NG PK-3S 02822	PK-NG 02823	PK-NG 02824

Further information can be found in ETA approval no.: 15/0686
Installation instructions can be found in the supplied installation guide.

10. Appendix

10.1 Standards, regulations and directives

Standard/regulation	Title	Valid
DIN 4102-11	Fire behaviour of building materials and building components; pipe encasements, pipe bushings, service shafts and ducts, and barriers across inspection openings	DE
DIN 4109	Sound insulation in buildings	DE
EN 12056	Gravity drainage systems inside buildings Part 1: General and performance requirements Part 2: Sanitary pipework, layout and calculation Part 3: Roof drainage, layout and calculation Part 4: Wastewater lifting plants, layout and calculation Part 5: Installation and testing, instructions for operation, maintenance and use	EU
EN 13501-2	Fire classification of construction products and building elements Part 2: Classification using data from fire resistance tests, excluding ventilation services	EU
EN 1366-3	Fire resistance tests for service installations – Part 3: Penetration seals	EU
EN 14366-1	Laboratory measurement of noise from waste water installations	EU
EN 1451-1	Plastic 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	EU
EN 1610	Construction and testing of drains and sewers	EU
EN 1825	Grease separators	EU
EN 752	Drain and sewer systems outside buildings	EU

10.2 Test report for leak testing

of a drainage system according to EN 1610, method using air 'LC'

Company

Address:
Postcode/town:

Customer

Address:
Postcode/town:

Construction site

Address:
Postcode/town:

Location

Component:
Room:
Pipe type:

Pipe system

☐ POLO-KAL XS	☐ POLO-KAL NG	☐ POLO-KAL 3S

Test

Activity	Objective	Checked
1. Apply initial pressure	110 mbar	_____ mbar
2. Maintain initial pressure	5 minutes	_____ minutes
3. Set test pressure	100 mbar	_____ mbar
4. Adhere to test duration	up to DN 200: 3 minutes DN 250: 4 minutes	_____ minutes
5. Pressure drop	max. 15 mbar	_____ mbar
6. Test passed		○ YES ○ NO

Performed by:

Notes:

Location/date

Signature

10.3 Chemical resistance

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
1,1-dichloroethylene	technical grade	B	C	B
1,2- dichloethylene	technical grade	B	C	B
1-nitropropane	technical grade	C	C	C
acetaldehyde	technical grade	C	A	C
acetamide	10 %	C	C	C
acetoacetic ester	technical grade	C	C	C
acetone	technical grade	C	A	C
acetophenone	technical grade	C	C	C
acetylacetone	saturated solution	C	C	C
acetylene	technical grade	A	A	A
acrylonitrile	technical grade	C	C	C
adipic acid	saturated solution	A	A	A
diethyl adipate	technical grade	C	C	C
alum, aqueous	saturated solution	A	A	A
allyl alcohol	technical grade	C	C	A
allyl chloride	technical grade	C	C	C
aluminium salts	saturated solution	A	A	A
formic acid	10 %	C	A	A
formic acid	40 %	C	A	B
formic acid	85 % technical grade	C	A	B
ammonia, aqueous	saturated solution	A	A	A
ammonium salts	saturated solution	A	A	A
amyl acetate	technical grade	C	A	C
amyl alcohol	technical grade	A	A	A
amyl chloride	technical grade	C	C	C
aniline	technical grade	C	A	C
aniline dyes	technical grade	C	C	C
aniline hydrochloride	saturated solution	B	B	B
anisole, methoxybenzene	technical grade	C	C	C
antimony salts	saturated solution	A	A	A
apple juice	-	A	A	A
malic acid	saturated solution	A	A	A
apple cider	-	A	A	A
arsenic acid	saturated solution	A	A	A
asphalt	technical grade	B	C	B
ASTM fuel	technical grade	C	C	C
ASTM oil	technical grade	C	C	C
essential oils	technical grade	C	C	C
barium salts	saturated solution	A	A	A
cottonseed oil	technical grade	B	C	A
BC 48, drilling oil	technical grade	B	C	B
benzaldehyde	saturated solution	C	A	C
petrol	5 %	C	C	A
petrol	technical grade	C	C	C
benzoic acid	suspension	B	A	A
benzene	technical grade	C	C	C
benzoyl chloride	technical grade	C	C	C
benzyl alcohol	technical grade	C	A	C
benzyl chloride	technical grade	C	C	C
succinic acid	saturated solution	A	A	A
beeswax	suspension	A	A	A

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
beer	-	A	A	A
bismuth salts	saturated solution	A	A	A
bitumen	technical grade	B	C	A
hydrogen cyanide	saturated solution	B	A	B
lead salts	saturated solution	A	A	A
borax	saturated solution	A	A	A
boric acid	saturated solution	A	A	A
spirits	-	A	A	A
brake fluid	technical grade	A	A	C
bromine, gas	technical grade	C	C	C
bromobenzene	technical grade	C	C	C
hydrobromic acid	48 %	C	A	C
2-butene-1,4-diol	technical grade	B	C	B
butadiene	gas, technical grade	C	C	C
butanal	technical grade	C	C	C
butanediol	technical grade	B	C	C
butanol	technical grade	C	A	A
butter	-	C	C	A
butyric acid	technical grade	C	C	C
butyl acetate	technical grade	C	A	C
butyl benzoate	technical grade	C	C	C
butylene	gas, technical grade	C	C	B
butyl glycol	technical grade	C	C	B
butylphenol	technical grade	C	C	C
butylphenone	technical grade	C	C	C
butyl phthalate	technical grade	C	C	B
butyl stearate	technical grade	C	C	A
calcium hydroxide	saturated solution	A	A	A
Calcium hypochlorite	saturated solution	B	A	B
calcium salts	saturated solution	A	A	A
carbitol	technical grade	B	C	B
carbolineum	technical grade	C	C	A
Cellosolve, 2-ethoxyethanol	technical grade	B	C	B
cellulose acetate	technical grade	B	C	C
chlorine, gas	50 ppm	C	C	C
chloral	technical grade	B	C	A
chloral hydrate	saturated solution	C	C	C
chloramine	aqueous	B	C	A
chlorobenzene	technical grade	C	C	C
chlorobromomethane	technical grade	C	C	C
chlorobutadiene	technical grade	C	C	C
chlorine dioxide	aqueous	C	C	C
chlorododecane	technical grade	C	C	C
chloroacetic acid	technical grade	B	C	B
methyl chloroacetate	technical grade	C	C	C
chloroethanol	technical grade	B	C	C
chloromethane, gas	technical grade	C	C	C
chloronaphthalene	technical grade	C	C	C
chloroform	technical grade	C	C	C
chloronitroethane	technical grade	C	C	C

Resistance at 20 °C **A** Resistant **B** Limited resistance (depending on concentration, temperature, frequency and duration) **C** Not resistant

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
chloroprene	technical grade	C	C	C
chloric acid	10 %	C	C	C
chlorosulfonic acid	technical grade	C	C	C
chlorotoluene	technical grade	C	C	C
chlorinated water	saturated solution	C	C	C
chromium potassium sulphate	saturated solution	A	A	A
chromium sulphuric acid	saturated solution	C	C	C
citronella oil	technical grade	C	C	B
crotonaldehyde	saturated solution	A	C	A
cyclohexane	technical grade	B	C	A
cyclohexanol	technical grade	C	C	A
cyclohexanone	technical grade	C	C	C
decalin	technical grade	C	C	C
decane	technical grade	C	C	C
dextrin	saturated solution	A	A	A
dextrose	saturated solution	A	A	A
diacetone alcohol	technical grade	C	A	C
dibenzyl ether	technical grade	C	C	C
dibutylamine	technical grade	C	C	C
dibutyl ether	technical grade	C	C	B
dibutyl phthalate	technical grade	C	C	C
dibutyl sebacate	technical grade	C	C	C
dichlorobenzene	technical grade	C	C	C
dichlorobutylene	technical grade	C	C	C
dichloroacetic acid	technical grade	C	C	B
dichloroacetic acid	40 %	C	C	B
methyl dichloroacetate	saturated solution	C	A	C
dichloroethane	technical grade	B	C	B
dichloroisopropyl ether	technical grade	C	C	C
dichloromethane	technical grade	C	C	C
diesel	technical grade	C	C	B
diethanolamine	technical grade	C	C	B
diethylamine	technical grade	C	C	B
diethylbenzene	technical grade	C	C	C
diethylene glycol	technical grade	A	A	A
diethyl ether	technical grade	C	C	B
diethyl sebacate	technical grade	C	A	C
dihexyl phthalate	technical grade	C	C	C
diisobutylene	technical grade	C	C	C
diisobutyl ketone	technical grade	C	A	C
diisooctyl phthalate	technical grade	C	C	C
diisopropylbenzene	technical grade	C	C	C
diisopropyl ether	technical grade	C	C	B
diisopropyl ketone	technical grade	C	A	C
dimethylamine	gas, technical grade	C	C	C
dimethylaniline	technical grade	C	C	C
dimethylformamide	technical grade	C	A	B
dimethyl phthalate	technical grade	C	C	C
dimethyl sulfate	technical grade	C	C	C
dinitrotoluene	technical grade	C	C	C
dinonyl phthalate	technical grade	C	C	C
dioctyl phthalate	technical grade	C	C	C

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
dioctyl sebacate	technical grade	C	C	C
dioxane	technical grade	C	C	C
dioxolane	technical grade	C	C	C
diphenyl	technical grade	B	C	B
diphenyl ether	technical grade	C	C	C
dipropylene glycol	technical grade	C	C	A
nitrous oxide	gas, technical grade	C	C	C
dodecyl alcohol	technical grade	B	A	A
fertilizer salts	technical grade	A	A	A
iron salts	saturated solution	A	A	A
natural gas	gas, technical grade	B	B	A
peanut oil	technical grade	C	C	B
crude oil	technical grade	C	C	B
vinegar	technical grade	C	A	A
acetic acid anhydride	technical grade	C	B	A
ethane	gas, technical grade	B	C	A
ethanol	technical grade	A	A	A
ethanolamine	technical grade	C	A	C
ethanethiol	technical grade	C	C	C
ethyl acetate	technical grade	C	A	C
ethyl acrylate	technical grade	C	A	C
ethyl benzene	technical grade	C	C	C
ethyl bromide	technical grade	C	C	B
ethyl cellulose	saturated solution	A	B	A
ethyl chloride	gas, technical grade	C	B	C
ethylene	gas, technical grade	B	C	A
ethylene bromide	technical grade	C	C	C
ethylene chlorohydrin	technical grade	C	C	C
ethylene chloride	gas, technical grade	C	C	C
ethylenediamine	gas, technical grade	B	A	B
ethylene dichloride	technical grade	C	C	C
ethylene glycol	technical grade	A	A	A
ethylene oxide	gas, technical grade	C	C	C
ethyl formate	technical grade	C	C	C
ethyl glycol	technical grade	B	B	C
ethyl glycol acetate	technical grade	C	C	C
ethyl oxalate	technical grade	C	C	C
ethyl pentachlorobenzene	technical grade	C	C	C
ethyl silicate	technical grade	B	C	A
ethanethiol	technical grade	C	C	C
fatty alcohol	technical grade	C	C	A
fats (TPE: animal)	technical grade	B	C	A
fatty acids	technical grade	B	C	A
aircraft engine fuel	technical grade	C	C	C
fluorine, gas	technical grade	C	C	C
fluorobenzene	technical grade	C	C	C
hydrofluoric acid	75 %	B	B	B
formaldehyde	saturated solution	A	A	A
formamide	technical grade	A	A	A
photo emulsions	technical grade	A	A	A
photo developers	technical grade	A	A	A
photo fixers	technical grade	A	A	A
antifreeze	technical grade	A	A	A

Resistance at 20 °C **A** Resistant **B** Limited resistance (Depends on concentration, temperature, frequency and duration) **C** Not resistant

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
fruit juice	technical grade	A	A	A
fructose	saturated solution	A	A	A
fumaric acid	technical grade	A	A	A
furan	technical grade	C	C	C
furfural	technical grade	C	C	C
furfuryl alcohol	technical grade	B	A	C
gallic acid	technical grade	B	A	B
gas oil	technical grade	C	C	B
gelatine	saturated solution	A	A	A
gear oil	technical grade	B	C	B
glucose	saturated solution	A	A	A
glucose syrup	saturated solution	A	A	A
glycerol	saturated solution	A	A	A
glycerol chlorohydrin	technical grade	C	C	C
glycine	10 %	A	A	A
glycolic acid	30 %	A	A	A
glycol	technical grade	A	A	C
urea	saturated solution	A	A	A
yeast	suspension	A	A	A
heating oil, petroleum based	technical grade	B	C	A
heating oil, coal-based	technical grade	B	C	A
heptane	technical grade	C	C	C
1-hexene	technical grade	C	C	B
hexachlorobutadiene	technical grade	C	C	C
hexafluorosilicic acid	50 %	B	B	B
hexane	technical grade	C	C	B
hexanal	technical grade	C	C	C
hexanol	technical grade	C	C	B
hexanetriol	technical grade	B	A	A
blast furnace gas	gas, technical grade	A	A	A
wood oil	technical grade	C	C	B
honey	100 %	A	A	A
hydraulic oil (glycol-based)	technical grade	C	C	C
hydraulic oil (mineral oil)	technical grade	C	C	B
hydraulic oil (phosphate ester)	technical grade	C	C	C
hydrazine	saturated solution	C	A	C
hydrazine hydrate	technical grade	C	A	C
hydroquinone	saturated solution	C	C	B
hydroxylammonium sulfate	saturated solution	A	A	A
hypochlorous acid	10 %	C	C	C
iodine, in alcohol	saturated solution	A	A	A
iodine-potassium iodide	saturated solution	A	A	A
iodine pentafluoride	technical grade	A	A	A
tincture of iodine	technical grade	A	A	A
isobutyl alcohol	technical grade	C	A	B
isooctane	technical grade	B	C	C
isooctanol	technical grade	B	B	A
isophorone	technical grade	C	C	C
isopropanol	technical grade	C	A	B
isopropyl acetate	technical grade	C	A	C
isopropyl alcohol	technical grade	C	A	B
isopropyl benzene	technical grade	C	C	C
isopropyl chloride	technical grade	C	C	C

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
isopropyl ether	technical grade	C	C	C
slurry / liquid manure	100 %	A	A	A
potassium hydroxide, caustic potash solution	saturated solution	A	A	A
potassium hypochlorite	saturated solution	C	C	C
potassium salts	saturated solution	A	A	A
milk of lime	saturated solution	A	A	B
camphor	technical grade	C	C	C
kerosene	technical grade	B	C	B
pine oil, spruce needle oil	technical grade	C	C	C
hydrofluorosilicic acid	technical grade	A	A	A
silicic acid	technical grade	A	A	A
carbon dioxide	saturated solution	A	A	A
carbon monoxide	technical grade	A	A	A
carbonic acid	saturated solution	A	A	A
carbon disulfide	technical grade	C	C	B
coke oven gas	technical grade	B	B	B
coconut fatty alcohol	technical grade	C	C	B
coconut oil	technical grade	C	C	B
aqua regia	saturated solution	C	C	C
creosote	technical grade	C	C	C
cresols	technical grade	C	C	B
radiator fluid	technical grade	A	A	A
copper salts	saturated solution	B	C	A
nitrous oxide	gas, technical grade	A	A	A
cod liver oil	technical grade	A	A	A
glue	technical grade	A	A	A
linseed oil	technical grade	C	C	B
coal gas	gas, technical grade	B	C	A
liqueur	-	A	A	A
lithium salts	saturated solution	A	A	A
magnesium salts	suspension	A	A	A
corn germ oil	saturated solution	C	C	B
maleic acid	saturated solution	B	A	B
almond oil	technical grade	C	C	B
margarine	technical grade	C	C	B
machine oil	technical grade	C	C	B
mayonnaise	technical grade	C	C	B
horseradish	suspension	A	A	A
seawater	-	A	A	A
molasses	technical grade	A	A	A
menthol	technical grade	A	A	A
mesityl oxide	technical grade	C	C	C
methane	technical grade	B	C	A
methanol	technical grade	B	C	A
methoxybutanol	technical grade	C	C	A
methyl acetate	technical grade	C	C	C
methyl acrylate	technical grade	C	C	C
methyl acrylic acid	technical grade	C	C	C
methyl acrylate	technical grade	C	C	C
methylamine	< 32 %	C	A	C
methyl bromide	technical grade	C	C	C
methyl butyl ketone	technical grade	C	C	C

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
methyl chloride	technical grade	C	C	C
methyl cyclopentane	technical grade	C	C	C
methylene chloride	technical grade	C	C	C
methyl ethyl ketone	technical grade	C	B	C
methyl formate	technical grade	C	C	C
methyl glycol	technical grade	C	C	C
methyl isobutyl ketone	technical grade	C	C	C
methyl methacrylate	technical grade	C	C	C
methyl salicylate	technical grade	C	C	C
methyl sulphuric acid	technical grade	C	A	C
milk	100 %	A	A	A
lactic acid	saturated solution	A	A	A
mineral oils	technical grade	C	C	B
mixed acid I (sulfuric acid, nitric acid, water)	technical grade	C	C	C
monomethylaniline	technical grade	C	C	C
morpholine	technical grade	C	A	C
must	100 %	A	A	A
engine lubricating oils	technical grade	C	C	B
naphtha	technical grade	C	C	B
naphthalene	technical grade	C	C	C
sodium hydroxide, caustic soda	40 %	A	A	A
sodium hypochlorite	10 %	C	C	C
sodium salts	saturated solution	A	A	A
n-butanol	technical grade	C	C	A
nickel salts	saturated solution	A	A	A
nitrobenzene	technical grade	C	C	C
nitroethane	technical grade	C	C	C
nitroglycol	technical grade	C	C	C
nitromethane	technical grade	C	C	C
nitropropane	technical grade	C	C	C
nitrous gases	technical grade	C	C	C
nitrotoluene,	technical grade	C	C	C
N-octane	technical grade	C	C	C
nonanol	technical grade	C	C	C
fruit pulp	technical grade	A	A	A
octachlorotoluene	technical grade	C	C	C
octadecane	technical grade	C	C	C
octanol	technical grade	C	C	B
octylcresol	technical grade	C	C	B
octane	technical grade	C	C	C
oils and fats	technical grade	C	C	B
olive oil	technical grade	C	C	B
oleic acid	technical grade	C	C	A
oxalic acid	saturated solution	A	A	A
ozone	1 %	A	A	A
palmitic acid	technical grade	B	C	B
palm oil	technical grade	C	C	C
paraffin oil (F65)	technical grade	B	C	B
paraformaldehyde	saturated solution	B	B	B
p-cymol	technical grade	C	C	C
pectins	technical grade	A	A	A
pentachlorophenyl	technical grade	B	C	C

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
pentane	technical grade	B	C	B
perchloroethylene	technical grade	B	C	B
perchloric acid	20 %	B	A	C
petroleum ether	technical grade	B	C	B
petroleum	technical grade	B	C	B
plant-based edible oils	technical grade	B	C	B
phenol	technical grade	C	C	C
phenylethyl ether	technical grade	C	C	C
phenylhydrazine	technical grade	C	C	C
phenylhydrazinium chloride	technical grade	C	C	C
phosphates (inorganic)	technical grade	A	A	A
phosphorus oxychloride	technical grade	C	A	C
phosphoric acid	technical grade	A	A	A
phthalic acid	saturated solution	C	C	C
phthalic anhydride	technical grade	C	C	A
picric acid	saturated solution	B	A	B
pinene	technical grade	C	C	B
piperidine	technical grade	C	C	C
propane, liquid	technical grade	A	C	A
propanol	technical grade	C	A	A
propionic acid	technical grade	C	C	C
propyl acetate	technical grade	C	C	C
propylamine	technical grade	C	C	C
propylene dichloride	technical grade	C	C	C
propylene glycol	technical grade	C	A	A
propylene oxide	technical grade	C	C	A
pyridine	technical grade	C	C	C
mercury	technical grade	A	A	A
mercury salts	saturated solution	A	A	A
rapeseed oil	technical grade	C	C	B
cleaning soap	aqueous solution, technical grade	A	A	A
castor oil	technical grade	C	A	B
crude oil (strong odour)	technical grade	C	C	C
sugarcane juice	saturated solution	A	A	A
sucrose solution	saturated solution	A	A	A
salicylic acid	saturated solution	A	A	A
nitric acid	30 %	C	A	C
nitric acid	35 %	C	A	C
nitrous acid	technical grade	B	A	B
hydrochloric acid	20 %	A	A	B
hydrochloric acid	35 %	A	A	B
lard	technical grade	C	C	B
lubricating oils	technical grade	C	C	B
soft soap	saturated solution	A	A	A
black liquor	technical grade	A	A	A
sulphur	technical grade	A	A	A
sulphur dioxide, aqueous	saturated solution	A	A	A
sulphurous acid	< 30 %	A	A	A
sulphurous acid	technical grade	A	A	B
sulphuric acid	50 %	C	A	C
sulphuric acid	90 %	C	C	C
sulphuric acid	98 %	C	C	C
sulphuric acid, battery acid	37,50 %	C	A	C

Resistance at 20 °C **A** Resistant **B** Limited resistance (Depends on concentration, temperature, frequency and duration) **C** Not resistant

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
sulphuric acid, fuming	concentrated	C	C	C
hydrogen sulphide	gas, technical grade	C	A	C
heavy fuel oil	technical grade	C	C	B
soap solution (for TPE soft soaps)	saturated solution	A	A	A
silage leachate	technical grade	C	C	C
silver salts	saturated solution	A	A	A
silicone oil	technical grade	A	A	A
silicone lubricant	technical grade	A	A	A
soya bean oil	technical grade	C	C	B
bacon fat	saturated solution	B	C	B
spindle oil	technical grade	C	C	B
starch	saturated solution	A	A	A
stearic acid	technical grade	B	B	B
coal tar	technical grade	C	C	B
styrene	technical grade	C	C	C
sulphuryl chloride	technical grade	C	C	C
tallow	technical grade	C	C	B
tannin	saturated solution	B	A	A
tannic acid	saturated solution	B	B	A
tar	technical grade	C	C	B
turpentine	technical grade	C	C	C
turpineol	technical grade	C	C	C
tetrachloroethane	technical grade	C	C	C
tetrachloroethylene	technical grade	C	C	C
tetrachloromethane	technical grade	C	C	C
tetrafluoroboric acid	technical grade	A	A	A
tetrahydrofuran	technical grade	C	C	C
tetralin	technical grade	C	C	C
thionyl chloride	technical grade	C	C	B
thiophene	technical grade	C	C	C
animal oil, bone oil	technical grade	C	C	B
ink	technical grade	A	A	A
toluene	technical grade	C	C	C
toluene diisocyanate	technical grade	C	C	B
transformer oil, insulating oil	technical grade	C	C	B
triacetin	saturated solution	C	A	B
trichloroacetic acid	< 50 %	C	B	C
trichloroethanes	technical grade	C	C	C
trichloroethylene	technical grade	C	C	C
tricresyl phosphate	technical grade	C	C	C
triethanolamine	50 %	B	C	B
triethylamine	technical grade	C	C	B
triethylene glycol	technical grade	B	B	A
trisodium phosphate	saturated solution	A	A	A
trinitrotoluene	suspension	C	C	C
trioctyl phosphate	technical grade	C	A	C
urine	-	A	A	A
Vaseline	technical grade	B	C	B
vinyl acetate	technical grade	C	C	C
vinyl chloride	technical grade	C	C	C
spermaceti, sperm oil	technical grade	C	C	B
detergent (TPE: for laundry)	technical grade	A	A	A
water	-	A	A	A

EN Medium	Concentration	POLO-KAL XS | 3S with Monotec socket at 20 °C	POLO-KAL NG with EPDM seal at 20 °C	POLO-KAL NG with NBR seal at 20 °C
hydrogen	gas, technical grade	A	A	A
hydrogen peroxide	< 10 %	A	A	A
hydrogen peroxide	12 %	A	A	A
hydrogen peroxide	30 %	A	A	A
wines and spirits	-	A	A	A
wine vinegar, table vinegar	5 %	A	A	A
tartaric acid	saturated solution	A	A	A
tartaric acid	saturated solution	A	A	A
whisky	-	A	A	A
lanolin	technical grade	B	C	A
xylenols	technical grade	C	C	C
xylenes	technical grade	C	C	C
zinc salts	saturated solution	A	A	A
citric acid	saturated solution	A	A	A

10.4 Dimensioning guidelines

Drainage systems are dimensioned in accordance with the European standard EN 12056.

For clarity, all dimensions in the section are given as outer pipe diameter (DN) in accordance with CEN/TC 155 and EN 1451-1 (e.g.DN 110 instead of DN 100). This makes them directly applicable to the dimensions of the
POLO-KAL® pipe systems. 'DN/OD' is simplified to 'DN' below. All dimensioning tables are based on the hydraulic properties of POLO-KAL® pipe systems, which often permit higher flow rates compared to the generally applicable standard tables.

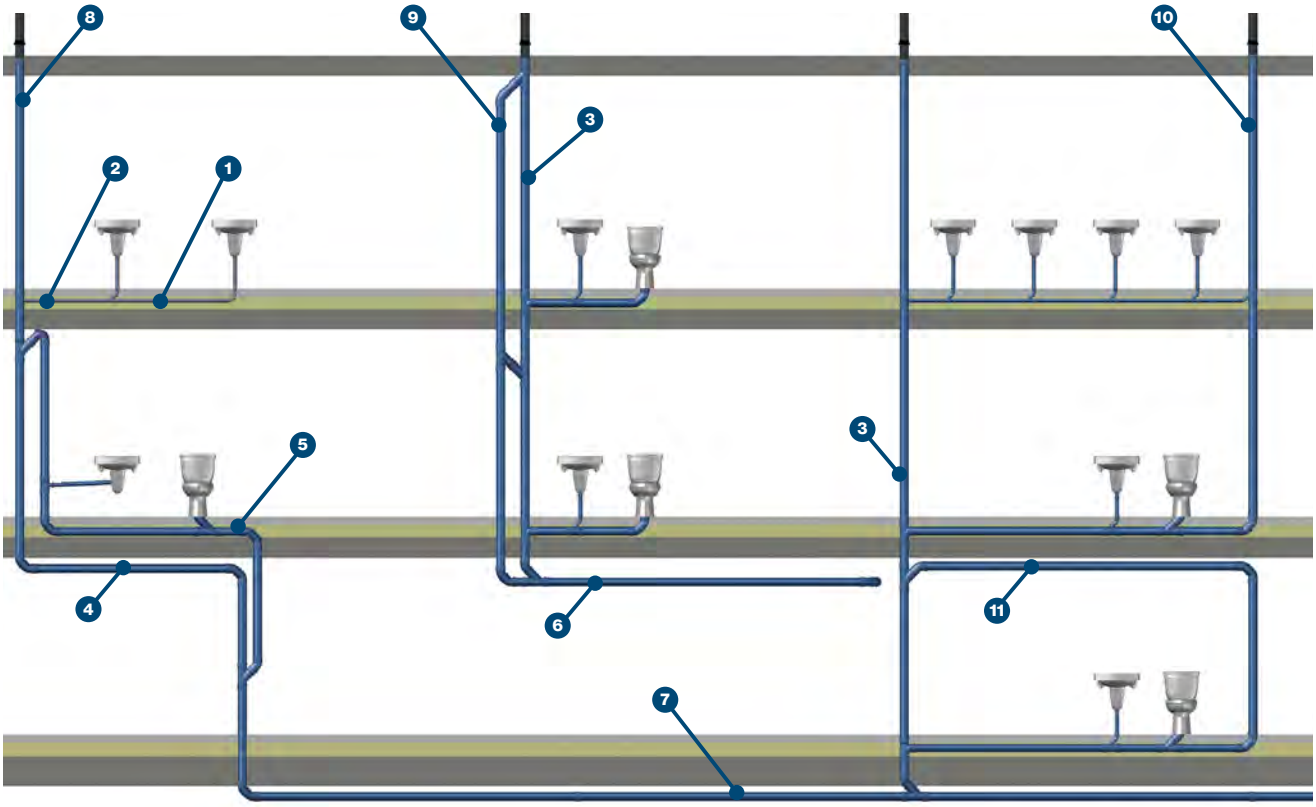
Tip:
Dimensioning has never been easier!

This section is based on the following guidelines and documents:

- EN 12056-2 Gravity drainage systems inside buildings
  Part 2: Sanitary pipework, layout and calculation

Please note that country-specific standards may contain deviating or additional requirements. Information provided in this section is based on system I in accordance with EN 12056-2.

10.4.1 Definition of wastewater pipes

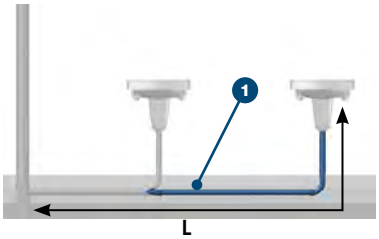


1	**Individual connection pipe**	From the drainage source to the point where it joins the downstream wastewater pipe.
2	**Collective connection pipe**	For combining several individual connection lines up to the stack, manifold or ground pipe.
3	**Stack**	Vertical drainage of rainwater and wastewater
4	**Stack offset**	Stack with an axis shift up to 10 m in length.
5	**Bypass pipe**	Secondary pipe in the area where a stack is redirected
6	**Manifold**	Horizontal pipe installed on a wall or in a ceiling

7	**Ground pipe**	Installed underground or protected by concrete slabs.
8	**Main ventilation**	Open extension at the top of a stack above the roof.
9	**Direct secondary ventilation**	Additional ventilation pipe routed directly next to the stack and connected to the stack on each floor.
10	**Indirect secondary ventilation**	Additional ventilation pipe at the end of the individual or collecting connection pipe. Routed over the roof or integrated into the main ventilation system.
11	**Vent**	Indirect secondary ventilation integrated into the stack, main ventilation or direct secondary ventilation on the same floor.

10.4.2 Individual connection pipes

- Minimum gradient: 1 %
- Maximum gradient: 5 %
- Maximum pipe length from the connection elbow to the collective connection pipe.



Max. pipe length L	Max. pipe length L	Max. number of 90° elbows [1]
Up to 4 m	No	3 pcs.
Up to 10 m	Yes	–
Over 10 m	Treat as manifold. See page 87	

[1] without connection elbow

Dimensioning is based on the number of elbows in the horizontal individual connection pipe:

Drainage source	DU	Minimum connection DN
Washbasin, bidet	0.5 l/s	40
Shower without plug	0.6 l/s	50
Shower with plug	0.8 l/s	50
Single urinal with cistern	0.8 l/s	50
Urinal with flush valve	0.5 l/s	40
Standing urinal	0.2 l/s*	40
Bath	0.8 l/s	50
Kitchen sink	0.8 l/s	50
Dishwasher (household)	0.8 l/s	50
Washing machine up to 6 kg	0.8 l/s	50
Washing machine up to 12 kg	1.5 l/s	75
WC with 6.0 l cistern	2.0 l/s	110
WC with 7.5 l cistern	2.0 l/s	110
WC with 9.0 l cistern	2.5 l/s	110**
Floor drain DN 50	0.8 l/s	50
Floor drain DN 70	1.5 l/s	75
Floor drain DN 100	2.0 l/s	90

* per person
** no more than two toilets and no more than one 90° total change of direction

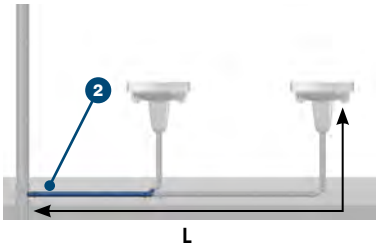
Note: Siphon and siphon connection elbows (washbasins, showers, etc.) are not taken into account for dimensioning according to the standard.

10.4.3 Collective connection pipes

- Maximum gradient: 5 %
- Maximum pipe length from the stack to the furthest connection elbow:

Max. pipe length L	Ventilation	Minimum gradient	Max. number of 90° elbows [1]	max. fall: (with 45° inclination or higher)
Up to 4 m	No	1 %	3 pcs.	1.0 m
Up to 10 m	Yes	0.5 %	–	3.0 m
Over 10 m	Treat as manifold. See page 87			

[1] without connection elbow



Connected loads (DU: discharge units) are added together for dimensioning:

Drainage source	DU
Washbasin, bidet	0.5 l/s
Shower without plug	0.6 l/s
Shower with plug	0.8 l/s
Single urinal with cistern	0.8 l/s
Urinal with flush valve	0.5 l/s
Standing urinal	0.2 l/s*
Bath	0.8 l/s
Kitchen sink	0.8 l/s
Dishwasher (household)	0.8 l/s
Washing machine up to 6 kg	0.8 l/s
Washing machine up to 12 kg	1.5 l/s
WC with 6.0 l cistern	2.0 l/s
WC with 7.5 l cistern	2.0 l/s
WC with 9.0 l cistern	2.5 l/s
Floor drain DN 50	0.8 l/s
Floor drain DN 70	1.5 l/s
Floor drain DN 100	2.0 l/s

* per person

The larger pipe determines the value:
- Based on the drainage source with the largest connected load (max. DU)
- Based on the total of all connected loads (∑DU)

Drainage source with max. DU	Unventilated		Ventilated		
	∑DU	Pipe	∑DU	Pipe	Ventilation 10 11
0.8 l/s	1.5	DN 50	2.2	DN 50	DN 40
0.8 l/s	2.0	DN 75	3.0	DN 75	DN 40
1.5 l/s	3.0	DN 75	4.5	DN 75	DN 50
2.0 l/s	6.0	DN 90 [2]	8.0	DN 90 [2]	DN 75
2.5 l/s	15.0	DN 110	25.0	DN 110	DN 75

[2] max. 2 WCs and no more than one 90° change of direction

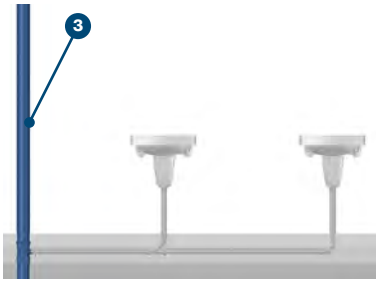
Example: An unventilated collective connection pipe with one WC (DU=2 l/s) and one washbasin (DU=0.5 l/s). The sum of the DUs (2.5 l/s) equates to DN 75. The drainage source with the largest DU (2.0 l/s) equates to DN 90. As a result, the collective connecting pipe needs to be dimensioned at DN 90.

10.4.4 Stacks

The wastewater flow rate QWW is calculated for stack dimensioning, whereby frequency (K) is taken into account:

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

Q_{WW}	Wastewater flow rate[l/s]
K	Frequency factor
∑DU	Sum of discharge units (DU)



Building type	K
Irregular use, e.g. residential buildings, guest houses, offices	0.5
Regular use, e.g. hospitals, schools, restaurants, hotels	0.7
Frequent use, e.g. in public toilets and/or showers	1.0
Special use, e.g. laboratories	1.2

Drainage source	DU
Washbasin, bidet	0.5 l/s
Shower without plug	0.6 l/s
Shower with plug	0.8 l/s
Single urinal with cistern	0.8 l/s
Urinal with flush valve	0.5 l/s
Standing urinal	0.2 l/s*
Bath	0.8 l/s
Kitchen sink	0.8 l/s
Dishwasher (household)	0.8 l/s
Washing machine up to 6 kg	0.8 l/s
Washing machine up to 12 kg	1.5 l/s
WC with 6.0 l cistern	2.0 l/s
WC with 7.5 l cistern	2.0 l/s
WC with 9.0 l cistern	2.5 l/s
Floor drain DN 50	0.8 l/s
Floor drain DN 70	1.5 l/s
Floor drain DN 100	2.0 l/s

* per person

Any continuous drainage and pump flow rates need to be added to the value Q_{WW}:

$$Q_{max} = Q_{WW} + Q_C + Q_P$$

Q_{max}	Total wastewater flow rate [l/s]
Q_{WW}	wastewater flow rate [l/s]
Q_C	Constant flow rate [l/s]
Q_P	Lifting station pump flow rate

The highest drainage value is taken as the basis:

- Calculated Q_{max} or
- connected load of the drainage source with the largest DU in the stack.

Stack with main ventilation

Permissible wastewater flow rate Q_{max}

Stack with main ventilation 3 8	POLO-KAL NG	POLO-KAL XS	POLO-KAL 3S
DN 75 [1]	1.5 l/s	1.5 l/s	1.5 l/s
DN 90 [2]	3.5 l/s [3]	3.5 l/s [3]	3.5 l/s[3]
DN 110	5.2 l/s [3]	5.2 l/s [3]	5.2 l/s[3]
DN 125	5.8 l/s	5.8 l/s	5.8 l/s
DN 160	9.5 l/s	9.5 l/s	9.5 l/s
DN 200	16.0 l/s	-	-

Stack with secondary ventilation

Permissible wastewater flow rate Q_{max}

Stack 3	Secondary ventilation 9 10	POLO-KAL NG	POLO-KAL XS	POLO-KAL 3S
DN 75 [1]	DN 50	2.0 l/s	2.0 l/s	2.0 l/s
DN 90 [1]	DN 50	4.6 l/s [3]	4.6 l/s [3]	4.6 l/s[3]
DN 110	DN 50	7.3 l/s [3]	7.3 l/s [3]	7.3 l/s[3]
DN 125	DN 75	12.4 l/s	12.4 l/s	12.4 l/s
DN 160	DN 90	14.1 l/s	14.1 l/s	14.1 l/s
DN 200	DN 110	21.0 l/s	-	-

[1] Not permitted if WC connected.
[2] Only permitted up to 10 m stack height with connected WC.
[3] Higher permissible wastewater flow rate due to elbow branch.

Tip: Use POLOPLAST ventilation elbows for easy integration of bypass pipes and secondary ventilation.

10.4.5 Manifolds and ground pipes

- Minimum gradient: 0.5 %
- Maximum gradient: 5 %
- Minimum nominal diameter DN 110

The wastewater flow rate Q_{WW} is calculated for dimensioning manifolds and ground pipes, whereby frequency (K) is taken into account:

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

Q_{WW}	Wastewater flow rate [l/s]
K	Frequency factor
∑DU	Sum of discharge units (DU)

Building type	K
Irregular use, e.g. residential buildings, guest houses, offices	0.5
Regular use, e.g. hospitals, schools, restaurants, hotels	0.7
Frequent use, e.g. in public toilets and/or showers	1.0
Special use, e.g. laboratories	1.2

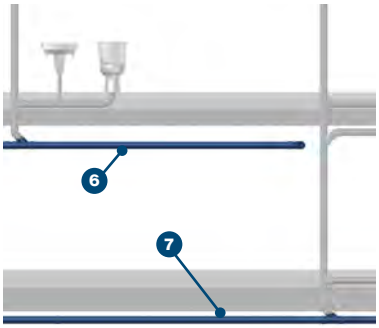
Any continuous drainage and pump flow rates need to be added to the value Q_{WW}:

$$Q_{max} = Q_{WW} + Q_C + Q_P$$

Q_{max}	Total wastewater flow rate [l/s]
Q_{WW}	Wastewater flow rate [l/s]
Q_C	Constant flow rate [l/s]
Q_P	Lifting station pump flow rate

The highest drainage value is taken as the basis:

- Calculated Qmax or
- connected load for the drainage source with the largest DU in the manifold or ground pipe



Drainage source	DU
Washbasin, bidet	0.5 l/s
Shower without plug	0.6 l/s
Shower with plug	0.8 l/s
Single urinal with cistern	0.8 l/s
Urinal with flush valve	0.5 l/s
Standing urinal	0.2 l/s*
Bath	0.8 l/s
Kitchen sink	0.8 l/s
Dishwasher (household)	0.8 l/s
Washing machine up to 6 kg	0.8 l/s
Washing machine up to 12 kg	1.5 l/s
WC with 6.0 l cistern	2.0 l/s
WC with 7.5 l cistern	2.0 l/s
WC with 9.0 l cistern	2.5 l/s
Floor drain DN 50	0.8 l/s
Floor drain DN 70	1.5 l/s
Floor drain DN 100	2.0 l/s

* per person

Manifolds and ground pipes for wastewater

Hydraulic discharge capacity at fill level 70 % with flow velocity ≥ 0.7 m/s

POLO-KAL XS, POLO-KAL NG

Permissible wastewater flow rate Q_{max}

Gradient	DN 110	DN 125	DN 160	DN 200	DN 250
0.5 %	-	-	9.74 l/s	17.29 l/s	31.19 l/s
0.6 %	-	-	10.68 l/s	18.96 l/s	34.20 l/s
0.7 %	-	5.96 l/s	11.55 l/s	20.50 l/s	36.96 l/s
0.8 %	4.54 l/s	6.38 l/s	12.35 l/s	21.93 l/s	39.54 l/s
0.9 %	4.82 l/s	6.77 l/s	13.11 l/s	23.27 l/s	41.96 l/s
1.0 %	5.08 l/s	7.14 l/s	13.83 l/s	24.54 l/s	44.24 l/s
1.1 %	5.33 l/s	7.49 l/s	14.51 l/s	25.75 l/s	46.42 l/s
1.2 %	5.57 l/s	7.83 l/s	15.16 l/s	26.90 l/s	48.50 l/s
1.3 %	5.80 l/s	8.15 l/s	15.78 l/s	28.01 l/s	50.49 l/s
1.4 %	6.03 l/s	8.46 l/s	16.38 l/s	29.07 l/s	52.41 l/s
1.5 %	6.24 l/s	8.76 l/s	16.96 l/s	30.10 l/s	54.26 l/s
2.0 %	7.21 l/s	10.13 l/s	19.61 l/s	34.79 l/s	62.70 l/s
2.5 %	8.07 l/s	11.34 l/s	21.94 l/s	38.92 l/s	70.14 l/s
3.0 %	8.85 l/s	12.42 l/s	24.04 l/s	42.65 l/s	76.87 l/s
3.5 %	9.56 l/s	13.43 l/s	25.98 l/s	46.09 l/s	83.05 l/s
4.0 %	10.23 l/s	14.36 l/s	27.78 l/s	49.29 l/s	88.81 l/s
4.5 %	10.85 l/s	15.24 l/s	29.48 l/s	52.29 l/s	94.22 l/s
5.0 %	11.44 l/s	16.06 l/s	31.08 l/s	55.13 l/s	99.33 l/s

Note: These dimensioning tables only apply to POLO-KAL® pipe systems.

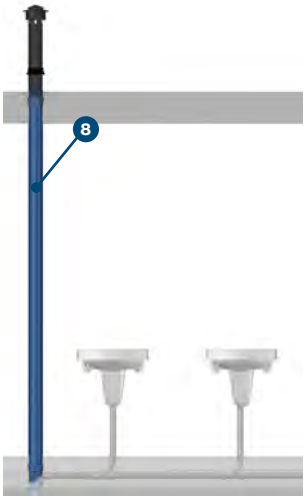
See Table B.2 in EN 12056-2:2000 for other pipe systems.

POLO-KAL 3S

Permissible wastewater flowrate Q_{max}

Gradient	DN 110	DN 125	DN 160
0.5 %	-	-	8.87 l/s
0.6 %	-	-	9.72 l/s
0.7 %	-	5.59 l/s	10.51 l/s
0.8 %	4.22 l/s	5.98 l/s	11.25 l/s
0.9 %	4.48 l/s	6.35 l/s	11.94 l/s
1.0 %	4.72 l/s	6.69 l/s	12.59 l/s
1.1 %	4.96 l/s	7.02 l/s	13.21 l/s
1.2 %	5.18 l/s	7.34 l/s	13.80 l/s
1.3 %	5.39 l/s	7.64 l/s	14.37 l/s
1.4 %	5.60 l/s	7.93 l/s	14.92 l/s
1.5 %	5.80 l/s	8.21 l/s	15.44 l/s
2.0 %	6.70 l/s	9.50 l/s	17.85 l/s
2.5 %	7.50 l/s	10.63 l/s	19.98 l/s
3.0 %	8.22 l/s	11.65 l/s	21.89 l/s
3.5 %	8.89 l/s	12.59 l/s	23.66 l/s
4.0 %	9.51 l/s	13.46 l/s	25.30 l/s
4.5 %	10.09 l/s	14.29 l/s	26.84 l/s
5.0 %	10.64 l/s	15.06 l/s	28.30 l/s

10.4.6 Ventilation line



- The **main ventilation** line must have at least the same cross-section as the stack and discharge from the roof.

If several ventilation lines are combined, the cross-section of the combined ventilation line has to be calculated:

$$A_L = \frac{A_1+A_2+A_3,+ \dots A_n}{2}$$

A_L	Cross-sectional area of the combined ventilation line
A_1, A_2, A_3, A_n	Cross-sectional area of individual ventilation lines

The dimension of the combined ventilation line must be at least the size of the largest connected ventilation line.

Cross-sectional areas of POLO-KAL® pipe systems:

	POLO-KAL NG **A**	**POLO-KAL** XS **A**	**POLO-KAL** 3S **A**
DN 40	10.41 cm^2	10.41 cm^2	–
DN 50	16.62 cm^2	16.62 cm^2	16.33 cm^2
DN 75	38.26 cm^2	38.26 cm^2	35.68 cm^2
DN 90	55.42 cm^2	55.42 cm^2	51.53 cm^2
DN 110	83.65 cm^2	83.65 cm^2	79.17 cm^2
DN 125	107.88 cm^2	107.88 cm^2	102.79 cm^2
DN 160	177.19 cm^2	177.19 cm^2	165.13 cm^2
DN 200	272.89 cm^2	–	–
DN 250	425.65 cm^2	–	–

11. References

Quadrill Complex

Linz . Austria

Pipe system POLO-KAL NG . POLO-KAL XS
Project scope 7.500 m in all dimensions

Special features
- Reliable delivery and quick, hassle-free assembly for speedy completion
- Slim design for space-saving installation and efficient operation
- Versatile use in residential, catering, retail and office spaces

PlusCity Shopping Center

Pasching . Austria

Pipe system POLO-KAL NG
Project scope 800 m

Special featues
- High safety standards
- Easy-to-install plug-in system
- Highly sound insulating pipe system

Allianz Stadium SK Rapid

Vienna . Austria

Pipe system POLO-KAL XS . POLO-KAL NG
Project scope 1.900 m (60 % POLO-KAL XS, 40 % POLO-KAL NG)

Special featues
- Sound protection in the ‘tube’ component
- High safety requirements

Vortuna Health resort

Bad Leonfelden . Austria

Pipe system POLO-KAL XS . POLO-KAL NG
Project scope 2.500 m

Special featues
- Numerous requirements for building services due to different room uses (spa, restaurant, surgeries, guest rooms) over a total area of 30,000 m^2.

Music theater Linz new building

Linz . Austria

Pipe system POLO-KAL 3S . POLO-KAL NG
Project scope 1.000 m

Special featues
- High quality and safety were top priorities
- Wastewater flow rate in all wet areas and stacks

Lux Tower

Linz . Austria

Pipe system POLO-KAL NG
Project scope 1.500 m vertical

Special featues
- Sound insulation requirements
- High quality standards

You can find further reference projects at

POLO-RDS Evolution

Pipe and cable penetration

12. Product overview

12.1 Pipe and cable penetration

The POLO-RDS Evolution pipe and cable penetration system is as systematic as it is flexible. The ingenious design details simplify planning and speed up installation – ensuring safe, leak-tight cable and pipe penetrations every time.

- **Simple. Smart. Safe. – POLO-RDS Evolution**
  A complete solution for wall and floor penetrations.
- **Polypropylene finned pipe**
  Engineered for simple, reliable installation.
- **Environmentally responsible – PVC-free and halogen-free**
- **Hinged sealing elements with onion skin design**
  Featuring an innovative installation monitor for maximum flexibility – and a guaranteed watertight seal.
- **Swift, straightforward installation**
- **Assured leak-tightness**

Floor penetration

Sealing element with installation monitor

Finned pipe

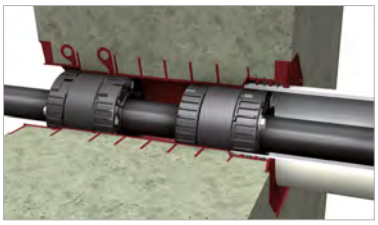
Sealing element with installation monitor

Longbow

12.2 Finned pipe

The finned pipe is cast directly into concrete wall formwork.

Leak-tight integration
- Integrated sealing fins
- Watertight up to 1 bar (10 m water column) when fitted with 2 sealing elements
- Excellent integration into the concrete wall
- Slightly angled fins for superior concrete adhesion
- Prevents water bypass from pressurised groundwater when correctly installed in waterproof concrete



Variable length

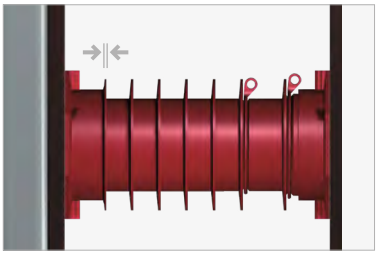
Shortening the finned pipe
- Suitable for wall thicknesses of 20 cm, 25 cm and 30 cm
- Easily shortened without any need for cutting tools
- Defined tear-off elements with tabs

Extended finned pipe
- Tight-welded polypropylene extension with integral seal for wall thicknesses from 30 cm to 60 cm
- Can be cut to any length, plus an additional 5 mm allowance (spring element)

Simple installation
- Fits directly without any need for formwork aids – the outward-curved wall flange with compression edges adapts perfectly to the formwork and prevents cement laitance from entering the finned pipe
- Anchor strips on the flange ensure a secure hold in the concrete
- Nail holes and axis markings simplify installation
- Multiple units can be arranged flange to flange

Integrated spring element

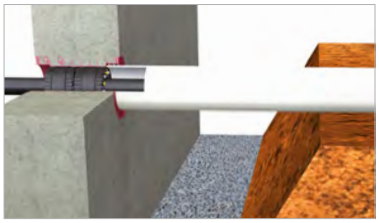
The disc spring activates when the formwork elements are braced:
- Compensates for formwork tolerances
- Ensures optimum bracing within the formwork
- Prevents shifting during concreting
- Prevents floating during concreting



Precise sealing element positioning

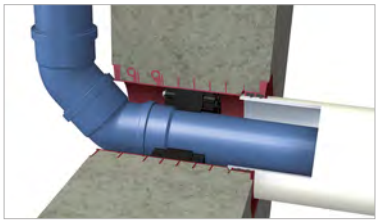
A defined stop edge guarantees accurate positioning of the sealing elements within the finned pipe.

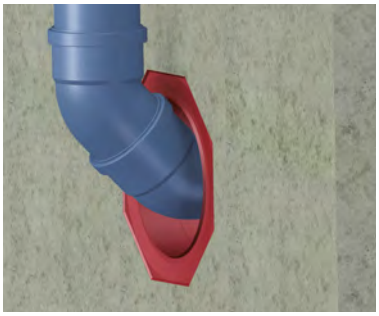
Settlement protection
The settlement protection pipe guards against deformation, crushing and shearing of media pipelines caused by settlement in excavation backfill.



Recessed pipe socket
The pipe socket of the underground drainage pipe (up to DN 200) can be fully inserted into the finned pipe:

- Ideal where space is limited
- Space-saving stack connection
- Accommodates pipe routing at 2 % gradient





12.3 Floor penetration

The POLO-RDS Evolution floor penetration combines absolute safety with outstanding simplicity. Within the DN 110 range, a variety of pipe and cable penetrations can be sealed using POLO-RDS Evolution sealing elements – fully watertight and radon-tight.

- Direct **building drainage** integration – Connection pipes for **water supply**
- Connection pipes for **electricity supply** lines – Connection pipes for **heat pumps**
- **Garden connections** (swimming pool power supply, rainwater tank, etc.)
- **Data lines** (fibre optic, cable TV, etc.) – Electric vehicle **charging stations**
- Reserve penetrations for **future installations**

Adjusting the length
The floor penetration can be shortened to suit your requirements.
Always maintain the minimum socket insertion depth.

Precise positioning
Secure the floor penetration to the reinforcement mesh using the positioning holes.
See page 109 for installation instructions.

Align with the top edge of the foundation slab

Add concrete and vibrate

Remove the protective cover

Leak-tightness
Watertight up to 1 bar (10 m water column)

PLT hose penetration

Domestic power supply cable penetration

Direct connection to domestic drainage POLO-KAL®

System-compatible sealing elements

Sealing element DN 100 hinged
Art. no. 01011

Sealing element DN 100 hinged
Art. no. 01015

Sealing element with multiple penetration DN 100, hinged
Art. no. 01010

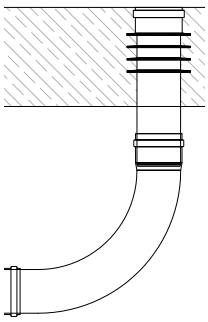
Blank sealing element DN 100
Art. no. 01020

12.3.1 POLO-RDS Evolution longbow

Effortless media pipeline insertion

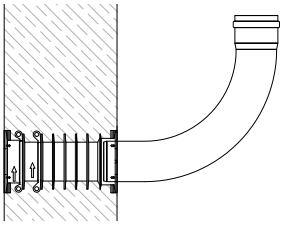
- No need to connect 6 × 15° bends
- Smooth internal wall without joints allows cables and pipes to glide through effortlessly
- Compatible with POLO-RDS Evolution floor penetration, finned pipe and PVC sewer pipes DN 110

12.3.2 Application and installation scenarios



Floor penetration application

When combined with a POLO-RDS Evolution floor penetration, pipes and cables can be routed simply and safely – even where changes of direction are required.



Finned pipe application

When combined with a POLO-RDS Evolution finned pipe, a 90° change of direction can be made directly on the external basement wall. The longbow is equally effective for any subsequent directional changes.

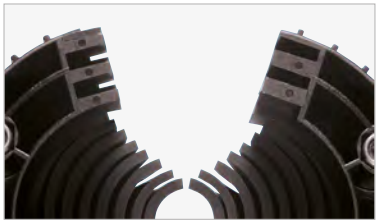
12.4 Sealing element

Creates a watertight seal between the media pipeline(s) and finned pipe, floor penetration or core drilling.

Retrofit installation
Installs without difficulty where cables and pipes are already in place:
- Hinged compression flanges available in dimensions 100, 150 and 200

Reliable installation
Patented yellow installation monitors ensure swift, straightforward and dependable installation
- Installation monitors pop out of the flange once the minimum seal tightness is achieved
- Reusable: simply press the installation monitors back into the flange after removing the sealing element

Flexible onion skin design
- Wide sealing range within a single sealing element
- Maximum possible on-site flexibility
- Adapts quickly and easily to different diameters



Defined insertion depth
Stop lugs on the outer compression flange ensure that the sealing element is correctly positioned within the finned pipe and floor penetration.
Simply slide the sealing element in as far as it can go.

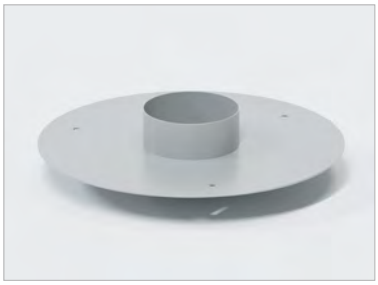
When installing deeper within the finned pipe or in a core drilling, the stop lugs can be removed.

Core drilling installation
The sealing elements can also be retrofitted in pairs into core drillings in walls, floor slabs or ceilings.

12.5 Torch-on flange

The POLO-RDS Evolution torch-on flange extends the capabilities of the POLO-RDS Evolution cable and pipe penetration system. When inserted into a POLO-RDS Evolution finned pipe, the POLO-RDS Evolution torch-on flange allows bitumen sheeting to be applied with an overlap of up to 100 mm.

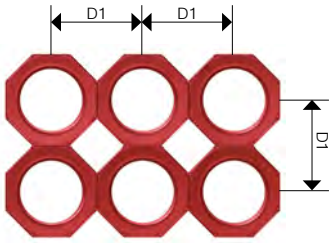
Available in the following dimensions:
DN 100 (art. no. 01051), **DN 150** (art. no. 01052) and **DN 200** (art. no. 01053)

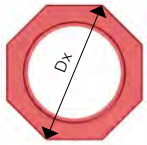


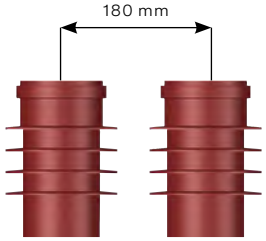
13. System properties

13.1 Technical data

POLO-RDS Evolution	Finned pipe				Floor penetration
	DN 100	DN 150	DN 200	DN 300	DN 100
Application	Installation in concrete wall				Installation in floor slab
Settlement protection	External socket for inserting a settlement protection pipe				Not required
Multiple arrangement	In a pack, wall flange to wall flange				According to axis dimension
Overall length	300 mm Can be shortened to 250 mm or 200 mm using the tear-off element				400 mm
Material	Polypropylene Halogen-free, cadmium-free, free of heavy metals				
Colour	Red, RAL 3004 purple red				
Leak-tightness	Sealed against seepage water and hydrostatic water pressure up to 1 bar (10 m water column)				
Operating temperature range	-30°C to +100°C				
Installation temperature	≥ 0°C				
Axis dimension for multiple arrangement D1	170 mm	220 mm	270 mm	386 mm	Axis dimension 180 mm
Outer diameter Dx	184 mm	238 mm	292 mm	415 mm	160 mm







POLO-RDS Evolution sealing element	DN 100	DN 150	DN 150	DN 200	DN 300
Sealing range	8–63 mm, blank	25–110 mm, blank	5×8–35 mm	50–160 mm, blank	160–250 mm, blank
Application	For installation in concrete walls and floor slabs to seal smooth-walled, dimensionally stable media pipes, cables and lines. **Sealing elements are not designed to absorb longitudinal forces**				
Design	Split and hinged				Fixed
Material	Polyamide, glass fibre reinforced				
Screw connection	Hexagon head screws M6, A2 stainless steel				
Sealing rubber	NBR, oil-resistant				
Colour	Black				
Water-tightness	Sealed against seepage water and hydrostatic water pressure up to 1 bar (10 m water column)				
Gas-tightness	Protection against gas ingress, including radon gas from the ground				
Operating temperature range	-30°C to +100°C				
Installation temperature	≥ 0°C				
Longitudinal forces	Not designed to absorb longitudinal forces				

14. Approvals and certificates

14.1 Water leak test: POLO-RDS Evolution finned pipe

Poloplast GmbH. & Co. KG
z.Hd.Hrn.Ing. Schöller
Poloplast-Straße 1
4060 Leonding

Magistrat der Stadt Wien
Magistratsabteilung 39 - VFA
Versuchs- und Forschungsanstalt
der Stadt Wien
Rinnböckstraße 15
A-1110 Wien
Tel.: (+43 1) 795 14-8039
Fax: (+43 1) 795 14-99-8039
E-Mail: post@m39.magwien.gv.at
www.wien.at

MA 39 - 2005K023

Wien, 13. Jänner 2005

Zusammenfassung der Dichtheitsprüfung des Rohrdurchführungssystems „POLO-RDS evolution" (siehe Untersuchungsbericht MA 39 – VFA 2004-1566.01)

Die Dichtheitsprüfung des Rohrdurchführungssystems „POLO - RDS evolution" mit einem Lamellenrohr DN 100 mm erfolgte in Anlehnung an die ÖNORM B 3303 („Wassereindringtiefe").

Antragsgemäß wurden die Prüfkörper 14 Tage mit einem Wasserdruck von 1,5 bar beaufschlagt.

Während der gesamten Prüfdauer konnte an der Unterseite der Prüfkörper (drucklose Seite) kein Wasserdurchtritt erkannt werden.

Bei der anschließenden Spaltung der Prüfkörper wurden Wassereindringtiefen von 4,5 cm (bis zur 1. Lamelle) bzw. 10 cm (bis kurz nach der 2. Lamelle) in den Beton festgestellt.

An den Innenflächen der Lamellenrohre waren keinerlei Feuchtigkeitsspuren sichtbar.

Auf Grund der gleichen Geometrie der Lamellenrohre mit DN 200 mm können aus Sicht der MA 39 – VFA die Ergebnisse der Dichtheitsprüfung auch auf diese Dimension angewendet werden.

Der Sachbearbeiter:

Ing.H.Kurz
Techn.Amtsrat

Magistrat der Stadt Wien
Magistratsabteilung 39
Versuchs- und Forschungsanstalt
der Stadt Wien
11, Rinnböckstraße 15
1110 Wien

Der Leiter der Versuchs- und Forschungsanstalt:

Dipl.Ing.W.Fleck
Senatsrat

DVR: 0000191 – SD 55

14.2 Gas leak test: Sealing elements

ZF-Steyr Werkstofftechnik A-SQ	**Untersuchungsbefund**	Eingangs-datum : 24.5.2006

Benennung:	**Auftraggeber:**
POLO - RDS-evolution Dichtelement	Hr. Schöller Fa.Poloplast

Grund der Untersuchung:	Radondichtheit soll beim POLO- RDS Dichtelement nachgewiesen werden.
Erwünschte Prüfung:	Nachweis der Radondichtheit mittels H_2-Spurentestgerät

1. Aufgabenstellung:
Das POLO RDS Element wird zur Einführung erdverlegter Kabel und Rohrleitungen in Kellerräume von Wohnhäuser eingesetzt. Es muss seitens Kundenforderung in der Lage sein, „Radongas" Dichtheit von der Außenseite zur Rauminnenseite zu gewährleisten. Dazu ist erforderlich, dass die eingesetzten Dichtelemente materialmäßig in sich gasdicht sind.
Zur Überprüfung der Dichtheit bietet sich Wasserstoff als Prüfgas an, der nachfolgende Vorzüge aufweist:

- Volumenmäßig das kleinste Gas, welches in der Natur bekannt ist. Das Wasserstoffmolekül, das als Testgas eingesetzt wird, besitzt einen Molekülradius von 60 pm (60×10^{-12} m).
- Radon besitzt hingegen einen Atomradius laut Literatur von 120 pm bis134 pm und ist daher als doppelt so großes Gas wie Wasserstoff zu betrachten. Dieser Zusammenhang führt zur Überlegung, Wasserstoff anstelle von Radon als Prüfmittel zu verwenden.
- Sehr gute Detektierbarkeit infolge jahrelanger Erfahrung der Gerätehersteller von Lecktestgeräten.

2. Eingesetzte Probe:
Der POLO –RDS Dichtungsgummi besteht aus einer NBR- Mischung. (Nitril-Butadien-Kautschuk)
Der Dichtgummi wurde auf die Stirnfläche eines Stahlzylinders angepresst. Die Verpressung erfolgt durch den Flanschring mit 4 Imbusschrauben. Die Messstelle liegt in der freigestellten Stirnfläche.
(siehe Anhang)

3. Versuchsbeschreibung:
An der Bodenseite des Zylinders wurde ein Anschluss für das Einleiten des Prüfgases angebracht. Als Prüfdruck wurde 0,2 bar, 0,5 bar und 1 bar Überdruck im Zylinder verwendet. Nach festgelegter Prüfdauer (10 min und 30 min) wurde die Dichtstelle am Flansch und bei den Schrauben von außen mit dem Sensor abgefahren, wobei im Suchmodus nach Undichtheiten gesucht wurde und im Analysemodus die Leckage gemessen wurde. Das Gerät wurde zu Beginn mit Kalibriergas abkalibriert. Die Kalibrierung wurde am Ende der Prüfung wiederholt.

4. Prüfergebnisse:

Prüfdruck: gemessen:	**0,2 bar nach 10 min**	**0,2 bar nach 30 min**	**0,5 bar nach 10 min**	**0,5 bar nach 30 min**	**1bar nach 10 min**	**1bar nach 30 min**
Ergebnis der Durchlässigkeit	0 ppm H_2	0 ppm H_2	0 ppm H_2	0 ppm H_2	0 ppm H_2	0 ppm H_2

Das Messgerät ist laut Hersteller in der Lage, Wasserstoff- Gehalte von 0,5 ppm H_2 zu erkennen. Das bedeutet, dass Leckraten ab 5×10^{-7} mbar l/s erfasst werden können.
5: Anhang (auf Folgeseite)
Messgerät, Probe, Zertifikat des Messgerätes.

6. Beurteilung: Die Wasserstoff-„Gasdichtheit" des POLO-RDS Dicht-Elementes konnte im Druckbereich von 0,2 bis1 bar nachgewiesen werden. Da Radongas einen größeren Radius wie das Wasserstoffmolekül besitzt, ist anzunehmen, dass die erzielten Ergebnisse bei der Verwendung von Radon ebenfalls erreicht werden.
Aufgrund der Prüfungen kann festgestellt werden, dass das Dichtelement POLO RDS evolution dicht gegen natürlich im Boden vorkommende Gase ist.

Datum erledigt: 22.6.2006	Bearbeiter: Karrer / Haslinger	Unterschrift: A-SQ Kollment

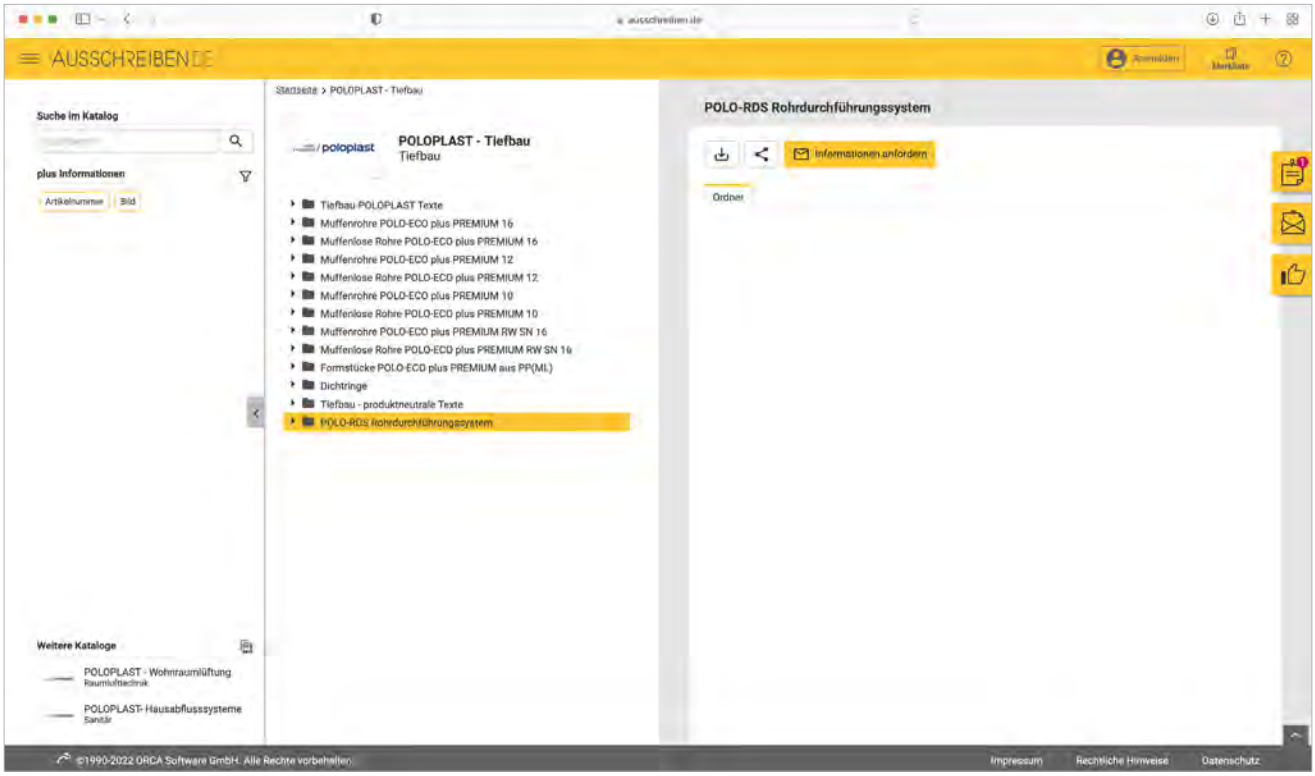
ZF Steyr
Präzisionstechnik GmbH & Co KG
Schönauer Strasse 5, A-4400 Steyr

15. Planning and layout

15.1 Tender texts

Tender texts for all POLOPLAST products are available free of charge on the platform:

- Straightforward transfer of texts into service specifications and quotations
- Export individual products or complete product ranges
- Always up to date
- Export options: GAEB, PDF or Word
- Drag and drop items into many popular tendering programs
- Manufacturer-neutral texts available



Tender texts in other formats

Do you need tender texts in a specific format, or do you have any questions? Simply contact your POLOPLAST sales representative or get in touch with POLOPLAST directly.

15.2 Product selection

Floor penetration		
	OL 400	**DN 100** Art. no. 01029

Longbow	
	DN 110 Art. no. 01048

Torch-on flanges	
	DN 100 Art. no. 01051
	DN 150 Art. no. 01052
	DN 200 Art. no. 01053

Finned pipes	OL	DN 100	DN 150	DN 200	DN 300
	300	Art. no. 01030	Art. no. 01036	Art. no. 01031	Art. no. 01034
	600	Art. no. 01070	-	Art. no. 01073	Art. no. 01076

Sealing elements	DN 100	DN 150	DN 200	DN 300
Sealing elements Single penetration	**13-50 mm Hinged** Art. no. 01011	**25-65 mm Hinged** Art. no. 01024	**50-125 mm Hinged** Art. no. 01012	**160 mm** Art. no. 01016
	52-58 mm Hinged Art. no. 01014	**70-90 mm Hinged** Art. no. 01025	**160 mm Hinged** Art. no. 01013	**200 mm** Art. no. 01017
	63 mm Hinged Art. no. 01015	**110 mm Hinged** Art. no. 01026		**250 mm** Art. no. 01018
Sealing elements Multiple penetration	**8, 2×10, 12, 14, 16, 18 mm Hinged** Art. no. 01010	**5×8-35 mm Hinged** Art. no. 01023	**2×32 mm** Art. no. 01082 **2×40 mm** Art. no. 01083 **2×50 mm** Art. no. 01084	
	2×20 mm Art. no. 01080 **2×25 mm** Art. no. 01081 **2×32 mm** Art. no. 01085			
Blank sealing elements	Art. no. 01020	Art. no. 01027	Art. no. 01021	Art. no. 01022

For core drilling (fit 2 sealing elements)	100-102 mm	150-152 mm	200-202 mm	300-302 mm
For media pipelines 	8-63 mm	8-110 mm	50-160 mm	160-250 mm

Packs	DN 100	DN 150		DN 200
Each pack contains: finned pipe, overall length 300 mm, and 1 or 2 sealing elements	**13-50 mm** Art. no. 01040	**25-65 mm** Art. no. 01046	**110 mm** Art. no. 01045	**50-125 mm** Art. no. 01041
		70-90 mm Art. no. 01047		**160 mm** Art. no. 01044

15.3 Number of sealing elements for wall penetration

Sealing element		Seepage water	Pressurised water	Core drilling	Art. no.
DN 100	For DN 13-50	2*	2	2	01011
	For DN 52-58	2*	2	2	01014
	For DN 63	2*	2	2	01015
	For DN 8, 2×10, 12, 14, 16, 18	1	2	2	01010
	Blank sealing element	1	2	2	01020
DN 150	For DN 25-65	2*	2	2	01024
	For DN 70-90	2*	2	2	01025
	Blank sealing element	1	2	2	01027
	For 5×DN 8-35	1	2	2	01023
DN 200	For DN 50-125	2*	2	2	01012
	For DN 50-125	1	1**	1**	01012
	For DN 160	2*	2	2	01013
	For DN 160	1	1**	1**	01013
	Blank sealing element	1	2	2	01021
DN 300	For DN 160	2*	2	2	01016
	For DN 160	1	1**	1**	01016
	For DN 200	2*	2	2	01017
	For DN 200	1	1**	1**	01017
	For DN 250	2*	2	2	01018
	For DN 250	1	1**	1**	01018
	Blank sealing element	1	2	2	01022

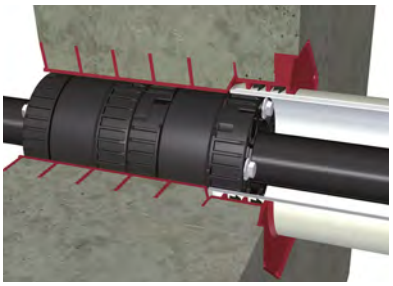
* For axis-parallel fixing of the media pipeline
** Sewer pipe DN 90/110/125/160 with gradient up to 2 % – watertight up to 0.30 bar (3 m water column)

15.4 Number of sealing elements for floor penetration

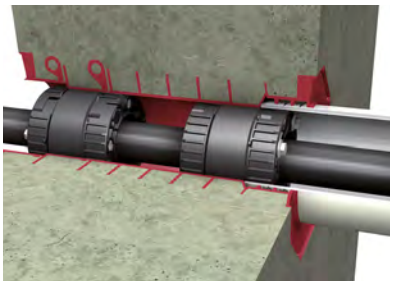
Sealing element		Seepage water	Pressurised water	Art. no.
DN 100	For DN 13-50	1	1	01011
	For DN 52-58	1	1	01014
	For DN 63	1	1	01015
	For DN 8, 2×10, 12, 14, 16, 18	1	1	01010
	Blank sealing element	1	1	01020

15.5 Installation examples

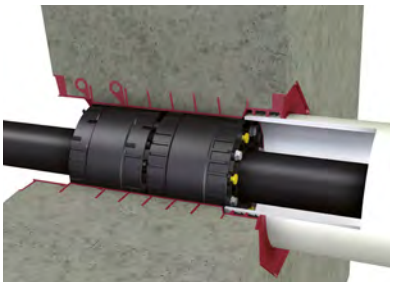
Wall thickness 20 cm (25 cm)



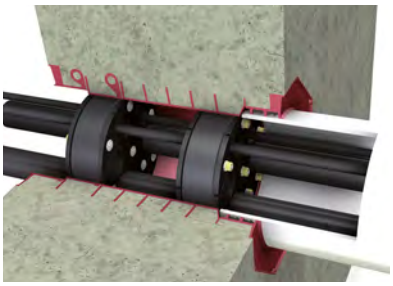
Wall thickness 30 cm

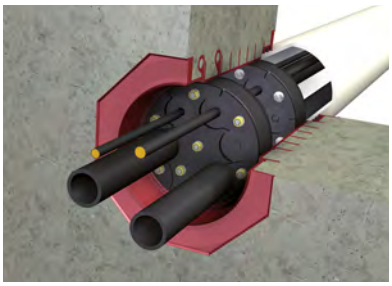


Wall thickness 30 cm,
DN 150 with installation monitor



Wall thickness 30 cm, DN 150 5× 8–35 mm

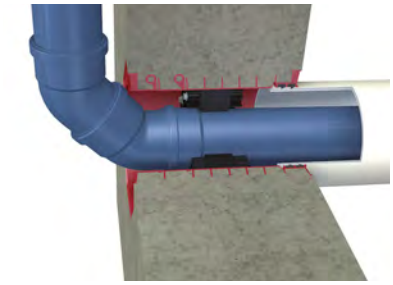


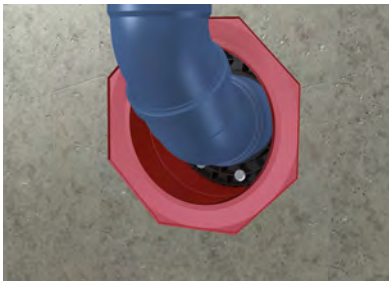


Wall thickness > 30–60 cm

Wall thickness > 60 cm

Stack redirection





16. Installation

16.1 Installation tools

Finned pipe
The finned pipe can be fitted simply by nailing it to the formwork.

For wall thicknesses of 20 cm and 25 cm, the finned pipe can be shortened without any need for cutting tools – a claw hammer is all you need.

Sealing element
Remove the sealing onion layers to accommodate the required media pipeline diameter using a sharp knife, or simply tear them off. Tighten the screws using a 10 mm socket, short extension bar and ratchet (fitted with a torque release as an option).

16.2 Multiple arrangement

Multiple arrangement: When fitting multiple units, the finned pipes can be installed flange to flange. When selecting the concrete grade, ensure the quality and maximum aggregate size will avoid gravel pockets in these areas.

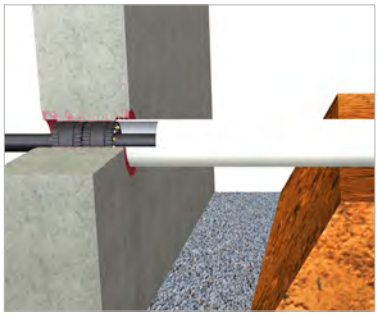
16.3 Settlement protection

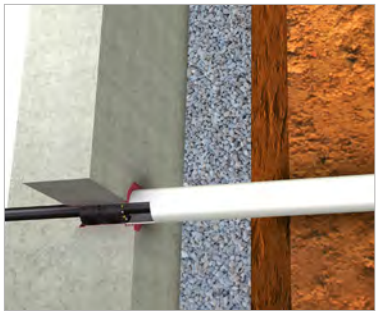
Excavation backfill naturally undergoes settlement until the ground consolidates in its final position. Pipes, cables and lines cannot fully accommodate this movement because they are held in a fixed position at the wall penetration. This may result in deformation, crushing and shearing of these lines – compromising the leak-tightness of the pipe penetration.

The settlement protection pipe prevents this:

1. Insert the lip seal from plastic sewer pipes (PP or PVC) into the grooves integrated into the external wall flange.
2. Cut the settlement protection pipe to length – ideally sized to bridge the excavation working space and rest on undisturbed ground. Minimum settlement protection pipe length: 1.0 m.
3. Feed the media pipeline through the settlement protection pipe and the finned pipe.
4. Insert the sealing elements and tighten the screws.
5. Push the settlement protection pipe into the flange as far as it can go.
6. Backfill the excavation in layers, compacting appropriately.

The media pipeline sits stress-free within the settlement protection pipe, shielded from settlement-induced deformation (ovalisation) – a key factor in maintaining a permanently leak-tight pipe penetration.





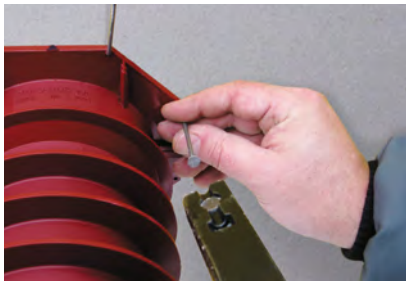
16.4 Installation instructions

16.4.1 Finned pipe

Description of the standard installation procedure

1. Mark the pipe axis position on the formwork wall.

2. Axis markings on the wall flange indicate where to position the finned pipe on the formwork.



3. Nail the finned pipe to the formwork wall.

4. Install the reinforcement.

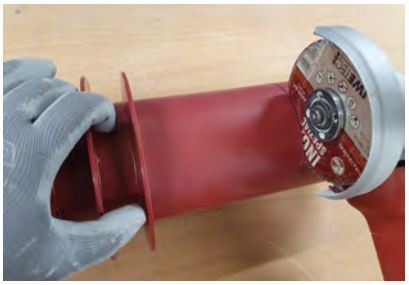
5. Erect the second formwork wall and tighten the formwork ties.

6. The POLO-RDS Evolution finned pipe is now fully concreted.

7. For wall thicknesses of 20 cm or 25 cm, shorten the finned pipe by pulling off the tear-off elements.

8. For wall thicknesses of 30–60 cm, use the finned pipe with an overall length of 600 mm.
DN 100 (art. no. 01070),
DN 200 (art. no. 01073),
DN 300 (art. no. 01076).

16.4.2 Installation of floor penetration



1. Cut the floor penetration to size using an angle grinder or saw, then chamfer and deburr the edges.

2. Protective cover = top edge of concrete. Use a laser to measure in.

3. Complete the reinforcement and carry out the final inspection.

4. Concrete flush and compact using a vibrator.

5. Remove the protective cover with a scaling hammer or screwdriver.

6. Connect domestic drainage pipes or fittings DN 110 directly.

Fitting sealing elements with onion skin design (art. no. 01011)

1. Remove the protective cover. – Feed the media pipeline through the concreted floor penetration.

2. Open the sealing element. Pull out the required number of onion rings, score and tear off (refer to table).

3. Fold the sealing element over the media pipeline and slide into the floor penetration until it meets the stop edge.

4. Tighten the screws so that they are hand-tight in several passes, working diagonally. Complete by tightening the screws to 6 Nm using a torque wrench.

16.4.3 Sealing elements with onion skin design

1. Feed the media pipeline through the concreted finned pipe.

2. Open the sealing element and pull out the onion rings.

3. Score and tear off the onion rings.

4. Fold the sealing element over the media pipeline and slide into the finned pipe as far as it can go. Alternatively, both sealing elements can be fitted from the inside. To do this, remove the stop lugs from the first sealing element and slide it into the finned pipe.

5. Tighten the screws in several passes, working diagonally. Tightening torque: 6 Nm.

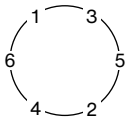
6. Once the installation monitors have released, tighten the screws to 6 Nm using a torque wrench.

Adapting the sealing elements to the media pipeline

Sealing element DN 100
13–50 mm

Media pipeline external ø		Rings to remove
13–15 mm		0
16–20 mm	3/8"–1/2"	1
21–25 mm	3/4"	2
26–30 mm		3
31–35 mm	1"	4
36–40 mm		5
41–45 mm		6
46–50 mm	6/4"	7

Sealing element DN 200
50–125 mm



Media pipeline external ø		Rings to remove
50–52 mm	6/4"	0
53–63 mm	2"	1
64–77 mm	2 1/2"	2
78–92 mm	3"	3
93–103 mm		4
104–114 mm	3 1/2"	5
115–125 mm	4"	6

16.4.4 Sealing element with installation monitor

1. Feed the media pipeline through the concreted finned pipe.

2. Open the sealing element. Pull out the required number of onion rings, score and tear off.

3. Fold the sealing element over the media pipeline and slide into the finned pipe as far as it can go. Alternatively, both sealing elements can be fitted from the inside. To do this, remove the stop lugs from the first sealing element and slide it into the finned pipe. Then continue as described above.

4. Tighten the screws in several passes, working diagonally. Begin with the screws at the split mechanism.

5. Once all the yellow installation monitors have popped out of the flange, a seal tightness of 0.3 bar has been achieved.

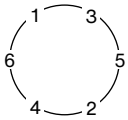
6. Where higher seal tightness is required, tighten the screws to 6 Nm using a torque wrench.

Adapting the sealing elements to the media pipeline

Sealing element DN 150
25–65 mm

Media pipeline external ø		Rings to remove
25-27 mm	3/4"	0
28-32 mm	1"	1
33-37 mm		2
38-42 mm	5/4"	3
43-47 mm		4
48-52 mm	6/4"	5
53-57 mm		6
58-62 mm		7
63-67 mm	2"	8

Sealing element DN 150
70–90 mm



Media pipeline external ø		Rings to remove
70-72 mm		0
73-77 mm	2 1/2"	1
78-82 mm		2
83-87 mm		3
88-92 mm	3"	4

16.4.5 Multiple sealing element

1. Feed the media pipelines through the concreted finned pipe.

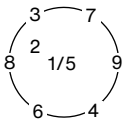
2. Open the sealing element. Pull out the required number of onion rings, score and tear off.

3. Fold the sealing element over the media pipelines and slide into the finned pipe until it meets the stop edge. Alternatively, both sealing elements can be slid in from the inside.

4. Tighten the screws in several passes, working diagonally. Start with the two centre screws. Complete by tightening the screws to 6 Nm using a torque wrench.

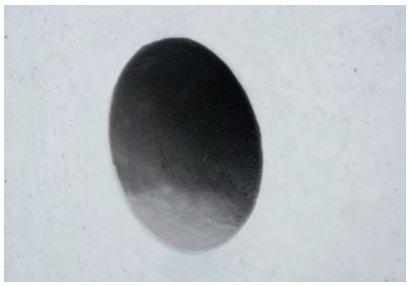
Adapting the sealing elements to the media pipeline

Sealing element DN 150
5×8–35 mm

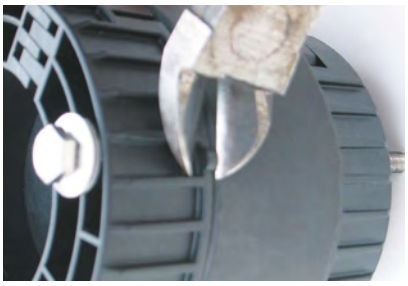


Media pipeline external ø		Rings to remove
8-10 mm		0
11-15 mm		1
16-20 mm	3/8"-1/2"	2
21-25 mm	3/4"	3
26-30 mm		4
31-35 mm	1"	5

16.4.6 Core drilling installation



1. Create a core drilling measuring 100 mm, 150 mm, 200 mm or 300 mm in diameter. Tolerance: -0/+2 mm. The cut surface may require post-treatment. **Always fit two sealing elements per core drilling.**



2. Install the sealing element as described above. For a flush finish, remove the stop lugs.

3. Tighten the screws in several passes, working diagonally. Tightening torque: max. 6 Nm.

16.4.7 Settlement protection

1. On the building exterior, insert lip seals into the two grooves of the finned pipe.

2. Feed the media pipeline through the settlement protection pipe and the finned pipe.

3. Fold the sealing element over the media pipeline and slide into the finned pipe as far as it can go.

4. Tighten the screws in several passes, working diagonally. Tightening torque: max. 6 Nm.

5. Insert the settlement protection pipe into the finned pipe.

6. For sewer pipe DN 160 or 200: use a settlement protection pipe of ≥ DN 250
For 250 mm media pipeline: use a settlement protection pipe of ≥ DN 315
Provide a bearing adjacent to the basement external wall.

16.4.8 Fitting the POLO-RDS Evolution torch-on flange in the finned pipe

1. Clean the groove.

2. Insert the lip seals.

3. Apply lubricant to the spigot end and slide it in as far as it can go.

4. Optional: secure to the wall.

Package contents:

- 1× POLO-RDS Evolution torch-on flange
- 2× lip seals
- 1× installation instructions

Inspect all components before installation to ensure that they are clean and intact.
When applying torch-on sheeting, always follow the manufacturer's instructions.

Flange width	Designation	Art. no.
120 mm	POLO-RDS Evolution torch-on flange DN 100	01051
120 mm	POLO-RDS Evolution torch-on flange DN 150	01052
120 mm	POLO-RDS Evolution torch-on flange DN 200	01053

17. References

A7 / Altona Tunnel

Hamburg . Germany

Pipe system	POLO-RDS Evolution, POLO-ECO plus Premium
Project scope	27 cable protection ducts

Special features

- Sealing of cable protection ducts DN 50–110
- Eight-lane tunnel construction, length 3.2 km
- Sealing elements for cable routes with 27 cable protection ducts
- Partially executed with POLO-ECO plus Premium casing pipes and ribbed pipes as wall penetrations

Mountain View

Kaltenbach . Austria

Pipe system	POLO-ECO plus Premium 12 . 16
Project scope	Approx. 900 m of pipes, 160 fittings, 40 units POLO-RDS Evolution and POLO-RDS Kanal Manhole connections

Special features

- Wastewater sewer system and stormwater drainage
- Challenging installation conditions due to existing coarse fill material and installation directly on the base slab
- Tight schedule, therefore prompt availability required and supply of all components from a single source

You can find further reference projects at

Notes

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