

Bridge drainage

TECHNICAL MANUAL

POLO-ECO plus PREMIUM



PURE
PROGRESS / **poloplast**

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General information

The data contained in the present manual are to help you to select our products for your purposes. Texts and illustrations have been collated with utmost care. Nevertheless, errors cannot be ruled out entirely. POLOPLAST cannot take any kind of responsibility for incorrect information and its consequences. POLOPLAST shall be grateful for any suggestions for improvement.

For further information, please do not hesitate to contact our technical field service.
Or contact our head office at: +43 (0)732 / 38 86-0, office@poloplast.com

GENERAL INFORMATION

1.1 Requirements placed on bridge drainage systems

Purpose

Drainage is an important element of the general bridge equipment. It comprises all structures and measures that are required to make sure that surface and sealing water is collected on the shoulders and drained away from the area of the bridge abutment or piers in a controlled and continuous way.



Strain

As bridges are part of road, freight and railway traffic systems, they are subject to high static loads. Apart from that, very different climatic and ecological conditions (such as changing temperatures, UV radiation, wind forces, ...) influence the entire structure and particularly the drainage system over the year.

Requirements

As bridges need to be maintained despite the high corrosive and mechanical loads acting on them (brine, salt spraying mists, high-pressure cleaning, ...), special attention needs to be paid to the structural designs and technical solutions chosen for the drainage system. Premature corrosion damage to the supporting structures and piers are often the consequence of defective, leaky or not fully functional drainage systems.

Maintenance

Flawless operation and safety of bridge structures over many decades can only be expected, if periodic inspections, regular maintenance and, whenever required, timely repair measures, are carried out. Maintenance and repair work have to be taken into account as early as during the engineering stage of the drainage system. It must be made sure that the structural elements are easily accessible and can be replaced later on.

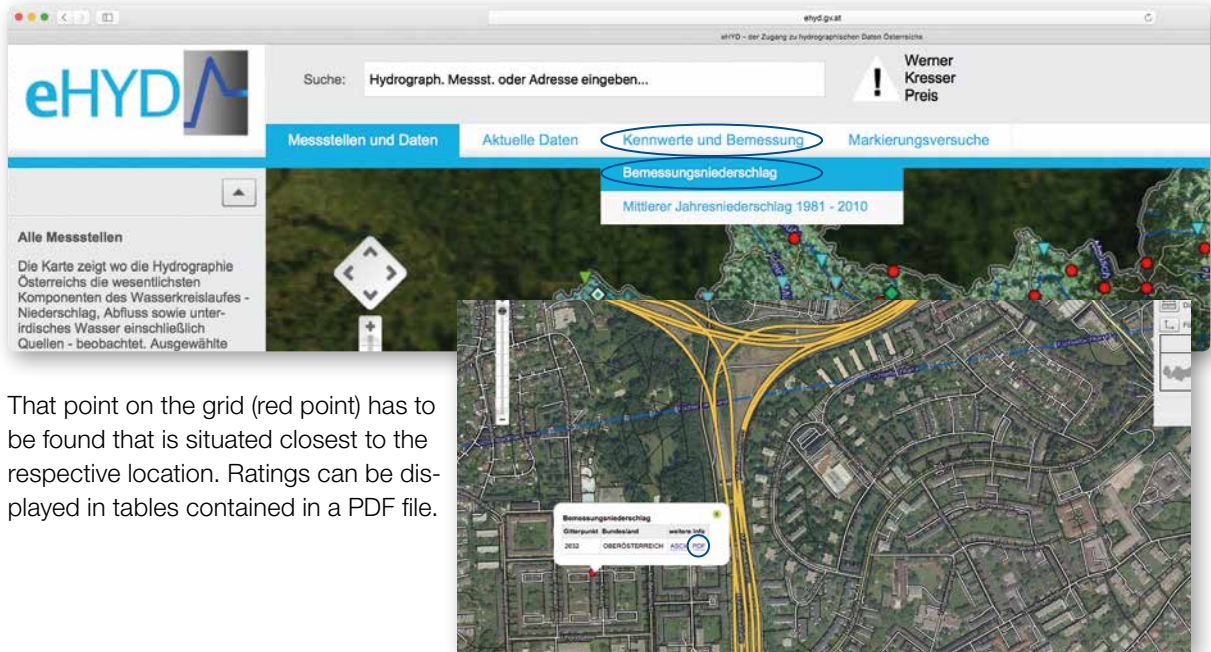


The suspension of cable conduits laid alongside the pipes, as well as supply and return lines that are part of the system, must also be planned and carried out thoroughly.

GENERAL INFORMATION

Planning

As a rule, a rainfall amount of 300 l/s.ha has to be taken as a basis for the design of the drainage system. For rated amounts of rainfall in Austria, refer to: <http://ehyd.gv.at>.



That point on the grid (red point) has to be found that is situated closest to the respective location. Ratings can be displayed in tables contained in a PDF file.

A runoff coefficient of 1.0 has to be applied for the total bridge area that is exposed to weather. The drainage system has to be designed for **a long-time resistance to internal pressure ≥ 0.5 bar** (5.0 m WC).

Collecting lines usually have to be **designed and built at a minimum slope of 1 %**. Areas where pipe dimensions change must always be planned with a linear slope of the pipe bottom.

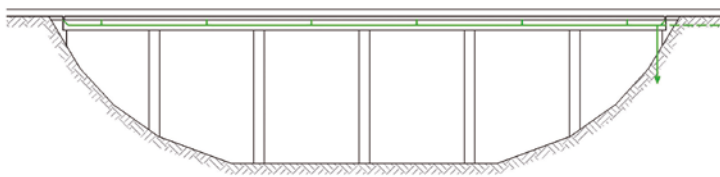
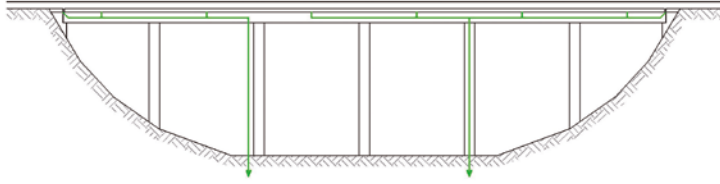
For any changes in direction, pipe bend angles must never exceed 45°. This is to say that, for example, two fittings with 45° each have to be used to achieve a 90° bend.

Minimum diameter DN/OD of plastic piping (following the RVS 15.04.31)

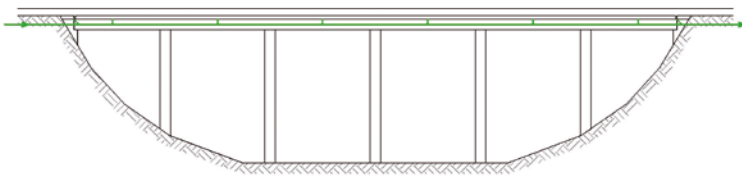
Designation DN/OD [mm]	DN/OD [mm]
Drainage of sealing structures (AE) ≥ 75	≥ 75
Collecting pipe for AE ≥ 110	≥ 110
Surface water drainage (TA) ≥ 160	≥ 160
Road crossing drainage system (FÜG) ≥ 160	≥ 160
Collecting pipe/longitudinal pipe (SL) ≥ 200 (160)	≥ 200 (160)
Downpipes (FL) ≥ 200 (160)	≥ 200 (160)

GENERAL INFORMATION

Examples of draining



Collecting the drainage water in longitudinal pipes, draining the water via piers (inside or outside, if required, into shafts)



Collecting the drainage water in longitudinal pipes, draining it, or leading the pipe on in the area of the abutment integration of the bridge drainage pipe into an existing road drainage pipe

General requirements placed on the pipe material

The following aspects need to be considered when choosing plastic pipe systems:

- High longitudinal stability of the pipe material
- Small coefficient of linear expansion
- UV resistance
- High abrasion resistance
- High hydraulic performance
- Long-time leakproofness
- Non-corroding, non-ageing material
- Material can be scavenged under high pressure
- Low weight – safe handling – quick and easy laying
- Large cleaning apertures that are easy to handle

1.1.1 Definitions and abbreviations used

AE Drainage of sealing structures
 TA, BE Surface water drainage, bridge inflow
 FÜG, FÜK.... Road crossing, road crossing structure
 SL Collecting pipe/longitudinal pipe
 FL..... Downpipe
 PST Cleaning element (POLO-EHP control)

GENERAL INFORMATION

1.2 POLO-ECO plus PREMIUM 12 . 10

The trend-setting further development of the 3-layer technology, POLO-ECO plus PREMIUM, featuring massive pipe walls and increased longitudinal stability, offers customers and engineers a wider range of possible applications while at the same time maintaining the high level of safety.



The outer layer

Made of mineral-reinforced PP-BLEND, the specially developed outer layer reduces the degree of thermal absorption. Apart from that, it makes POLO-ECO plus PREMIUM highly robust and ensures its excellent longitudinal and point stability.

The bearing layer

Mineral-reinforced, highly crystalline polypropylene is decisive for the enormous strength and rigidity of POLO-ECO plus PREMIUM, as well as for its extreme viscosity that ensures the high flexibility of the pipe system.

The inner layer

High-quality, mineral-reinforced polypropylene is responsible for the high resistance to chemicals in the pH range between 2 and 13, for the high resistance to abrasion and impact, as well as for the very smooth inner surfaces, which guarantee the optimum draining property of POLO-ECO plus PREMIUM.

The advantages of POLO-ECO plus PREMIUM 12 . 10

- **High longitudinal stability**
Specially developed material recipes provide extremely high longitudinal stability values.
- **UV resistance**
Longstanding technical functionality because of tested UV resistance (max. 30 years).
- **POLO-TC (TOP-CONNECT) socket system**
provides optimal laying reliability, while saving time and money.
- **Numerous tests confirm**
its outstanding quality and fitness for use.
- **Excellent resistance to impact and abrasion**
provide long-lasting reliable functionality.
- **High chemical resistance**
ensures its longevity.
- **High resistance to thermal stress**
allows it to be used with high loads from changes in temperature.
- **Smooth pipe inner surface**
prevent deposits and incrustation and guarantee optimal hydraulic drainage.
- **Wide range of fittings**
in dimensions that are in accordance with practical needs and offer tailor-made solutions.

GENERAL INFORMATION

- **More than 25 years of experience in multi-layer technology**
POLOPLAST has 25 years of knowledge and experience in the tried and tested three-layer technology.
- **Pipe walls made of three layers**
withstand even harder laying and operating loads.
- **20 years of experience in multi-layer technology**
POLOPLAST has 20 years of knowledge and experience in the tried and tested three-layer technology.

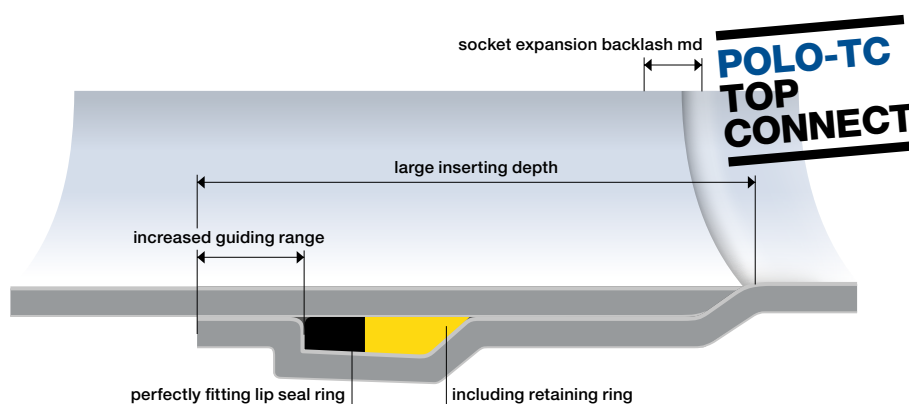
1.3 Connection technique and leakproofness

POLO-TC (TOP-CONNECT)

Socket system

The innovative sealing system.
Premium quality that connects!

- Moulded push-fit socket
- Increased guiding range
- Included retaining ring made of PP compound material
- Extraction-proof sealing ring and seam that can be cleaned
- Optimum laying reliability
- Long-term leakproofness

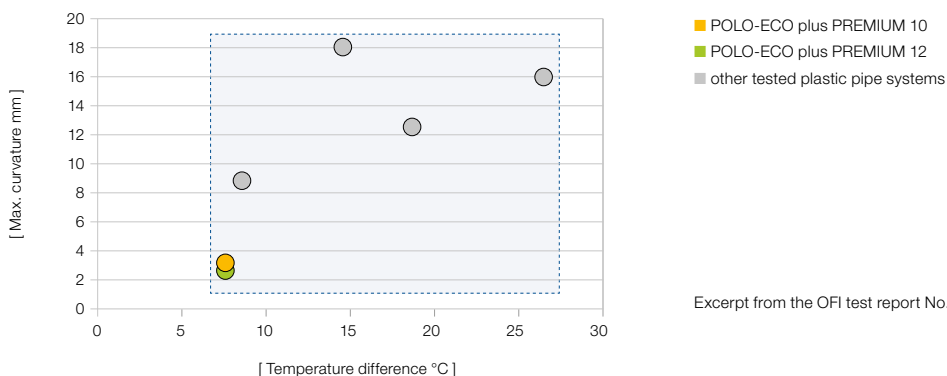


1.4 Product performance

1.4.1 Longitudinal stability test OFI – Austrian research institution for chemistry and technology

The longitudinal stability of bridge drainage pipes needs to be reasonably high. The structure of POLO-ECO plus PREMIUM pipes ensures a perfect ratio between ring rigidity and excellent longitudinal stability.

Maximum curvature vs. temperature difference



Excerpt from the OFI test report No. 306.759-5 Vienna, January 2011

GENERAL INFORMATION

GENERAL INFORMATION

TECHNICAL DATA

RANGE OF PRODUCTS

LAYING INSTRUCTIONS

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

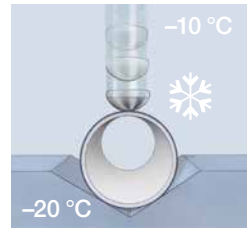
1.4.2 UV resistance

Relating to the UV resistance of our POLO-ECO plus PREMIUM pipe system, we are able to guarantee its flawless technical functioning for a maximum of thirty years, provided the observance of the general regulations on laying and assembly according to THB POLO-ECO plus PREMIUM Bridge Drainage 12/2016, and based on the POLOPLAST General Terms and Conditions.



1.4.3 Frost resistance thanks to high impact strength at low temperatures

Tests according to the Staircase Method as per EN 1411 prove that POLO-ECO plus PREMIUM maintains its viscosity under load even at low temperatures.



1.4.4 Dynamic resistance to scavenging

The dynamic resistance of pipes and socket connections to scavenging has to be proved according to CEN/TR 14920. The scavenging pressure at the nozzle is 120 bar (± 5.0), with 25 (50) scavenging cycles, and a scavenging water flow of > 80 l/min.



1.4.5 High leakproofness and long-term leakproofness

The leak test shows the truth: The socket connection remains leakproof even if the pipe deformation is extremely high. Long-term leakproofness of the elastomeric sealing ring connection has to be proved by measuring the contact pressure and the tightness of the pipe connection following the regulations of EN 14741.



1.4.6 Points for quality

Point load and puncture tests of the three-layered pipes show outstanding results and prove that POLO-ECO plus PREMIUM withstands even extreme loads.



1.4.7 Long-time rupture strength

Thanks to the materials used, the layer adhesion of POLO-ECO plus PREMIUM pipes, as well as their long-time rupture strength, are excellent; apart from that, they also feature high resistance to abrasion and long-time impermeability.

The tests for long-time resistance to internal pressure were conducted by an accredited testing institution; as they constitute an essential quality criterion, they are continuously monitored.



TECHNICAL DATA

2.1 Standards and approvals

2.1.1 Standards

ON RULE-ONR 20513	Polypropylene plastic pipes systems with multi-layer wall structure (PP-ML) for unpressurized underground sewage pipes
ATV-DVWK-A 127	Structural analysis of waste water and sewage pipes
EN 1295-1	General requirements concerning the structural analyses of piping
ÖNORM B 2503	Additional instructions for design, construction and testing of sewage systems
EN 1610	Laying and testing of waste water and sewage piping
ENV 1046	Plastic pipe and protective pipe systems Systems beyond buildings, which convey water or waste water – Methods of above-ground and underground laying
EN 476	General requirements concerning structural components of waste water and sewage pipes

2.1.2 Approvals

Austria



Austria



Austria



Germany



Germany



Austria



Czechia



France



Poland



2.1.3 Directives and regulations on roads (RVS)

Bridge drainage – RVS 15.04.31 (issue dd. 01.10.2011); for the supplement “PP-ML pipe systems” refer to the “1st amendment dated 01.11.2013”

**Brücken
Brückenausrüstung
Anlagen für den Umweltschutz**

Blatt 1.0

BRÜCKENENTWÄSSERUNG

**RVS 15.04.31
ABÄNDERUNG**

*Bridges
Equipment of Bridges
Environmental Protection Structures
Bridge Drainage*

1. Abänderung vom 1. November 2013

Die seitens der Österreichischen Forschungsgesellschaft Straße - Schiene – Verkehr veröffentlichte

RVS 15.04.31: Brücken
1. Oktober 2011 Brückenausrüstung
Anlagen für den Umweltschutz
Brückenentwässerung

wird wie folgt abgeändert:

Die Tabelle 1 wird wie folgt um eine Spalte für PP-ML erweitert:

Tabelle 1: Übersicht über die wichtigsten Kennwerte der gebräuchlichsten Materialien

Kennwert	Guss	GF-UP	PE-HD	Edelstahl	PP-ML
E-Modul (Ringrichtung) [N/mm ²]	170.000	8.000	150 bis 200		2.400
E-Modul (Längsrichtung) [N/mm ²]	170.000			200.000	2.400
Absolute Wandrauhigkeit k [-]	0,01	0,01	0,01	0,01	0,01
Rohrsteifigkeit [N/m ²]		10.000			10.000
Ringzugfestigkeit [N/mm ²]	550	30 bis 50			24
Längszugfestigkeit [N/mm ²]	420	15 bis 20	8 bis 10	490 bis 690	24
Empfohlener Stützabstand [m]		3		3,3	1,5 bis 3,0
Mittlerer Abrieb bei 100.000 Zyklen „Darmstädter Abriebversuch“ [mm]		0,45			0,08

4.6.2.1 Kunststoff wird wie folgt ergänzt:

4.6.2.1.1 Polyethylen (PE), Polypropylen (PP)

Rohre aus Polyethylen hoher Dichte (PE-HD 80, PE-HD 100) gemäß ÖNORM EN 13244-1, Rohre aus Polypropylen gemäß ÖNORM B 5174

- Farbe von Rohren aus HPE
HPE-Rohre sind aus materialtechnischen Gründen allgemein schwarz. Es werden auch graue (betongrau) Rohre hergestellt.
- Verformungsmodul
Die Verformungsmodul der Kunststoffe sind von Temperatur, Spannung und Beanspruchungsdauer abhängig.

AG: Brückenbau
AA: Brückenausrüstung
Ausgabe 1. November 2013
Die Verbindlicherklärung dieser RVS erfolgt mittels Erlass durch das BMVIT.
Details können der Homepage der FSV www.fsv.at entnommen werden.

ÖSTERREICHISCHE
FORSCHUNGSGESELLSCHAFT
STRASSE • SCHIENE • VERKEHR  Wir finden neue Wege.

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Personalisiert für: Poloplast GmbH & Co. KG, Produktentwicklung, Leonding am 11.11.2013

Brücken

Blatt 1/1

BRÜCKENENTWÄSSERUNG

RVS 15.04.31

- Temperaturverhalten
Die unterschiedliche Wärmeausdehnung zwischen Beton bzw. Stahl und den Kunststoffen bedingt vielfach besondere konstruktive Maßnahmen.

4.6.2.1.2 Mehrschicht – Verbundrohrleitungssysteme (PP-ML)

Rohre und Formstücke aus verstärktem Polypropylen-Compound/-Blend sind gemäß ONR 20513 auszuführen.

- Farbe von Mehrschicht – Verbundrohrleitungssystemen
PP-ML - Rohre und Formstücke sind grundsätzlich in betonähnlicher Farbe zu verwenden. Eine entsprechende UV-Beständigkeit ist zu gewährleisten.
- Verformungsmodul
Die Verformungsmodul der Kunststoffe sind von Temperatur, Spannung und Beanspruchungsdauer abhängig.
- Temperaturverhalten
Aufgrund der mineralischen Verstärkung der Mittelschicht beträgt der Längenausdehnungskoeffizient der PP-ML – Rohrsysteme $44 \cdot 10^{-6} \text{ K}^{-1}$. Aufgrund der speziellen Farbe werden jedoch kaum Temperaturen über 75 °C erreicht. Die unterschiedlichen Wärmeausdehnungen zwischen Beton bzw. Stahl und dem Mehrschicht – Verbundrohrleitungssystem bedingt entsprechende konstruktive Maßnahmen in Hinblick auf das Aufhängesystem.

Die Tabelle 2 wird wie folgt um eine Zeile für PP-ML erweitert:

Tabelle 2: Vergleich der Längenänderungen je Rohrmaterial

	10 m / ΔT 55° C	10 m / ΔT 65° C	10 m / ΔT 75° C	10 m / ΔT 85° C	10 m / ΔT 95° C
	[mm]				
TW – Stahl	6,6	7,8	9,0	10,2	11,4
TW – Stahlbeton	5,5	6,5	7,5	8,5	9,5
Guss	5,5	6,5	7,5	8,5	9,5
Edelstahlrohr	9,1	10,7	12,4	14,0	15,7
GF-UP	16,5	19,5	22,5	25,5	28,5
PE	93,5	110,5	127,5	144,5	161,5
PP-ML	24,2	28,6	33,0	37,4	41,8

5. Angeführte Richtlinien, Normen und Literatur wird wie folgt ergänzt:

- ONR 20513 Mehrschichtverbund-Rohrleitungssysteme (PP-ML) für erdverlegte, drucklose Abwasserkanäle und -leitungen aus verstärktem Polypropylen-Compound/-Blend – Abmessungen, Anforderungen, Prüfungen, Nachweis der Konformität

Zu beziehen bei der Österreichischen Forschungsgesellschaft Straße – Schiene – Verkehr
Ausgabe 1. November 2013
Dieses Werk ist urheberrechtlich geschützt.

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STRASSE • SCHIENE • VERKEHR  Wir finden neue Wege.

TECHNICAL DATA

2.2 POLO-EHP control

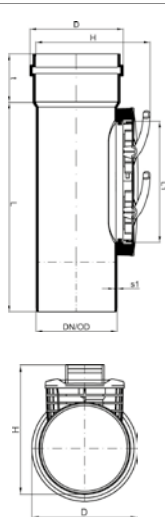
The POLO-EHP control pipe features a large cleaning aperture that fulfils all practical needs of maintenance, inspection and cleaning – the handy supplement to the POLO-ECO plus PREMIUM products.

2.2.1 Simple maintenance and cleaning

- **Simple and safe locking mechanism**
 - no metal, no corrosion
 - handled without any tools
- **Pressure relieved when unlocked**
ensuring safe operation
- **Large lid aperture in conformity with the standards**
 - refer to EN 13598-1 and ÖNORM B2501
 - clear opening dimensions 100 × 300 mm, ensuring comfortable maintenance
- **High leakproofness under internal pressure**
high short-time and long-time leakproofness under internal pressure
- **No offensive smell – closed gutter**
all advantages for sewage inspection
- **Unchanging cross section**
no hydraulic influences
- **Conformity of the system and the materials**
contain no halogen, ecologically safe



2.2.2 Product line



A. no.	DN/OD	L	s1 (min)	t socket	D	H	L1	kg/pc.	design	Leak-proof under pressure, short-time/bar	Leak-proof under pressure, long-time/bar
06590	110	468	3.6	65.0	129.2	196	301	2.3	SG	1.5	1.0
06591	125	474	4.0	73.0	146.4	222	301	2.5	SG	1.5	1.0
06592	160	488	5.1	84.0	184.8	251	301	3.2	SG	1.5	1.0
06593	200	518	7.0	120.0	230.5	295	301	4.6	SG	1.5	1.0
06594	250	680	8.5	150.0	290.0	330	301	8.5	HF	1.0	0.5
06595	315	680	10.8	180.0	362.5	400	301	13.0	HF	1.0	0.5
06596	400	1000	13.6	230.0	457.5	485	301	30.0	HF	1.0	0.5
06597	500	1000	17.1	280.0	571.0	585	301	49.0	HF	1.0	0.5

SG ... Injection moulded

HF ... Hand moulded

Subject to technical alterations

TECHNICAL DATA

2.3 POLO-ECO plus PREMIUM 12 . 10

2.3.1 Technical data

Designation	POLO-ECO plus PREMIUM 12, POLO-ECO plus PREMIUM 10	
Pipe	PP sewage pipe with three-layered wall structure	
Fittings	up to DN/OD 200, mostly injection-moulded, from DN/OD 250 with three-layered walls, hand-moulded, connections welded using heat reflector welding or extrusion welding	
Pipe material	Polypropylene (PP-BLEND)/PP-MV/PP without halogen or lead	
Colour	Outer covering layer – opal white	similar to RAL Design 1209005
	Middle bearing layer – titanium grey	similar to RAL 9011
	Inner layer – light grey	similar to RAL 7035
Ring rigidity	POLO-ECO plus PREMIUM 12 (≥ 12 kN/m ²) POLO-ECO plus PREMIUM 10 (≥ 10 kN/m ²) at 23 °C, according to EN ISO 9969	
Dimensions outer diameter	POLO ECO plus PREMIUM 10 nominal diameters DN/OD 110, 125 mm POLO ECO plus PREMIUM 12 nominal diameters DN/OD 160, 200, 250, 315, 400, 500 and 630 mm Draining of sealing structures, nominal diameters DN/OD 75 and 90 mm	
Face-to-face dimensions	Push-fit socket pipes 1 m, 3 m and 6 m Pipes without push-fit socket 1 m Draining of sealing structures 0.5 m and 1 m	
Pipe connection	Moulded POLO-TC (TOP-CONNECT) socket system with PP supporting ring and/or weld-on injection-moulded socket, DN/OD 630 without PP supporting ring and highly elastic, non-ageing lip ring seal, BL system, made of elastomers according to DIN 4060	
Seal	Highly elastic, non-ageing lip ring seal BL (SBR) system, made of elastomer material according to EN 681-1 and NBR lip seal rings meeting increased requirements concerning resistance to oil and grease	
Chemical resistance	Pipes and fittings made of PP – according to DIN 8078, supplement 1 seals made of SBR/NBR – according to ISO TR 7620	
Temperature range of use	-30 to +95 °C	
Coefficient of roughness	k = 0.01 mm	
Mean coefficient of elongation	0.044 mm/m ^{°K}	

TECHNICAL DATA

GENERAL INFORMATION

Pipe marking

POLO-ECO plus PREMIUM sewage pipes bear the following marking: Designation, class of rigidity, company name in short, outer diameter × wall thickness, material, low-temperature range of use, range of melt flow indices, application area code, approval body/test number, test label/test number and date of manufacture

TECHNICAL DATA

Wall thickness dimensioning

	DN/OD	SDR*	s, min
Draining of sealing structures	75	27	2.6
	90	30	3.0
POLO-ECO plus PREMIUM 10	110	28	3.9
	125	29	4.3
POLO-ECO plus PREMIUM 12	160	28	5.8
	200	28	7.2
	250	28	8.8
	315	28	11.2
	400	28	14.2
	500	28	17.8
	630	28	22.7

Dimensions in mm

SDR* = ratio between diameter and wall thickness $SDR = \frac{da}{s}$

RANGE OF PRODUCTS

Standard physical values

Designation	Unit	Value	Standard
Melt index range (230 °C/2.16 kg)	g/10 min.	0.3–0.6	ISO 1133
Average density	g/cm ³	1.20	ISO 1183
Yield stress	N/mm ²	> 24	ISO 527-2
E-modulus, short-time	MPa	> 3,200	
E-modulus, long-time	MPa	> 850	

LAYING INSTRUCTIONS

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

TECHNICAL DATA

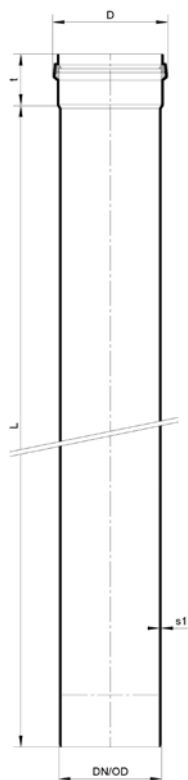
3.1 POLO-ECO plus PREMIUM – bridge drainage product line

Dimensions in mm

For technical data, including the AutoCAD drawings, please refer to our on-line product catalogue at <http://produktkatalog.poloplast.com>.

POLO-ECO plus PREMIUM

Push-fit socket pipe
with factory-fitted lip ring



	A. no.	DN/OD**	L	s1(min)	t	D	kg/pc.*
Draining of sealing structures	05188	75	500	2.6	52	91	0.65
	05189	75	1000	2.6	52	91	1.28
	05192	90	500	3.0	54	107	0.95
	05193	90	1000	3.0	54	107	1.81
POLO-ECO plus PREMIUM 10	05201	110	1000	3.9	81.0	130	1.90
	05203	110	3000	3.9	81.0	130	5.30
	05206	110	6000	3.9	81.0	130	10.50
	05211	125	1000	4.3	87.0	148	2.50
	05213	125	3000	4.3	87.0	148	6.90
	05216	125	6000	4.3	87.0	148	13.60
POLO-ECO plus PREMIUM 12	06221	160	1000	5.8	96.0	187	4.30
	06223	160	3000	5.8	96.0	187	11.80
	06226	160	6000	5.8	96.0	187	23.10
	06231	200	1000	7.2	119.0	232	6.60
	06233	200	3000	7.2	119.0	232	18.20
	06236	200	6000	7.2	119.0	232	35.50
	06241	250	1000	8.8	152.0	290	11.00
	06243	250	3000	8.8	152.0	290	28.80
	06246	250	6000	8.8	152.0	290	56.20
	06251	315	1000	11.2	184.0	363	17.80
	06253	315	3000	11.2	184.0	363	46.20
	06256	315	6000	11.2	184.0	363	89.00
	06261	400	1000	14.2	237.0	458	29.20
	06263	400	3000	14.2	237.0	458	74.60
	06266	400	6000	14.2	237.0	458	143.00
	06271	500	1000	17.8	288.0	572	47.9
	06273	500	3000	17.8	288.0	572	119.7
	06276	500	6000	17.8	288.0	572	226.5
	06281	630	1000	22.7	293.0	710	73.9
	06283	630	3000	22.7	293.0	710	187.2
	06286	630	6000	22.7	293.0	710	356.9

* approximate weights

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

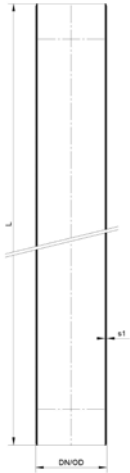
RANGE OF PRODUCTS

Dimensions in mm

GENERAL INFORMATION

TECHNICAL DATA

POLO-ECO plus PREMIUM Pipe without push-fit socket



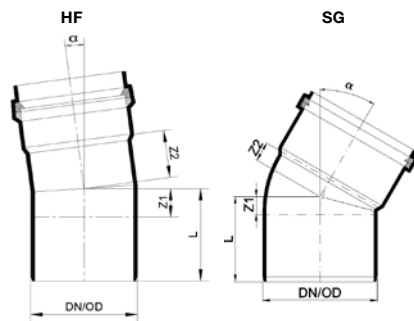
	A. no.	DN/OD**	L	s1 (min)	kg/pc.*
POLO-ECO plus PREMIUM 10	05180	110	1000	3.9	1.7
	05181	125	1000	4.3	2.2
POLO-ECO plus PREMIUM 12	06182	160	1000	5.8	3.7
	06183	200	1000	7.2	5.8
	06184	250	1000	8.8	14.8
	06185	315	1000	11.2	14.1
	06186	400	1000	14.2	22.5
	06187	500	1000	17.8	36.1
	06188	630	1000	22.7	56.6

RANGE OF PRODUCTS

3.2 POLO-ECO plus PREMIUM fittings

POLO-ECO plus PREMIUM bend made of polypropylene, with inserted lip seal ring, heat reflector welded connection

all bends "without" internal bead



	A. no.	DN/OD**	Z1	Z2	L	Method	kg/pc.*
$\alpha=7.5^\circ$	06320	160	18.9	16.2	114.9	SG	0.6
	06330	200	34.5	136.0	153.0	HF	1.9
	06340	250	33.5	84.0	186.0	HF	4.2
	06350	315	49.0	160.5	233.0	HF	6.0
	06360	400	57.5	165.5	293.0	HF	16.3
	06370	500	65.0	193.5	350.0	HF	31.0
	06380	630	57.0	466.5	350.5	HF	38.0
	$\alpha=15^\circ$	02520	75	7.0	10.0	55.0	SG
02526		90	20.0	13.0	71.0	SG	0.4
06301		110	13.0	13.0	80.0	SG	0.3
06311		125	11.5	13.5	85.5	SG	0.4
06321		160	13.0	16.0	98.0	SG	0.7
06331		200	13.0	23.0	131.0	SG	1.4
06341		250	31.5	95.0	183.5	HF	3.2
06351		315	59.0	124.5	243.0	HF	8.7
06361		400	68.5	159.0	304.0	HF	16.9
06371		500	79.0	184.0	364.0	HF	31.2
06381	630	78.5	487.5	371.5	HF	38.0	

LAYING INSTRUCTIONS

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

SG ... Injection moulded

HF ... Hand moulded

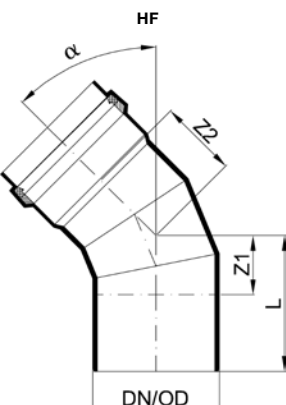
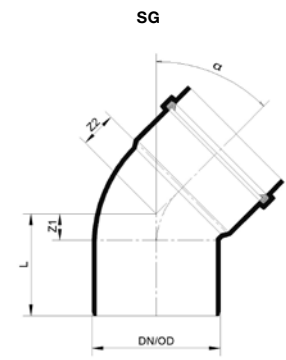

* approximate weights

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

RANGE OF PRODUCTS

Dimensions in mm

POLO-ECO plus PREMIUM bend made of polypropylene, with inserted lip seal ring, heat reflector welded connection		A. no.	DN/OD**	Z1	Z2	L	Method	kg/pc.*
$\alpha=30^\circ$		02521	75	13.0	16.0	62.0	SG	0.3
		02527	90	26.0	18.0	77.0	SG	0.4
		06302	110	21.0	20.5	88.0	SG	0.3
		06312	125	19.5	21.5	93.5	SG	0.4
		06322	160	25.0	28.0	110.0	SG	0.8
		06332	200	27.0	37.0	144.0	SG	1.7
		06342	250	61.5	111.0	213.5	HF	4.6
		06352	315	84.0	141.0	268.0	HF	8.8
		06362	400	96.0	195.0	331.0	HF	17.0
		06372	500	108.0	212.5	393.0	HF	33.7
06382	630	121.5	370.0	414.5	HF	38.0		
$\alpha=45^\circ$		02522	75	19.0	23.0	68.0	SG	0.3
		02528	90	31.0	25.0	82.0	SG	0.4
		06303	110	29.0	29.0	96.0	SG	0.3
		06313	125	29.0	31.0	103.0	SG	0.5
		06323	160	37.0	41.0	122.5	SG	0.9
		06333	200	41.0	52.0	159.0	SG	2.0
		06343	250	117.0	154.5	269.0	HF	5.6
		06353	315	151.0	225.0	335.0	HF	10.9
		06363	400	192.5	297.0	429.5	HF	21.5
		06373	500	242.0	321.0	530.0	HF	39.6
06383	630	313.5	592.5	606.5	HF	38.0		
$\alpha=67.5^\circ$		06304	110	44.0	44.0	111.0	SG	0.3
		06314	125	46.0	48.0	120.0	SG	0.5
		06324	160	59.0	62.0	144.0	SG	0.9
		06334	200	133.0	198.0	252.0	HF	3.4
$\alpha=87.5^\circ$		06305	110	60.5	60.0	127.5	SG	0.3
		06315	125	64.0	66.5	138.5	SG	0.5
		06325	160	84.0	87.0	169.0	SG	1.0
		06335	200	106.0	115.0	230.0	SG	2.4
		06345	250	223.0	281.0	375.0	HF	6.8
		06355	315	313.0	373.0	497.0	HF	14.1
		06365	400	430.0	520.0	665.0	HF	24.4
		06375	500	495.0	586.0	780.0	HF	52.3
		06385	630	607.0	855.5	900.0	HF	41.0

SG ... Injection moulded

HF ... Hand moulded

* approximate weights

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

GENERAL INFORMATION

TECHNICAL DATA

RANGE OF PRODUCTS

LAYING INSTRUCTIONS

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

RANGE OF PRODUCTS

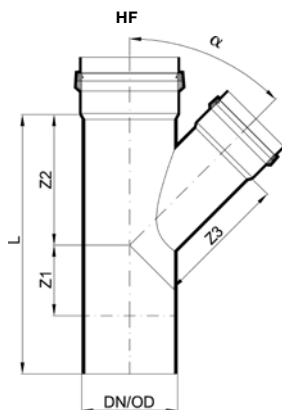
Dimensions in mm

GENERAL INFORMATION

POLO-ECO plus PREMIUM Branch

made of polypropylene, with inserted lip seal ring, extrusion weld connection

$\alpha=45^\circ$



TECHNICAL DATA

RANGE OF PRODUCTS

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A. no.	DN/OD**	Z1	Z2	Z3	L	Method	kg/pc.*
06400	110/110	29.0	144.0	144.0	240.0	SG	0.7
06401	125/110	28.0	160.5	154.0	262.5	SG	0.9
06402	125/125	28.0	160.5	160.5	262.5	SG	1.0
06403	160/110	25.0	174.0	184.0	261.0	SG	1.3
06405	160/160	35.0	209.0	209.0	329.0	SG	1.9
06407	200/125	20.0	263.0	282.0	402.0	HF	2.6
06408	200/160	13.0	234.0	256.0	365.0	SG	3.4
06409	200/200	52.0	240.0	239.5	416.0	SG	4.0
06412	250/160	193.5	331.0	327.5	680.0	HF	6.9
06413	250/200	185.0	343.5	359.0	680.0	HF	8.2
06414	250/250	138.0	386.5	383.0	680.0	HF	10.2
06417	315/160	136.0	361.0	373.0	680.0	HF	11.1
06418	315/200	108.0	390.0	407.0	680.0	HF	14.5
06419	315/250	72.5	429.0	433.0	680.0	HF	15.5
06420	315/315	361.0	455.0	456.0	1000.0	HF	24.4
06423	400/160	271.5	495.0	534.0	1000.0	HF	28.9
06424	400/200	327.0	438.0	444.0	1000.0	HF	31.0
06425	400/250	273.0	486.0	471.0	1000.0	HF	30.6
06426	400/315	255.5	507.5	516.0	1000.0	HF	33.6
06427	400/400	202.0	564.0	561.5	1000.0	HF	42.9
06430	500/160	247.0	468.0	500.5	1000.0	HF	46.1
06431	500/200	196.0	513.0	509.0	1000.0	HF	46.9
06432	500/250	191.0	521.0	534.5	1000.0	HF	48.9
06433	500/315	148.5	563.5	589.0	1000.0	HF	53.4
06434	500/400	50.5	661.5	662.5	1000.0	HF	60.1
06440	630/160	63.0	644.0	675.0	1000.0	HF	76.5
06441	630/200	34.5	672.5	695.5	1000.0	HF	77.4
06442	630/250	0.0	707.5	718.5	1000.0	HF	79.0
06443	630/315	46.5	707.0	758.0	1000.0	HF	81.5
06444	630/400					HF	103.9
06445	630/500	Special designs on request				HF	112.9
06446	630/630					HF	127.0
$\alpha=90^\circ$							
06453	160/110	113.0	105.0	122.0	320.0	HF	1.5
06455	160/160	138.0	130.0	132.0	364.0	HF	2.0
06456	200/110	100.0	109.0	125.0	320.0	HF	2.5
06458	200/160	126.0	138.0	135.0	383.0	HF	5.4
06459	200/200	136.2	143.0	138.0	398.0	HF	4.2
06462	250/160	402.0	131.0	159.0	680.0	HF	6.9
06464	250/250	358.0	173.0	172.0	680.0	HF	10.7
06467	315/160	317.0	179.5	221.0	680.0	HF	11.1
06473	400/160	156.0	607.0	260.0	1000.0	HF	28.5
06477	400/400	461.0	307.0	293.0	1000.0	HF	44.1
06485	500/500	365.0	355.0	342.0	1000.0	HF	62.7
06490	630/160	501.5	205.5	374.5	1000.0	HF	76.0
06491	630/200	481.5	225.5	375.0	1000.0	HF	76.4
06492	630/250	456.5	250.5	373.0	1000.0	HF	77.4
06493	630/315	424.0	283.0	380.0	1000.0	HF	79.0
06494	630/400					HF	84.0
06495	630/500	Special designs on request				HF	89.6
06496	630/630					HF	112.3

RANGE OF PRODUCTS

Dimensions in mm

GENERAL INFORMATION

TECHNICAL DATA

RANGE OF PRODUCTS

LAYING INSTRUCTIONS

DESIGN EXAMPLES

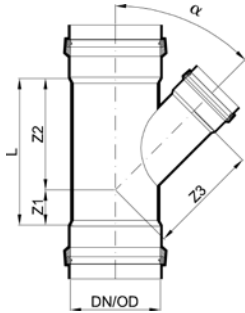
INVITATION TO TENDER TEXTS

POLO-ECO plus PREMIUM

Three-socket-branch

made of polypropylene, with inserted lip seal ring, extrusion weld connection

$\alpha=45^\circ$



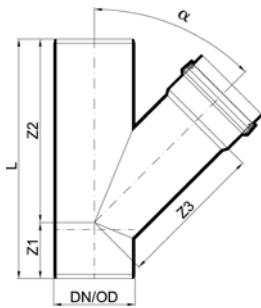
A. no.	DN/OD**	Z1	Z2	Z3	L	Method	kg/pc.*
06552	160/160	85	221	212	306.0	HF	2.4
06553	200/160	61	234	256	295.0	HF	3.7
06554	250/160	98	309	267	407.0	HF	9.4
06555	315/160	56	360	373	417.0	HF	16.4
06556	400/160	107	420	432	527.0	HF	39.2
06557	500/160	102	477	599	579.0	HF	44.8

POLO-ECO plus PREMIUM

Branch without socket

made of polypropylene, with inserted lip seal ring, extrusion weld connection

$\alpha=45^\circ$

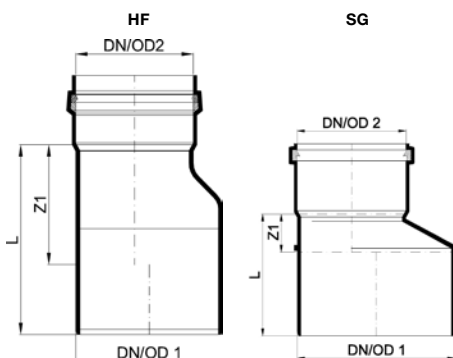


A. no.	DN/OD**	SN	Z1	Z2	Z3	L	Method	kg/pc.*
06560	160/160	SN 12	177.0	333.0	254.0	510	HF	2.8
06561	200/160	SN 12	175.0	375.0	219.0	550	HF	3.9
06563	250/160	SN 12	176.0	425.0	319.0	600	HF	6.0
06565	315/160	SN 12	339.0	662.0	364.0	1000	HF	14.9

POLO-ECO plus PREMIUM

Transition pipe

made of polypropylene, with inserted lip seal ring, heat reflector weld connection



A. no.	DN/OD**	Z1	L	Method	kg/pc.*
02743	110/75	26.0	84	SG	0.3
02741	110/90	40.0	66	SG	0.2
06500	125/110	18.0	92	SG	0.3
06501	160/110	39.0	124	SG	0.5
06502	160/125	32.0	117	SG	0.5
06503	200/160	55.0	174	SG	1.1
06505	250/200	169.0	321	HF	3.2
06507	315/250	217.0	401	HF	6.5
06509	400/315	279.0	514	HF	13.8
06511	500/400	342.5	580	HF	26.9
06512	630/500	66.5	414.0	HF	55.7

SG ... Injection moulded

HF ... Hand moulded

* approximate weights

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

RANGE OF PRODUCTS

Dimensions in mm

GENERAL INFORMATION

POLO-ECO plus PREMIUM

Double socket

made of polypropylene, with inserted lip seal ring, heat reflector weld connection



A. no.	DN/OD**	Z1	L	Method	kg/pc.*
06530	110	2.8	145	SG	0.3
06531	125	3.5	157	SG	0.4
06532	160	3.6	180	SG	0.6
06533	200	4.0	240	SG	1.5
06534	250	9.0	292	SG	2.2
06535	315	94.0	457	HF	8.2
06538	630	113.0	716.0	HF	35.2

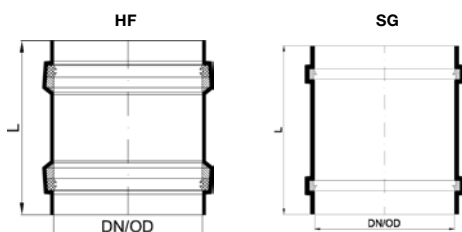
The **double socket** interconnects two spigot ends when a pipe line is laid for the first time. The double socket covers nearly every case of application that may occur when sewage pipes are fitted together for the first time.

TECHNICAL DATA

POLO-ECO plus PREMIUM

Sleeve

made of polypropylene with inserted double lip seal rings (DN/OD 110–315) or lip seal rings (DN/OD 400–630) extrusion weld connection



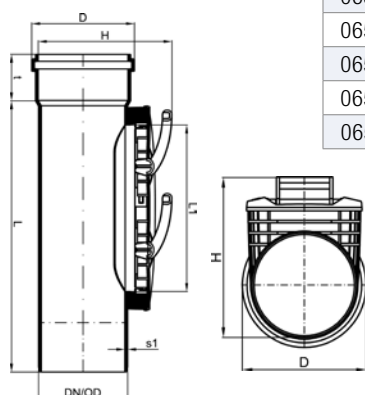
A. no.	DN/OD**	L	Method	kg/pc.*
02712	75	110	SG	0.3
02716	90	127	SG	0.3
06520	110	145	SG	0.3
06521	125	157	SG	0.4
06522	160	180	SG	0.6
06523	200	240	SG	1.3
06524	250	294	SG	2.1
06525	315	359	HF	5.8
06526	400	465	HF	11.7
06527	500	558	HF	23.4
06528	630	716	HF	34.0

The **sleeve** can be used, if a branch has to be retrofitted or pipes need to be replaced (repair). Mark the length of the sleeve on the spigot ends of the pipe.

RANGE OF PRODUCTS

LAYING INSTRUCTIONS

POLO-EHP control white for POLO-ECO plus PREMIUM



A. no.	DN/OD	L	s1(min)	t	D	H	L1	Method	kg/pc.
06590	110	468	3.6	65.0	129.0	196	301	SG	2.3
06591	125	474	4.0	73.0	146.5	222	301	SG	2.5
06592	160	488	5.1	84.0	185.0	251	301	SG	3.1
06593	200	518	7.0	120.0	230.5	295	301	SG	4.6
06594	250	680	8.5	150.0	290.0	330	301	HF	8.5
06595	315	680	10.8	180.0	362.5	400	301	HF	13.0
06596	400	1000	13.6	230.0	457.5	485	301	HF	30.0
06597	500	1000	17.1	280.0	571.0	585	301	HF	49.0

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

SG ... Injection moulded

HF ... Hand moulded

* approximate weights

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

RANGE OF PRODUCTS

Dimensions in mm

GENERAL INFORMATION

TECHNICAL DATA

RANGE OF PRODUCTS

LAYING INSTRUCTIONS

DESIGN EXAMPLES

INVITATION TO TENDER TEXTS

POLO-ECO plus PREMIUM

Socket plugs

made of polypropylene,
extrusion welded connections

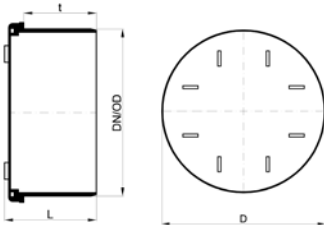


A. no.	DN/OD**	L	Method	kg/pc.*
06540	110	62.0	SG	0.1
06541	125	81.0	SG	0.2
06542	160	92.0	SG	0.3
06543	200	122.5	SG	0.8
06544	250	118.0	HF	1.6
06545	315	134.5	HF	2.3
06546	400	115.0	HF	5.6

Preferably use the original plugs for POLO-ECO plus pipes. The insertion length of socket plugs made of PVC-KG may be too short (L2), which is why leaks might occur.

POLO-ECO plus PREMIUM

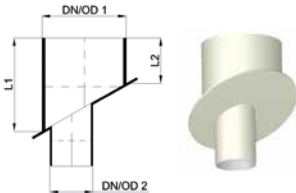
Screwed lids



A. no.	DN/OD	t	L	Method	D	kg/pc.
02395	160	63	90	SG	175	0.3
02927	200	94	111	SG	215	0.6
02928	250	89	114	SG	262	1.3

POLO-ECO plus PREMIUM

Inlets for road crossing structures



A. no.	DN/OD 1	DN/OD 2	L1	L2	L3	Method	kg/pc.
06589	315	160	350	170	480	HF	5.4

POLO-ECO plus PREMIUM

Lip seal ring KGLI-NBR

oil and grease resistant



A. no.	DN/OD	kg/pc.
00150	75	0.001
00151	90	0.001
00162	110	0.002
00163	125	0.003
00164	160	0.005
00165	200	0.007
00166	250	0.018
00167	315	0.28
00168	400	0.42
00169	500	0.75
00160	630	1.20

POLO-ECO plus PREMIUM

Inlet pipe seal ELRD



DN/OD	Bore Ø	A. no.
75	83	04464

SG ... Injection moulded

* approximate weights

HF ... Hand moulded

** DN/OD – according to EN 476 Dimension Nominal / Outside Diameter

Subject to technical alterations

LAYING INSTRUCTIONS

4.1 Installation

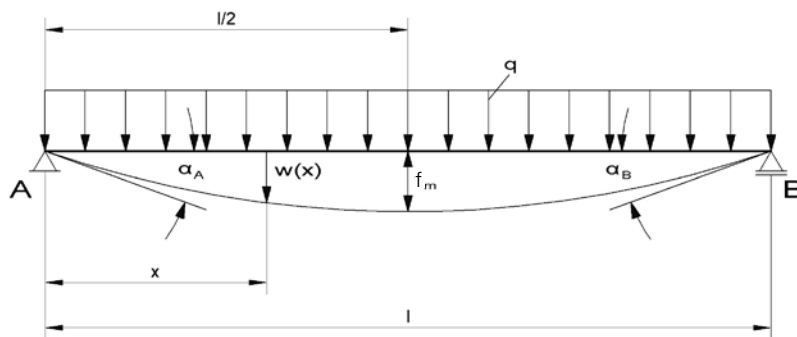
4.1.1 Structural design of pipes

Provided the observance of the general instructions, as well as the specific laying instructions contained in the technical manual on bridge suspensions, POLO-ECO plus PREMIUM can be used for this type of application without any structural design restrictions.

High longitudinal stability

Calculated sagging based on the system “determined by its structural design”:

Calculation result for POLO-ECO plus PREMIUM 12 with the following assumptions:



- Max. load assumed when filled up
- Safety factor 3 taken into account

Pipe DN/OD	Distance between supports L [cm]	Sag f_m [cm]
160	150	0.15
200	200	0.30
250	200	0.19
250	250	0.47
315	200	0.12
315	300	0.62
400	200	0.11
400	300	0.54
500	200	0.10
500	300	0.51
630	200	0.19
630	300	0.95

Thanks to its high longitudinal stability, POLO-ECO plus PREMIUM 12 in general shows very low sag. The calculation results remain distinctively below the minimum longitudinal gradient of $\geq 1.00\%$ that must be met by collecting pipes according to the stipulations of the RVS 15.04.31.

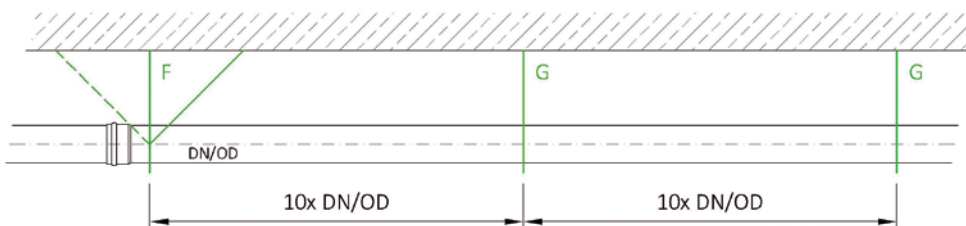
LAYING INSTRUCTIONS

4.1.2 Suspension distance

Standard situation

The following formula applies as a rule in order to guarantee a long-standing reliable functioning of the pipe system under the assumption of possible full load (filled up pipe) and such ambient circumstances as wind load and UV radiation, as well as a high long-time longitudinal stability:

Suspension distance = $\leq 10 \times \text{DN/OD}$ (maximum distance: 300 cm)



Suspension distance dependent on DN/OD (F ... fixed point, G ... floating point)

Pipe DN/OD	Full load (draining) distance [cm]	Partial load (e.g. cable conduit) distance [cm]
110–125	150	150–200
160–200	200	200–250
250	250	300
315–630	300	300

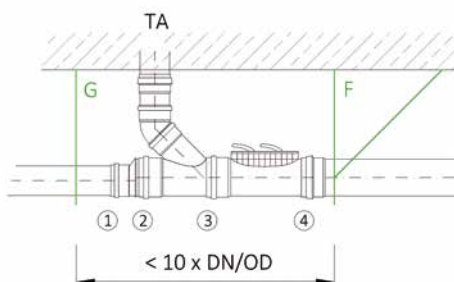
Special case: suspension distance $> 10 \times \text{DN/OD}$

Given certain circumstances, such as a specific orientation or structure of the bridge, and a resulting reduced influence of the said ambient parameters, or a generally reduced load (for example, if used as a cable conduit) the suspension distance may be increased as follows – provided the planner and/or POLOPLAST have been consulted:

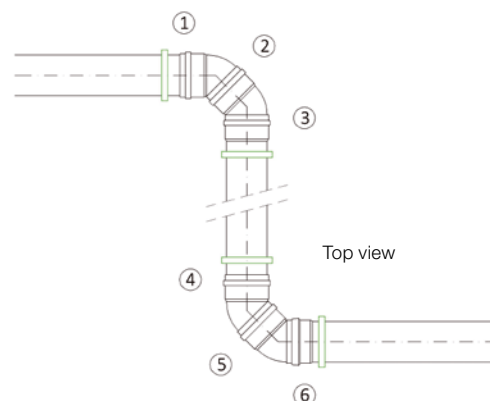
System-connected suspension distances of 150, 200 or 300 cm (dependent on DN/OD) are to be applied, as the standard manufacturing length of pipes are 300 and/or 600 cm, and from a structural design point of view, the recommended positions for suspensions are in the area of the socket connections.

Special case: suspension distance $< 10 \times \text{DN/OD}$

If several fittings are used one after the other, or if fittings are combined with short pipe sections, the suspension distances need to be reduced correspondingly in order to guarantee sufficient longitudinal stability of the system in the area of these multiple joints (view the drawings below).



Special case 1: use of multiple fittings



Special case 2: horizontal bend of a collecting pipe

LAYING INSTRUCTIONS

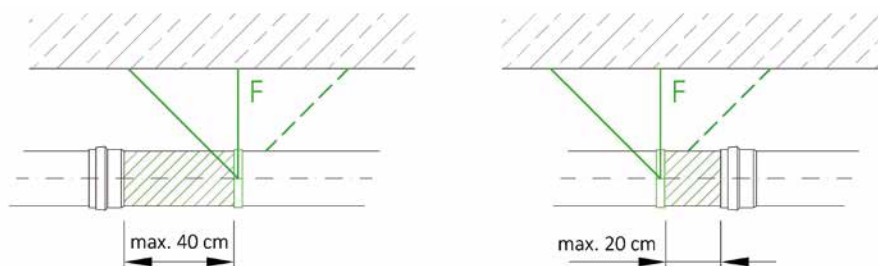
GENERAL INFORMATION

4.1.3 Location of fixed points on the collecting pipe

To enable the pipe to compensate for thermally induced changes of length and the resulting shear and tensile forces, **fixed points** (pipe clamps with a permanently elastic rubber insert) must be arranged at **distances of approximately six metres** of pipe length in the area of up to approximately 40 cm behind the pipe sockets. The appropriate frictional connection of these fixed points to the structure must be provided in an axial direction.

Usually, struts (for example, threaded rods M12–16, or flat steel bars) are arranged in a longitudinal direction at angles of approximately 45°–60°, which keep the pipe clamp in its position.

TECHNICAL DATA



Suspension in the area of the socket

Suspension in the area of the spigot end

- Fixed-point clamp with permanently elastic rubber insert
- Longitudinal stabilisation using threaded bars

RANGE OF PRODUCTS

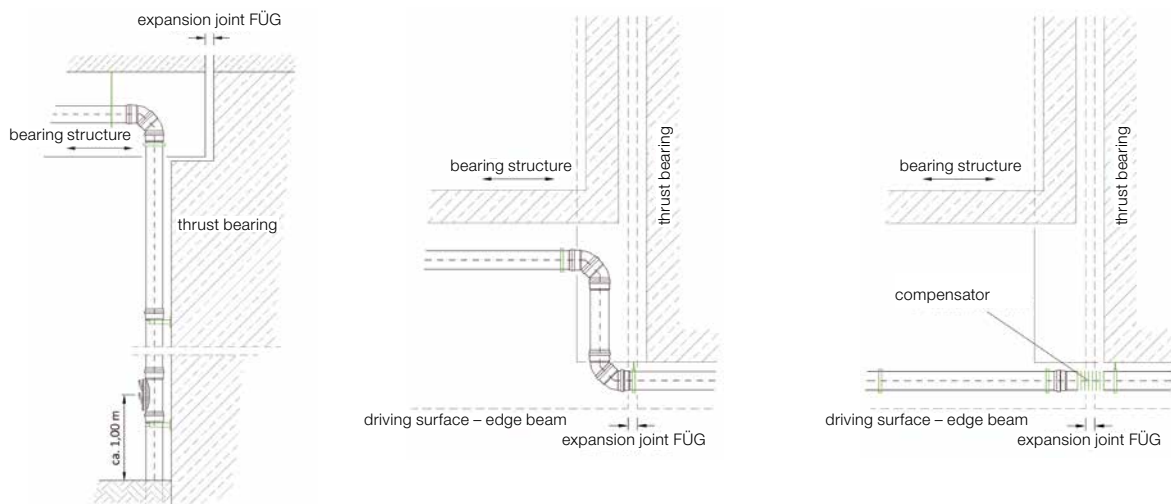
4.1.4 Bridge dilation

Depending on the expected degree of dilation of the bridge or pipe, it may be necessary to specifically arrange expansion legs, expansion boxes or expansion joints in the area of the dilation joint between the supporting structure and the abutment. The same measure applies to the transition between collecting pipe and downpipe in the area of flexible pier supports.

Appropriate measures need to be taken in coordination with the planner.

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Engineering examples



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4.1.5 Linear expansion

The **mean coefficient of linear expansion** is 0.044 mm/m°K.

Calculation formula: $\Delta L_T = \alpha \cdot L_{\text{pipe}} \cdot \Delta T$

ΔL_T change of length because of change of temperature [mm]

L_{pipe} pipe length [m]

α coefficient of linear expansion [mm/mK]

ΔT difference in temperature [K]

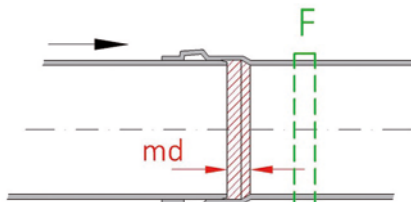
Change in length of different pipe materials for comparison purposes

	α	6.0 m/ Δ 50°	6.0 m/ Δ 40°	6.0 m/ Δ 70°	6.0 m/ Δ 80°	
		[mm]				
TW – Steel	0.012	2.88	3.60	4.32	5.04	5.76
TW – Reinforced concrete	0.010	2.40	3.00	3.60	4.20	4.80
Cast parts	0.010	2.40	3.00	3.60	4.20	4.80
High-grade steel	0.017	3.96	4.95	5.94	6.93	7.92
GF-UP	0.030	7.20	9.00	10.80	12.60	14.40
PE-HD	0.170	40.80	51.00	61.20	71.40	81.60
PP-ML	0.044	10.56	13.20	15.84	18.48	21.12

Socket expansion backlash

A corresponding longitudinal expansion backlash between **the spigot end of the pipe and the limit stop of the socket**, which enables the changes in length of the pipe to be compensated for in a controlled way, must be ensured when laying the system.

The insertion depth of the socket needs **to be reduced** by the required dimension of expansion (also refer to the table below).



Socket expansion backlash (md) depending on the laying temperature

Referring to a pipe length of 6.0 m, the following assumptions are applicable, depending on the ambient temperature on site and the pipe material temperature (if the material was stored on site before) (see RVS 15.04.31, clause 4.6.4):

Ambient temperature (\approx material temperature)	Socket expansion backlash md [cm]
30 °C	0.5
15 °C	1.0
0 °C	1.5
-15 °C	2.0
-30 °C	2.5

LAYING INSTRUCTIONS

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4.1.6 Bent socket connections

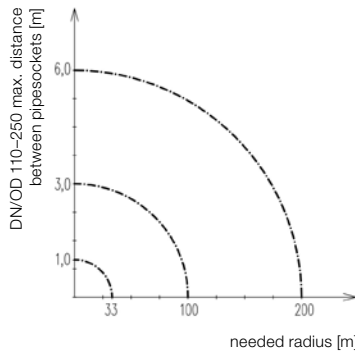
According to the requirements stated in EN 476 (clause 6.3.4) concerning the maximum admissible bend of sockets, the following limits need to be observed.

DN/OD 110–250: $a = 20 \text{ mm/m}$ DN/OD 315–630: $a = 10 \text{ mm/m}$

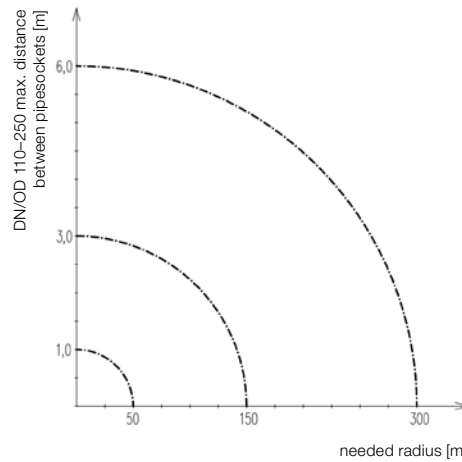
a ... deflection of the connection [in mm] per metre pipe length

From these maximum deflection values, the minimum curve and bend radius for POLO-ECO plus PREMIUM are as represented in the illustration below.

TECHNICAL DATA



POLO-ECO plus PREMIUM DN/OD 110–250

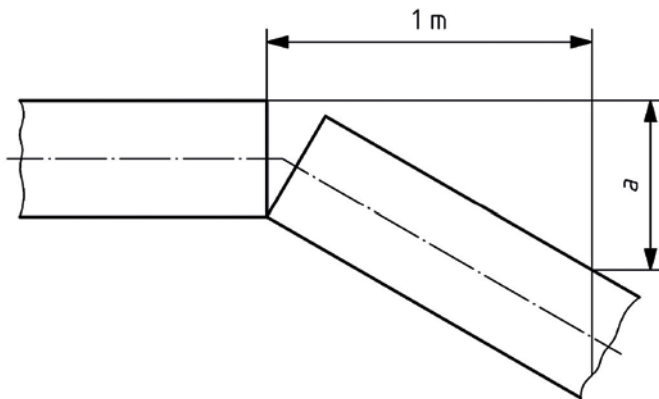


POLO-ECO plus PREMIUM DN/OD 315–630

RANGE OF PRODUCTS

According to EN476:2011, clause 6.3.4, in gravity systems, a deflection of the sockets per one metre length, refer to the illustration, of 30 mm for $DN < 300$, of 20 mm for $300 \leq DN \leq 600$, of 10 mm for $600 \leq DN \leq 1,000$ and of $10 \times 1,000/DN$ for $DN > 1000$, is admissible.

LAYING INSTRUCTIONS



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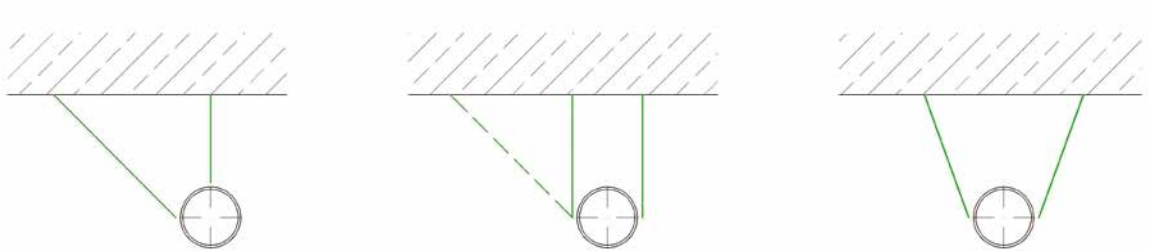
LAYING INSTRUCTIONS

4.2 Pipe suspension

Type and location of suspensions on the supporting structure of the bridge depend on the options that are admissible from a structural design point of view. The dimensioning of the pipe suspension has to consider the load conditions and the expected stress, and must always be agreed with the planner or system manufacturer. For longevity reasons, stainless steel is usually chosen for all components of the suspension.

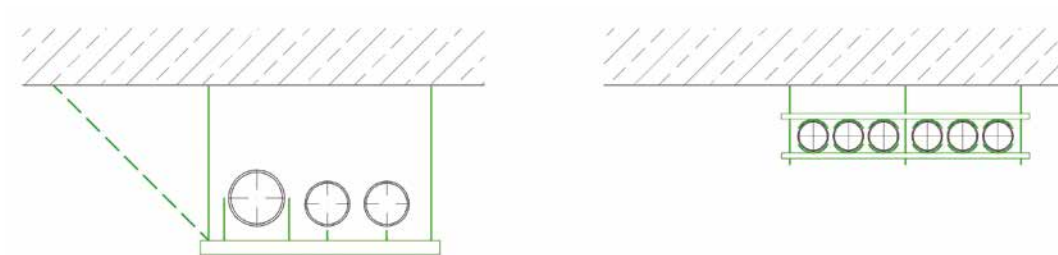
The illustrations below represent some examples of commonly used types of suspensions, vertical and horizontal.

Vertical laying of a single pipe



- Fixed or standard clamps with threaded bars
- Singular, double (height-adjustable) and oblique suspension
- Optional transverse stabilisation

Vertical assembly of several pipes



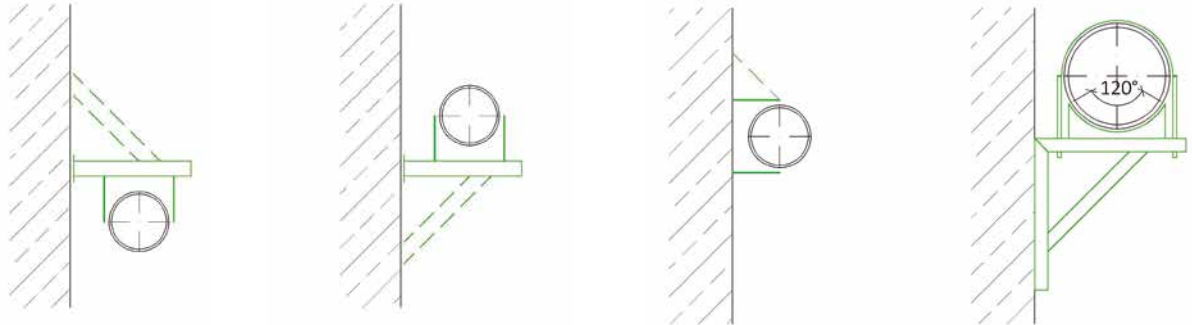
- Multiple suspension using supporting bases and threaded bars
- Cable conduits with supporting bases, pipe lagging and threaded bars
- Optional transverse stabilisation

Design examples



LAYING INSTRUCTIONS

Horizontal laying



- Fixed or standard clamps with threaded bars and brackets
- Optional stabilising strut
- Lightweight design: clamp with threaded bars and strut
- Massive design: bracket, supporting lagging and steel strap retainer



Example: massive design, bracket

4.2.1 Pipe clamps

In order to meet the requirement of long-standing resistance to corrosion, clamps made of stainless steel are used in most cases.

4.2.1.1 Purpose

Depending on the type of frictional connection between system pipe and pipe clamp used, two different kinds of clamps with different functions are used:

Fastening in normal points

- Sliding bracket, no frictional connection: (High-grade) steel clamp (with or) without rubber insert

Fastening in fixed points

- Fixed clamp, permanent frictional connection: (High-grade) steel clamp with permanently elastic, non-ageing rubber insert

4.2.1.2 Dimensioning

Recommended minimum dimensions of the steel pipe clamps, depending on the outer diameter DN/OD of plastic pipes:

Pipe DN/OD	Steel strap of the clamp, width × thickness [mm]	Metrical thread of the socket
50, 75, 90	24 × 2	M10
110, 125	30 × 2.5	M12
160, 200	30 × 3	M16
250, 315	40 × 4	M16
400	50 × 5	M16
500, 630	70 × 6	M16

LAYING INSTRUCTIONS

4.2.2 Collecting pipe – transverse stabilisation

With increasing vertical distance between the pipes, and depending on the occurring wind load, additional measures may be required to ensure sufficient transverse stabilisation. These measures need to be agreed with the planner and/or the manufacturer of the fastening system. Various designs can be used (refer to clause 4.2, vertical laying)

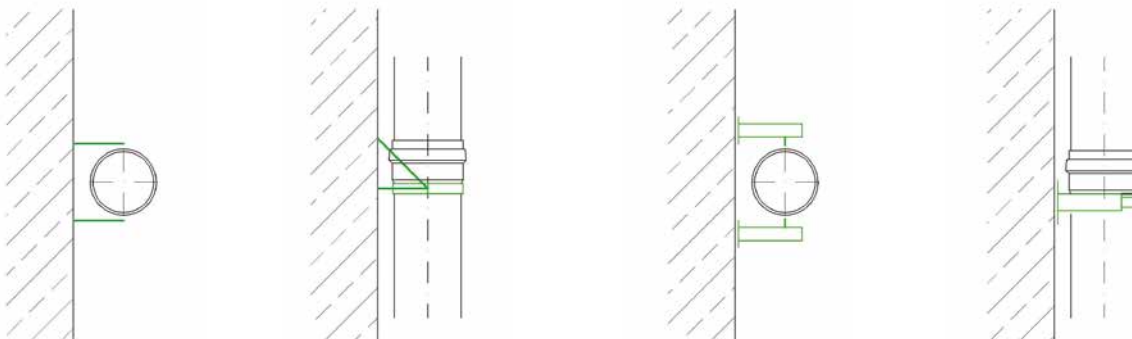
4.2.3 Location of fixed points on the downpipe

Downpipes are subject to high dynamic load, particularly during storms, which is why their fastening must be particularly strong. Independent of the pipe dimension, **a maximum distance of two metres must usually be observed** between the clamps.

Supporting fastenings as fixed points need to be arranged immediately beneath the pipe sockets at distances of approximately six metres. Type and dimensions of the fastening elements must always be coordinated with the planner and/or the system manufacturer.

Here, as for the laying of collecting pipes, the socket expansion backlash (md) needs to be considered (refer to clause 4.1.5).

Laying of downpipes



- Fixed-point clamp with permanently elastic rubber insert
- Supporting fastening element beneath the pipe socket
- Threaded bars or steel bracket

Design examples



LAYING INSTRUCTIONS

4.3 Further information

Information based on the RVS 15.04.31 dated 01.10.2011, and the amendment dated 01.11.2013

4.3.1 Pressure tightness

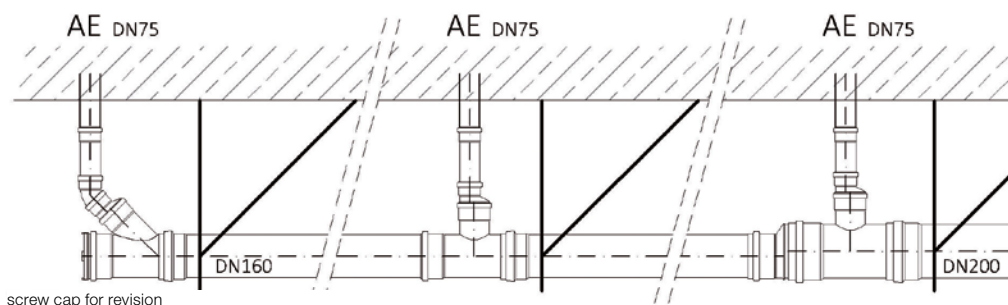
*“The drainage system needs to be designed to withstand an interior pressure of at least 0.5 bar.” **

POLO-ECO plus PREMIUM and all its components fulfil this requirement, provided the existence of a corresponding frictional connection of the suspension and fastening element that is protected against shearing forces.

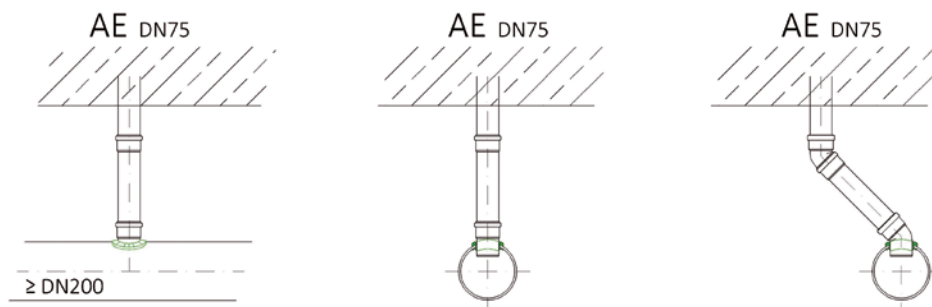
4.3.2 Drainage of sealing structures

“As a rule, drainage pipes of sealing structures must have the minimum dimension of DN 70.”

Drainage pipes of sealing structures can be integrated into POLO-ECO plus PREMIUM DN/OD 200–630 collecting pipes; for this leakproof integration, a **branch** or **inlet pipe seal ELRD** needs to be used.



Integration of drainage pipes of sealing structures using branches

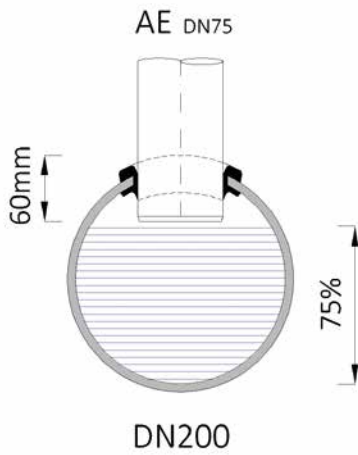


Integration of drainage pipes of sealing structures using inlet pipe seals ELRD POLOPLAST

* cf. RVS 15.04.31

LAYING INSTRUCTIONS

4.3.3 POLO-Inlet pipe seal ELRD 75 . EPDM UV-resistant . A. no. 04464



POLO-ECO plus PREMIUM bridge drainage connection AE 75 to SL using an ELRD 75. Bore 83 mm, below the degree of filling according to the stipulation of the standard: 75 %



POLO-ELRD 75 + padsaw 83 mm



EPDM seal with circumferential groove



AE connecting pipe DN 75

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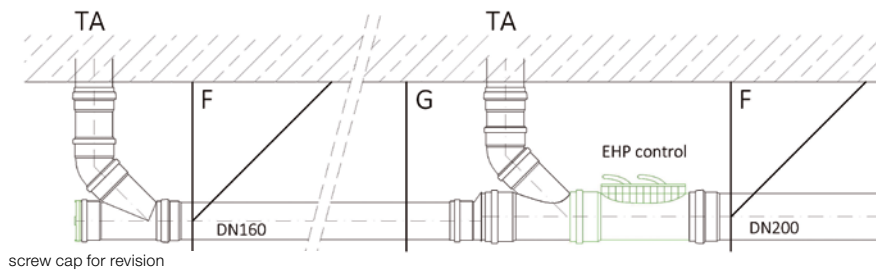
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4.3.4 Cleaning aperture enabling maintenance

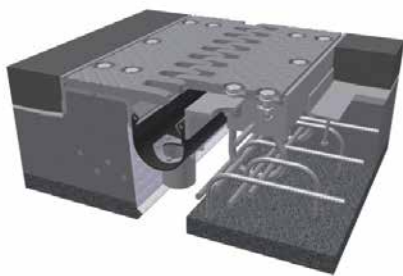
The RVS 15.04.31 stipulates that cleaning apertures must be provided in the following situations:

- every junction of a bridge inlet and a collecting pipe
- every transition of a longitudinal pipe to a downpipe and vice versa
- in the location where the downpipe enters the underground pipe, approximately one metre above the soil level



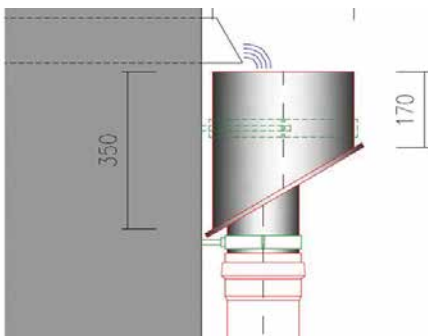
- **Screwed lid** DN/OD 160–250, at the beginning of every collecting pipe
- **POLO-EHP control** cleaning element DN/OD 110–500 with maintenance aperture 10 × 30 cm and two-lever lock.

4.3.5 Road crossing construction FÜK in general



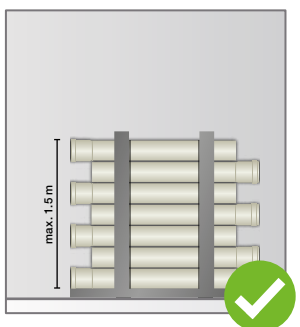
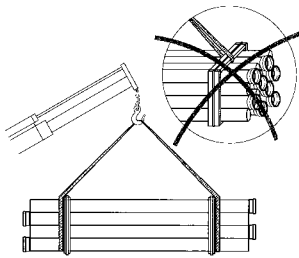
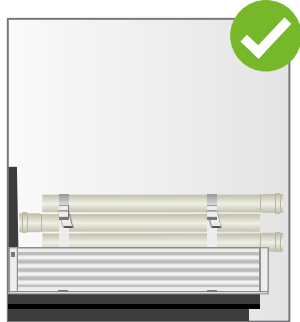
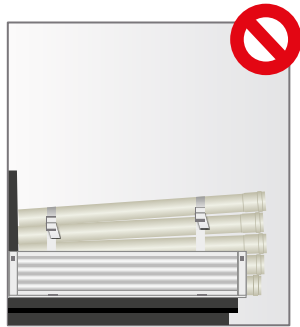
Example: FÜK finger-type transition with elastomer outlet chute usual FÜK inlet made of high-grade steel (to avoid corrosion!)

4.3.5.1 POLO – FÜK = inlet for road expansion joints without dirt trap . A. no. 06589



POLO – FÜK inlet funnel DN 315/160

LAYING INSTRUCTIONS



4.4 Transportation and storage

4.4.1 Loading and transportation

When loading pipes and fittings, make sure to rule out any possible damage during transportation.

Fasten the pipes thoroughly before transporting them. The supporting posts on the sides must be flat and must not have any sharp edges. For transportation, pipes that are no longer on pallets should be supported over their entire length to avoid sagging. The sockets need to be staggered.

Pipes on pallets need to be loaded and unloaded using belts, as shown in the illustration.

4.4.2 Unloading and storage

Take the necessary care when unloading pipes. Never tilt the pipes to unload them, nor throw them down or pull them over sharp edges (for example, loading boards).

No permanent deformation or damage must occur to the pipes following storage. The storage area should be level. Do not stack unpalleted pipes higher than 1.5 metres. By staggering the sockets, the individual layers of pipe are reasonably supported over the entire area. Protect pipe stacks from rolling apart.

Discolouration that might possibly occur does not affect the functionality.



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4.5 Cutting to length and bevelling

Before starting laying, check the pipes and push-fit sockets for possible damage from transportation. Make sure to lay pipes with push-fit sockets in such a way that the push-fit socket is oriented against the direction of flow.

4.5.1 Cutting to length

If necessary, cut the pipes to length at right angles to the pipe axis. Make sure to use suitable cutting tools. Remove burrs.

Suitable tools are, for example:

- small angle grinders with removable aluminium abrasive cutting disc (for example, Tyrolit, type No. 739982) or
- large angle grinders with segmented diamond cutting disc

Fittings must not be cut to length.



Cutting to length using a large angle grinder

4.5.2 Bevelling

Bevelling can be done

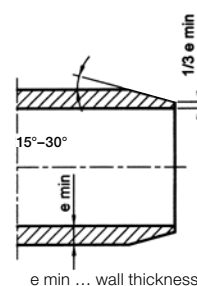
- using a small angle grinder with removable serrated abrasive disc for smaller pipe dimensions, and
- using a small angle grinder with removable rasp abrasive disc (BOSCH, type No. 2608600180-736) and a serrated disc for finishing, if large pipe dimensions are treated.

Bevelling at angles of approximately 15° – 30° according to EN 1610

The remaining wall thickness of the pipe end must at least be one third of the thickness of the pipe end.



Bevelling using a rasp disc



Bevelling the spigot end

4.5.3 Cutting to length and chamfering in one operation

To perform cutting and chamfering of the pipes in one go, use the POLO cutting and chamfering tool contained in our product list. This tool is suitable for plastic pipes in the dimensional range of DN/OD 110 to DN/OD 315 mm.

A second operation is required for chamfering pipes DN/OD > 315.

1. Use a large angle grinder (refer to clause 4.5.1) to cut the pipe to the required length.
2. Use the cutting and chamfering tool to chamfer the spigot end.

The set consists of a shock-proof case, a cutting tool 1,200 W with special cutting disc, two roller brackets, a universal marking tape DN/OD 110–DN/OD 315, including felt pen, and a face spanner.



Subject to technical alterations

DESIGN EXAMPLES

5.1 Design examples

A 9 Pyhrn Motorway . Steyr Viaduct . Klaus . Austria

Operating organisation: ASFINAG

Pipe material: POLO-ECO plus PREMIUM 12 pipe

Dimensions: DN 315–DN 400



S 10 Mühlviertler Speedway . F 45 Fly-over Ramp 3 . AS Grünbach/Sandl . Austria

Operating organisation: ASFINAG

Pipe material: POLO-ECO plus PREMIUM 12 pipe

Dimensions: DN 75–DN 200



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S 10 Mühlviertler Speedway . F 48 Feldaist Bridge . Freistadt Nord . Austria

Operating organisation: ASFINAG
Pipe material: POLO-ECO plus PREMIUM 12 pipe
Dimensions: DN 110–DN 400

TECHNICAL DATA



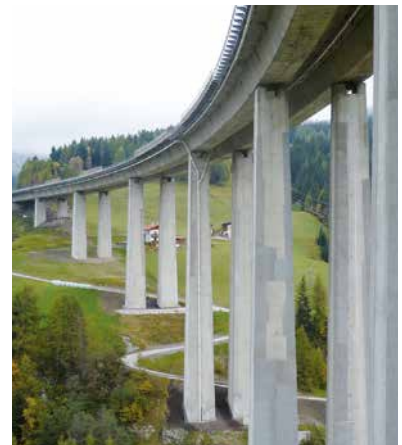
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Motorway Bridge Obernberg – A 13 Brenner Motorway . Austria

Operating organisation: ASFINAG
Pipe material: POLO-ECO plus PREMIUM 12 pipe
Dimensions: DN 160–DN 315

DESIGN EXAMPLES



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INVITATION TO TENDER TEXTS

6.1 POLO-ECO plus PREMIUM bridge drainage/suspension

Invitation to tender text for PP-ML sewage pipes and fittings according to ÖNORM R 20513
Pipes and fittings, tested, certified and monitored according to ONR 20513 and GRIS (No. 145)
Also refer to RVS 15.04.31 . Supplement dated 01.11.2013

PP sewage pipe, mineral-reinforced

Three-layer, mineral-reinforced polypropylene (PP-ML) sewage pipe with moulded push-fit socket
ring rigidity $\geq 10 \text{ kN/m}^2$ DN/OD 110–125 . Ring rigidity $\geq 12 \text{ kN/m}^2$ DN/OD 160–630
Mean coefficient of linear expansion: $0.04 \text{ mm/m}^\circ\text{K}$. Colour: opal white/light grey . UV resistant
Brand: POLO-ECO plus PREMIUM or equivalent

PP sewage fitting

Fittings made from polypropylene (PP) according to ONR 20513 with push-fit socket
Colour: opal white/light grey . UV resistant

PP sealing structure drainage pipe DN/OD 75

Three-layer polypropylene (PP) pipe DN/OD 75 with moulded push-fit socket
Colour: opal white/light grey . UV resistant

PP sealing structure drainage fitting DN/OD 75

Fittings made of polypropylene (PP) DN/OD 75 with push-fit socket
Colour: opal white/light grey . UV resistant

PP cleaning element

System cleaning element made of polypropylene (PP) with push-fit socket . Simple two-lever operation
without metal screw connections . Cleaning aperture min. $300 \times 100 \text{ mm}$ for camera inspection and HP
scavenging . Leakproof under pressure up to 1.5 bar . Colour: opal white/light grey . UV resistant

Screwed lid

Screwed lid for cleaning apertures at the beginning of collecting pipe strings. DN/OD 125–250

Inlet pipe seal DN/OD 75

Inlet pipe seal made of UV-stabilised EPDM . For leakproof integration of the sealing structure drainage into
the collecting pipe

PP-FÜK inlet DN/OD 315/160

Inlet funnel for drainage of road crossing structures . Colour: opal white/light grey . UV resistant

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GENERAL INFORMATION	01	Three-layer, mineral-reinforced PP-ML sewage pipe according to ÖNR 20513 and GRIS, with moulded push-fit socket. Ring rigidity SN8 ≥ 10 kN/m ² and SN12 ≥ 12 kN/m ² PP fitting according to ÖNR 20513 and GRIS . With push-fit socket PP sewage cleaning element with push-fit socket . Cleaning aperture min. 300 × 100 mm . Free of metal; System colour opal white/light grey . UV resistant	
	0101	Three-layer PP-ML pipe, rigidity class SN8 DN/OD corresponds to outer diameter e.g. POLO-ECO plus PREMIUM 10 or equivalent	
TECHNICAL DATA	0101 A	Three-layer PP-ML pipe SN8 DN/OD 110	..... m
	0101 B	Three-layer PP-ML pipe SN8 DN/OD 125	..... m
	0102	Three-layer PP-ML pipe, rigidity class SN12 DN/OD corresponds to outer diameter e.g. POLO-ECO plus PREMIUM 12 or equivalent	
RANGE OF PRODUCTS	0102 A	Three-layer PP-ML pipe SN12 DN/OD 160	..... m
	0102 B	Three-layer PP-ML pipe SN12 DN/OD 200	..... m
	0102 C	Three-layer PP-ML pipe SN12 DN/OD 250	..... m
	0102 D	Three-layer PP-ML pipe SN12 DN/OD 315	..... m
	0102 E	Three-layer PP-ML pipe SN12 DN/OD 400	..... m
LAYING INSTRUCTIONS	0102 F	Three-layer PP-ML pipe SN12 DN/OD 500	..... m
	0102 G	Three-layer PP-ML pipe SN12 DN/OD 630	..... m
	0103	Extra charge: PP sewage fittings for pipes \leq SN16 DN/OD corresponds to outer diameter e.g. POLO-ECO plus PREMIUM or equivalent	
DESIGN EXAMPLES	0103 A	Extra charge: PP fittings DN/OD 110–630 1 CU corresponds to 1.00 € of the current manufacturer's price list	..... CU
	0104	Extra charge: PP cleaning elements DN/OD 110–500 DN/OD corresponds to outer diameter e.g. POLO-EHP control or equivalent	
	0104 A	Extra charge: PP cleaning element DN/OD PC

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0105	PP sealing structure drainage pipes/fittings DN/OD 75 POLO-ECO plus PREMIUM or equivalent	
0105 A	Sealing structure drainage pipe DN/OD 75	..... m
0106	Extra charge: PP sealing structure drainage fittings e.g. POLO-ECO plus PREMIUM or equivalent	
0106 A	Extra charge: PP fittings DN/OD 75 1 CU corresponds to 1.00 € of the current manufacturer's price list CU

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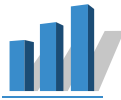
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02/08.17_EN_wanted.co.at

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