TECHNICAL MANUAL

Marine

POLO-KAL NG . POLO-KAL NG Vacuum . POLO-KAL NG ASV

PURE PROGRESS / poloplast

CONTENTS

General information

The information provided in this technical manual is intended to help you select our products for your application. Text and images were compiled with utmost care. Nevertheless, errors cannot be entirely excluded. POLOPLAST does not assume legal liability or any other form of liability for erroneous information and its consequences. POLOPLAST is grateful for any suggestions or comments.

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

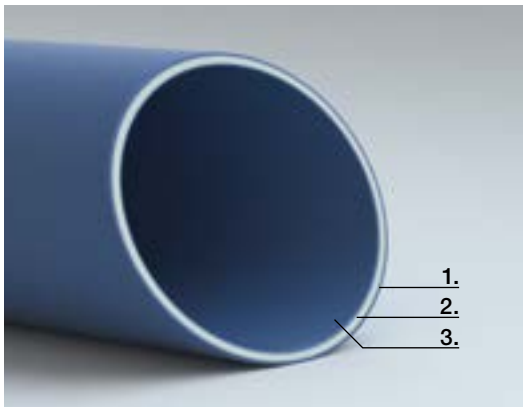
GENERAL INFORMATION

1.1 Scope

The scope of these specifications is to supply indications on the material, the design and installation of the drainage system POLO-KAL NG, respectively POLO-KAL NG Vacuum. The three-layer drainage system made of mineral reinforced polypropylene is suitable to use for whether black or grey water applications and is manufactured by POLOPLAST GmbH & CO KG.

1.2 POLO-KAL NG and POLO-KAL NG Vacuum

The POLO-KAL NG and POLO-KAL NG Vacuum is a polypropylene multi-layer non-pressure drainage system, comprising tubes and fittings with push-fit sockets and factory-inserted lip seals made of EPDM. These pipes and fittings are commercial products with dimensions and quality according to EN 1451-1. The pipe consists of polypropylene in the inner and outer layer. The middle layer additionally contains minerals for reinforcement. The fittings consist of polypropylene and additionally minerals for reinforcement.



1. External layer made of PP
The tough protective shell of the pipe.
Sturdy and highly impact resistant.

2. Intermediate layer made of mineral-reinforced PP
Mineral-reinforced plastic provides high stability and establishes the superior noise-insulating effect of POLO-KAL NG.

3. Internal layer made of PP
Tremendous surface smoothness and resistance to chemical agents.

The advantages of POLO-KAL NG

- **Outstanding noise insulating values.** The tried and tested 3-layer technology reliably absorbs flow noise effectively.
- **Low weight** of the pipe system, reduces the total weight of the ship significantly and enables easy transportation and assembling.
- **Long-living and non-corrosive** – optimal resistance to salt-containing air, no corrosion.
- **High assembling security** provided by the established push-fit system. No risk of fire, due to sparks caused by cutting the pipes.
- **Fast and easy assembling** of the highly noise-insulated push-fit system POLO-KAL NG.
- **Smooth inner surface** prevents the accumulation of deposits.

- **Precision sealing system**. Precisely-shaped push-fit sockets. Rapid assembly. Durable connection.

- **25 years of multi-layer technology experience**. POLOPLAST has more than 25 years of knowledge and experience with the tried and tested 3-layer technology and 60 years of experience with building drainage.

1.3 Fields of application

The pipe system is produced in a series of diameters from DN/OD 40–200, and is particularly suitable for the following fields of application:

- **Gravity drainage for grey- and rainwater including internal and external scuppers.** The POLO-KAL NG pipes and fittings (DN/OD 40–200), deliver a convincing performance distinguished by superior quality and excellent noise insulation values.
- **Vacuum discharge for black water (DN/OD 40–75).** The POLO-KAL NG Vacuum pipes in combination with the POLO-KAL NG fittings, deliver a reliable and long lasting performance, even at the demanding vacuum discharge application.
- **Air vent for fresh water, ballast, grey and black water tanks.**

Nominal size = outside diameter [mm]	Pipe minimal wall thickness	
	POLO-KAL NG for gravity discharge	POLO-KAL NG Vacuum for vacuum discharge
DN 40	1.8 mm	1.9 mm
DN 50	2.0 mm	2.3 mm
DN 75	2.6 mm	3.4 mm
DN 90	3.0 mm	-
DN 110	3.4 mm	-
DN 125	3.9 mm	-
DN 160	4.9 mm	-
DN 200	6.8 mm	-

The fittings of POLO-KAL NG can be used for gravity drainage and vacuum discharge.

With reference to the use of this system, Res. A.753 (18) of the International Maritime Organization (I.M.O.) for the application of plastic pipes on board ships applies. The POLO-KAL NG system can be adopted under freeboard deck only if kept within the compartment and according to limitations in type approval certificates issued by classification societies. Only system components which are part of type approval have clearance for use.

Applications under direct UV-radiation are not permitted.

1.4 Type approvals

RINA SERVICES

Certificate No. MAC068914XG

Certificate No. 12-00016_(E2)

TYPE APPROVED PRODUCT DNV·GL DNVGL.COM/AF

TAK00001J3

1.5 Technical notes

1.5.1 Crossing decks and bulkheads

Decks and bulkheads without class specifications
The pipes can be implemented through the decks and bulkheads without special measures.
To avoid damage to pipes due to possible contact with the deck or bulkhead holes the following precautionary actions shall be taken:

- The minimum clearance between pipes of all diameters and the hole in the plate has to be 20 mm.
- When applying a securing clamp make sure to keep a maximum distance of 200 mm from the hole.

Decks and bulkheads with class specifications
When fire prevention areas with fire protection class A or B are crossed by plastic pipes, arrangements should be made to ensure that the fire security is not affected.
These regulations should be consistent for fire protection certification for A and B. The fire protection sleeve has to be tested and approved in combination with our products. Such approvals can be requested directly from the fire protection sleeve manufacturers.
The installation has to be done according to the guidelines of the fire protection sleeve manufacturer.

1.5.2 Technical data POLO-KAL NG

Material	Pipe: PP/PP-MV/PP; Fitting: PP-MV free of halogen and cadmium and free of heavy metals
Colour	Blue RAL 5014
Resistance to hot water	Long-term 60 °C 5h/day = 87.600 h/50 years Short-term 90 °C 10 min/day = 3.000 h/50 years
Pipe marking	POLO-KAL NG pipes are typically marked as follows: charge number, company name, product name, product description, indication of material, category of application, category of rigidity, dimension and wall thickness, certificates, made in Austria, EAN Code
Chemical resistance	Chemical resistance of the POLO-KAL NG system comprises the pH range from 2 to 13. Pipes and fittings made of PP according to DIN 8078 Beiblatt 1 and ISO TR 10358. Seal material EPDM or NBR according to ISO TR7620.
Connections	Push-fit sockets according EN 1451-1 with factory-inserted lip seals. Seal material = EPDM (from DN/OD 200 it is NBR)
Fire behaviour	according **EN 13501-1**: **D - s2, d1** according **DIN 4102**: **B2** (normal inflammability) **Q1** (low smoke development) **TR1** (no drip formation)
Ring rigidity	The ring rigidity of the pipe has been proved according to EN ISO 9969. The rigidity is at least 6.0 kN/m^2 over the entire range of dimensions DN/OD 32–160 mm. The ring rigidity of DN/OD 200 mm is at least 8.0 kN/m^2.
Pressure	Atmospheric max 1.5 bar short-term
E-Modulus	2400–3100 MPa according to ISO 178
Mean coefficient of elongation LAG	0.05 mm/mK (OFI test report No. 47.423)
Low-temperature impact strength	❄ –20 °C, safe transportation and laying, even at low temperatures. (Test report TGM VA KU 25000/1)
UV-resistance	POLO-KAL NG pipes and fittings are designed to withstand outdoor storage for 2 years in Europe

GENERAL INFORMATION

1.5.3 Technical data POLO-KAL NG Vacuum pipes

Material	PP/PP-MV/PP free of halogen and cadmium and free of heavy metals
Colour	Blue RAL 5014
Working temperature for vacuum discharge	Long-term 23 °C Short-term 45 °C
Pipe marking	POLO-KAL NG Vacuum pipes are typically marked as follows: charge number, company name, product name, Lloyds register certificate Number, category of application, indication of material, dimension and wall thickness, fire classification, Rina certificate Number, Made in Austria, EAN Code
Chemical resistance	Chemical resistance of the POLO-KAL NG system comprises the pH range from 2 to 13. Pipes and fittings made of PP according to DIN 8078 Beiblatt 1 and ISO TR 10358. Seal material EPDM according to ISO TR7620.
Connections	Push-fit sockets according EN 1451-1 with factory-inserted lip seals. Seal material = EPDM
Fire behavior	according **EN 13501-1**: **D - s2, d1** according **DIN 4102**: **B2** (normal inflammability) **Q1** (low smoke development) **TR1** (no drip formation)
Ring rigidity	The ring rigidity of the pipe has been proved according to EN ISO 9969. The rigidity is at least 18.0 kN/m^2.
Pressure	Atmospheric max 1.5 bar short-term
Max vacuum	–0,9 bar
E-Modulus	2400–3100 MPa according to ISO 178
Mean coefficient of elongation LAG	0.05 mm/mK
Low-temperature impact strength	❄ –20 °C, safe transportation and laying, even at low temperatures
UV-resistance	POLO-KAL NG Vacuum pipes are designed to withstand outdoor storage for 2 years in Europe

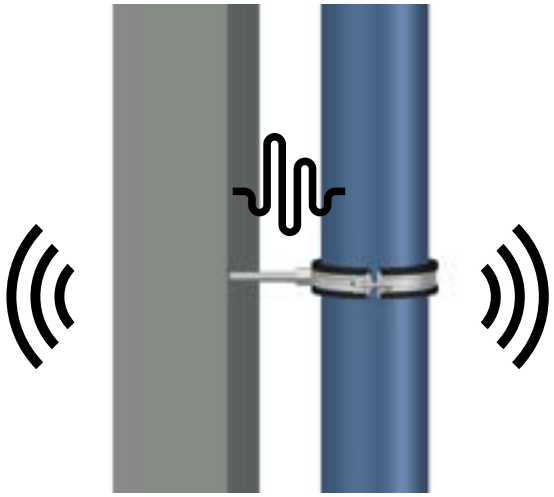
1.5.4 Soundproofing

The POLO-KAL NG considerably reduces the noise produced by the flow of water.

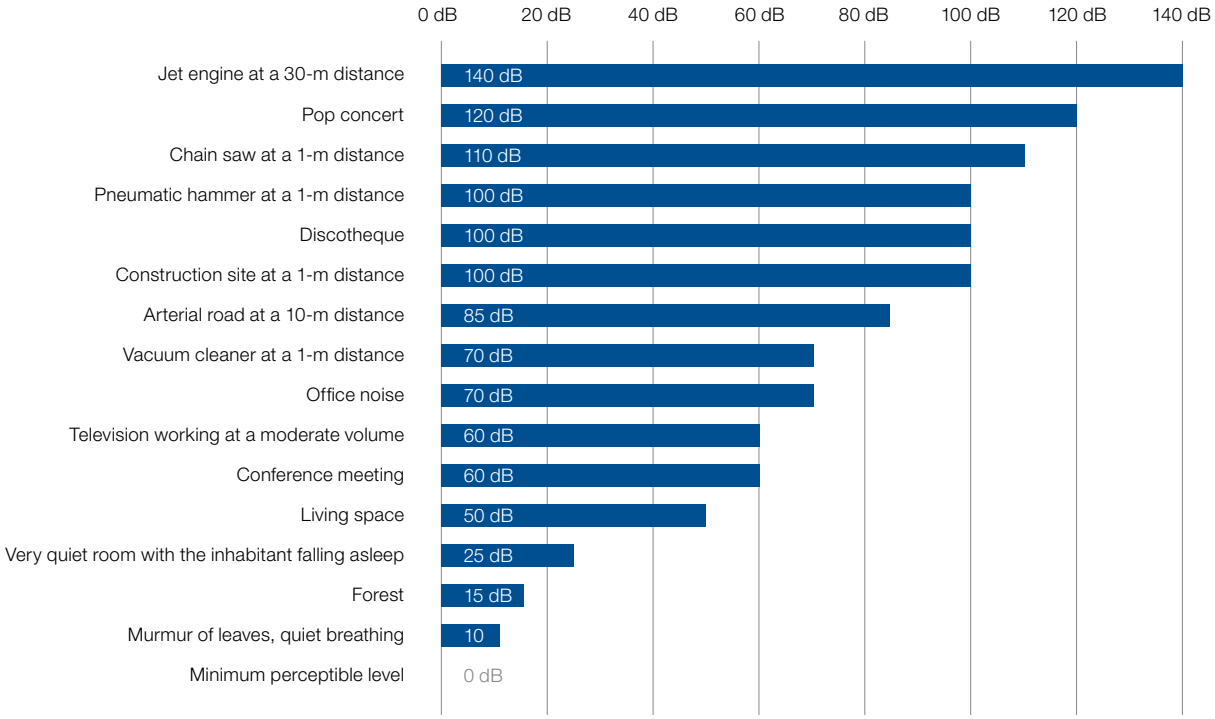
Tests conducted at the Fraunhofer Laboratory in Stuttgart (Germany) have proved the highly sound insulating properties of this pipe system. Thanks to the standardised test set-up in compliance with the EN 14366 standard, the acoustic properties can be assessed in an unbiased way.

The POLO-KAL NG is installed on a concrete wall with a mass per surface unit equating to 220 kg/m^2. Pipes and fittings in the dimension of 110 mm were used.

Under these conditions the noise level in the metering chamber reached $L_{AFeq,n}$ = 22 dB(A) at a water flow rate of 4 l/s.



In the described circumstances, POLO-KAL NG provides a sound level as low as in an average bedroom.



1.5.5 Linear expansion

If the working temperature is higher than the installation temperature the pipe expands. These expansion forces have to be absorbed by the pipe and the fixing system.

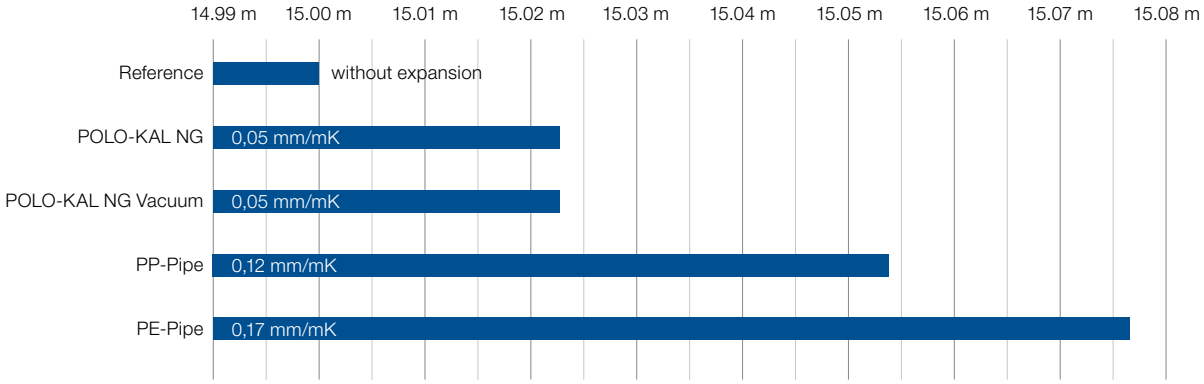
In the case of high wastewater temperatures the linear expansion can be calculated as shown below:

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

Pipe system	LAK
POLO-KAL NG	0.05 mm/mK
POLO-KAL NG Vacuum	0.05 mm/mK

Example:
A POLO-KAL NG pipe has a straight length of 15 m. Given an ambient temperature of 25 °C, wastewater is conducted at a maximum temperature of 55 °C. This results in a temperature difference of 30 Kelvin.

Linear expansion = 0.05 mm/mK × 30 K × 15 m = 22.5 mm
A linear expansion of ca. 2 cm can thus be expected. Other pipe materials have a linear expansion up to 8 cm.



Instances of linear expansion can be compensated by drawing out the spigot ends of several push-fit connections by no more than 1 cm. Alternatively, long sleeve sockets can be used in the traditional way.

1.5.6 Use in commercial kitchens

POLO-KAL NG is suitable to be used for draining away greasy waste water from canteen kitchens to grease traps. The factory-fitted lip ring seals need to be replaced by oil and grease resistant NBR lip ring seals. Downstream of the grease trap, all POLO-KAL® pipe systems can be used.
As far as supply lines and the operation of grease traps are concerned, the requirements of the EN 1825 standard, as well as the requirements indicated by the grease trap manufacturer, apply. As an optional solution, electric heat tracing can be installed up to the grease trap. The surface temperature of the electric heat tracing must not exceed 45 °C.

1.5.7 Use with commercial devices

In case of drainage of dish washing machines, potwashers and potwash tables, kettles, Bain Marie of distribution counters, laundry machines or similar consider the maximum temperatures according section 1.5.2.

1.5.8 Maintenance

Due to the material properties of polypropylene in general and the material mix as well as the low surface tension of the POLO-KAL NG and POLO-KAL NG Vacuum pipe system in particular, the incrustation process (scaling) can be prolonged.

Nevertheless, with time every marine sewage system becomes eventually lined up with a certain build-up of calcium, magnesium hard water scale and struvite deposits. For this case, various cleaning methods are existing, using different kinds of chemicals. The POLO-KAL NG pipe system as well as the POLO-KAL NG Vacuum pipes are tested with the following substances:

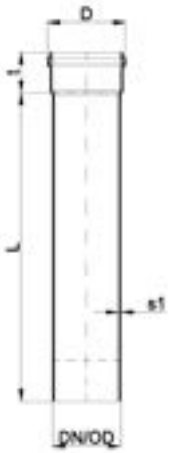
- Hydrochloric acid up to 42 % concentration
- Phosphoric acid up to 25 % concentration
- Sulfuric acid up to 50 % concentration
- Caustic soda

For use of other aggressive chemicals, please contact us.

2.1 Product range

Dimensions in mm

POLO-KAL NG
Socket pipe
PKEM
with factory-fitted lip ring



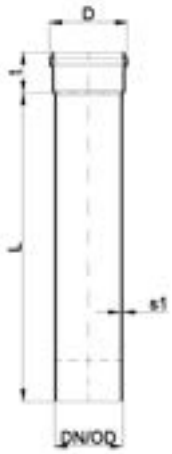
DN/OD*	L	s1(min)	t(min)	D(max)	kg/pc.	A. no.
40	150	1.8	45	53	0.04	02010
40	250	1.8	45	53	0.07	02011
40	500	1.8	45	53	0.13	02012
40	750	1.8	45	53	0.20	02019
40	1000	1.8	45	53	0.26	02013
40	1500	1.8	45	53	0.39	02014
40	2000	1.8	45	53	0.52	02015
40	3000	1.8	45	53	0.78	02016
50	150	2.0	47	63	0.06	02020
50	250	2.0	47	63	0.09	02021
50	500	2.0	47	63	0.19	02022
50	750	2.0	47	63	0.28	02029
50	1000	2.0	47	63	0.37	02023
50	1500	2.0	47	63	0.56	02024
50	2000	2.0	47	63	0.74	02025
50	3000	2.0	47	63	1.12	02026
75	150	2.6	53	89	0.11	02030
75	250	2.6	53	89	0.19	02031
75	500	2.6	53	89	0.38	02032
75	750	2.6	53	89	0.56	02039
75	1000	2.6	53	89	0.75	02033
75	1500	2.6	53	89	1.13	02034
75	2000	2.6	53	89	1.51	02035
75	3000	2.6	53	89	2.26	02036
75	4000	2.6	53	89	3.01	02037
90	150	3.0	57	106	0.16	02070
90	250	3.0	57	106	0.26	02071
90	500	3.0	57	106	0.53	02072
90	750	3.0	57	106	0.79	02079
90	1000	3.0	57	106	1.06	02073
90	1500	3.0	57	106	1.58	02074
90	2000	3.0	57	106	2.11	02075
90	3000	3.0	57	106	3.17	02076
90	4000	3.0	57	106	4.29	02077
110	150	3.4	62	128	0.22	02040
110	250	3.4	62	128	0.37	02041
110	500	3.4	62	128	0.74	02042
110	750	3.4	62	128	1.11	02049
110	1000	3.4	62	128	1.49	02043
110	1500	3.4	62	128	2.23	02044
110	2000	3.4	62	128	2.97	02045
110	3000	3.4	62	128	4.46	02046
110	4000	3.4	62	128	5.94	02047

Subject to technical alterations | *DN/OD – according to European standardisation CEN/TC 155: Dimension Nominal / Outside Diameter

PRODUCT RANGE

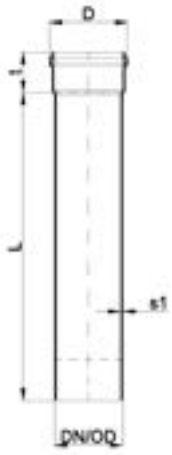
Dimensions in mm

POLO-KAL NG
Socket pipe
PKEM
with factory-fitted lip ring



DN/OD	L	s1(min)	t(min)	D(max)	kg/pc.	A. no.
125	150	3.9	67	145	0.29	02050
125	250	3.9	67	145	0.48	02051
125	500	3.9	67	145	0.97	02052
125	1000	3.9	67	145	1.94	02053
125	1500	3.9	67	145	2.91	02054
125	2000	3.9	67	145	3.88	02055
125	3000	3.9	67	145	5.82	02056
125	4000	3.9	67	145	7.76	02057
160	150	4.9	77	184	0.47	02060
160	250	4.9	77	184	0.79	02061
160	500	4.9	77	184	1.58	02062
160	1000	4.9	77	184	3.16	02063
160	1500	4.9	77	184	4.74	02064
160	2000	4.9	77	184	6.32	02065
160	3000	4.9	77	184	9.47	02066
160	4000	4.9	77	184	12.63	02067
200	1000	6.8	122	228	5.78	02951
200	3000	6.8	122	228	17.34	02953
200	6000	6.8	122	228	32.7	02954

POLO-KAL NG Vacuum
Socket pipe
PKVEM
with factory-fitted lip ring



DN/OD	L	s1(min)	t(min)	D(max)	kg/pc.	A. no.
40	250	1.9	45	53	0.09	01411
40	500	1.9	45	53	0.16	01412
40	750	1.9	45	53	0.23	01413
40	1000	1.9	45	53	0.30	01414
40	1500	1.9	45	53	0.44	01415
40	2000	1.9	45	53	0.58	01416
40	3000	1.9	45	53	0.85	01417
50	250	2.3	47	63	0.14	01421
50	500	2.3	47	63	0.25	01422
50	750	2.3	47	63	0.36	01423
50	1000	2.3	47	63	0.46	01424
50	1500	2.3	47	63	0.68	01425
50	2000	2.3	47	63	0.89	01426
50	3000	2.3	47	63	1.32	01427
75	250	3.4	53	89	0.32	01431
75	500	3.4	53	89	0.56	01432
75	750	3.4	53	89	0.80	01433
75	1000	3.4	53	89	1.04	01434
75	1500	3.4	53	89	1.53	01435
75	2000	3.4	53	89	2.01	01436
75	3000	3.4	53	89	2.99	01437

PRODUCT RANGE

Fittings for POLO-KAL NG and POLO-KAL NG Vacuum

Dimensions in mm

POLO-KAL NG Bend PKB
with factory-fitted lip ring

	DN/OD	Z1	Z2	R	L	kg/pc.	A. no.
15°	40	7	8	21	51	0.04	02110
	50	7	8	27	56	0.05	02120
	75	9	10	40	64	0.12	02130
	90	13	8	47	73	0.16	02170
	110	13	13	57	80	0.26	02140
	125	12	13	90	85	0.36	02150
	160	36	16	115	121	0.72	02160
	200	13	23	120	131	1.56	02960
30°	40	10	11	21	54	0.04	02111
	50	11	12	27	60	0.06	02121
	75	15	15	40	70	0.12	02131
	90	13	19	47	72	0.17	02171
	110	21	20	58	88	0.28	02141
	125	20	22	90	93	0.39	02151
	160	25	28	115	133	0.80	02161
	200	48	37	120	144	1.70	02962
45°	40	13	14	21	57	0.04	02112
	50	15	16	27	63	0.06	02122
	75	21	21	40	75	0.15	02132
	90	26	20	47	85	0.19	02172
	110	49	29	57	116	0.36	02142
	125	50	31	90	124	0.43	02152
	160	60	41	115	145	0.78	02162
	200	66	52	120	183	1.85	02963
67.5°	40	18	19	21	62	0.05	02113
	50	22	22	27	70	0.06	02123
	75	31	31	40	86	0.13	02133
	90	33	27	47	92	0.21	02173
	110	44	44	58	111	0.33	02143
	125	46	48	90	119	0.49	02153
	160	59	62	115	144	0.90	02163
87.5°	40	24	25	21	68	0.05	02114
	50	29	30	27	78	0.07	02124
	75	42	42	40	97	0.15	02134
	90	50	42	47	109	0.22	02174
	110	60	60	58	128	0.37	02144
	125	64	66	90	138	0.53	02154
	160	84	87	115	169	0.98	02164
	200	106	115	125	230	2.36	02965

Subject to technical alterations

PRODUCT RANGE

Dimensions in mm

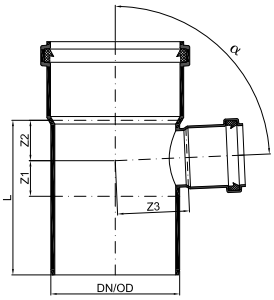
POLO-KAL NG Branch PKEA
with factory-fitted lip ring

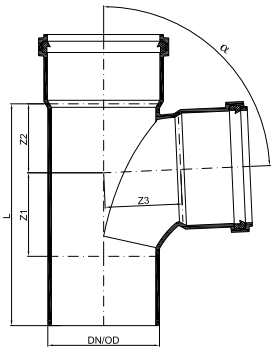
	DN/OD	Z1	Z2	Z3	L	kg/pc.	A. no.
45°	40/40	13	54	54	111	0.08	02206
	50/40	8	59	61	115	0.10	02212
	50/50	15	66	66	129	0.11	02215
	50/50	22	68	71	229	0.13	01516
	75/50	3	80	84	138	0.20	02218
	75/75	21	98	98	173	0.28	02221
	90/50	–2	84	92	142	0.26	02210
	90/75	14	114	117	187	0.35	02834
	90/90	25	112	112	196	0.40	02211
	110/40	–14	92	106	145	0.35	02204
	110/50	–13	99	109	153	0.38	02224
	110/75	5	117	123	189	0.48	02227
	110/90	19	132	135	218	0.55	02839
	110/110	47	144	144	259	0.67	02230
	125/75	12	130	139	215	0.66	02233
	125/90	28	161	183	262	1.02	02843
	125/110	40	161	154	274	0.86	02236
	125/125	50	161	160	284	0.96	02239
	160/90	29	174	184	288	1.43	02840
	160/110	29	174	184	287	1.26	02242
	160/125	34	198	201	309	1.58	02240
	160/160	59	209	209	353	1.83	02245
	200/160	41	229	253	388	3.23	02971
	200/200	59	240	240	423	4.00	02973
67.5°	40/40	18	35	35	97	0.08	02207
	50/40	16	36	40	101	0.09	02213
	50/50	22	42	42	112	0.10	02216
	75/50	17	49	56	121	0.18	02219
	75/75	52	88	85	193	0.29	02222
	90/50	14	69	71	143	0.40	02835
	90/75	100	88	84	247	0.38	02832
	90/90	36	77	76	172	0.35	02831
	110/50	11	57	40	136	0.36	02225
	110/75	25	71	82	163	0.43	02228
	110/90	46	103	107	216	0.58	02837
	110/110	44	93	92	203	0.58	02231
	125/90	75	104	105	248	0.79	02844
	125/110	63	116	117	248	0.73	02237
	160/90	56	111	126	243	1.11	02841
	160/110	53	121	135	251	1.17	02243

PRODUCT RANGE

Dimensions in mm

POLO-KAL NG Branch
PKEA 87.5°
with factory-fitted lip ring





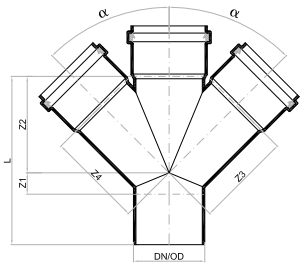
* swept entry branch

DN/OD	Z1	Z2	Z3	L	kg/pc.	A. no.
40/40	24	25	25	94	0.07	02208
50/40	24	25	30	98	0.09	02214
50/50	29	30	30	108	0.10	02217
75/50	30	32	43	117	0.18	02220
75/50	189	43	52	299	0.30	01513
75/75	42	45	45	142	0.23	02223
90/50	29	35	52	123	0.23	02830
90/75	47	49	50	156	0.34	02833
90/90*	70	59	64	189	0.29	02248
110/50	30	34	61	132	0.34	02226
110/75	43	48	63	158	0.42	02229
110/90	19	132	135	218	0.47	02836
110/110*	82	88	76	219	0.58	02232
125/75	96	83	84	249	0.63	02235
125/90	75	65	83	214	0.86	02845
125/110	67	76	75	216	0.71	02238
125/125	65	76	75	215	0.76	02241
160/90	81	95	135	261	1.89	02842
160/110	81	95	107	261	1.21	02244
160/125	78	97	103	251	1.28	02246
160/160	115	118	118	310	1.72	02247
200/160	112	127	134	361	2.90	02972
200/200	140	127	126	388	3.80	02974

PRODUCT RANGE

Dimensions in mm

POLO-KAL NG
Double branch PKDA
with factory-fitted lip ring

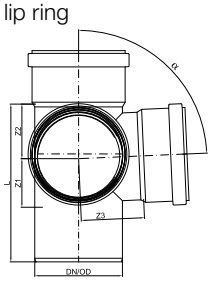


	DN/OD	Z1	Z2	Z3	Z4	L	kg/pc.	A. no.
45°/180°	50/50/50	16	65	72	65	181	0.14	01512
	50/50/50	22	68	71	71	229	0.16	01517
	75/50/50	6	83	84	84	142	0.25	02295
	75/75/75	23	101	100	100	177	0.37	02396
	110/50/50	–8	97	107	107	156	0.42	02258
	110/75/75	9	111	125	114	257	0.53	02398
	110/110/110	29	147	145	145	243	0.89	02259
	125/110/110	32	165	158	158	266	1.10	02234
	160/110/110	9	183	188	188	269	1.48	02399
	160/160/160	58	212	212	212	355	2.53	01514
67.5°/180°	50/50/50	18	39	39	39	106	0.10	02849
	90/50/50	16	59	74	74	144	0.33	02848
	90/90/90	36	77	77	77	173	0.44	02846
	110/50/50	14	57	78	78	139	0.38	02260
	110/75/75	25	72	82	82	163	0.50	02263
	110/110/110	44	95	96	96	206	0.74	02261
	125/110/110	48	101	104	104	218	0.88	02262
	160/110/110	73	127	133	133	268	1.37	02264
87.5°/180°	50/50/50	27	30	31	31	108	0.14	01515
	75/50/50	50	44	55	55	147	0.23	01519
	75/50/50	191	44	56	56	289	0.34	01520
	75/75/75	40	44	46	49	141	0.29	02265
	90/90/90	49	59	59	59	168	0.44	02847
	110/50/50	31	37	69	69	135	0.38	02255
	110/75/75	44	50	66	66	160	0.48	02269
	110/110/110	69	69	96	96	196	0.64	02267
	125/110/110	69	78	81	81	216	0.86	02272
	160/110/110	92	100	115	115	269	1.37	02274

PRODUCT RANGE

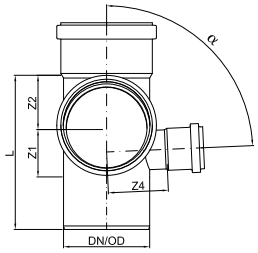
Dimensions in mm

POLO-KAL NG Double corner branch PKEDA
with factory-fitted lip ring



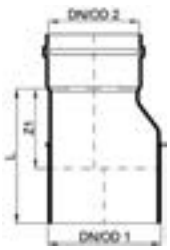
	DN/OD	Z1	Z2	Z3	Z4	L	kg/pc.	A. no.
45°/90°	75/50/50	3	79	84	84	138	0.25	01526
	110/50/50	-15	85	110	110	153	0.42	01530
	110/75/75	3	116	123	123	189	0.58	01531
	160/110/110	19	175	184	184	282	1.57	01535
87.5°/90°	50/50/50	27	30	31	31	108	0.14	01537
	75/50/50	52	44	55	55	149	0.24	01546
	75/50/50	191	43	55	55	288	0.34	01545
	75/75/75	40	44	47	47	141	0.31	02297
	90/90/90	52	60	57	68	167	0.43	02829
	110/50/50	50	35	63	63	153	0.38	01540
	110/75/75	41	47	63	67	157	0.48	01541
	110/110/110	61	68	68	79	198	0.66	02275
	110/L110/R75	62	69	57	69	198	0.60	02277
	110/L75/R110	62	69	69	71	198	0.60	02279
	125/110/110	67	76	83	75	216	0.86	02276
	160/110/110	81	95	107	106	261	1.36	02278
	160/160/160	120	109	109	109	314	2.12	01543
87.5°/135°	75/50/50	191	43	55	55	288	0.34	01544

POLO-KAL NG Double corner branch level PKEDA
with factory-fitted lip ring



	DN/OD	Z1	Z2	Z3	Z4	L	kg/pc.	A. no.
87.5°	90/90/50	70	58	64	64	189	0.41	02826
	90/50/90	70	58	64	64	189	0.41	02827
	110/110/50	83	66	67	77	217	0.61	02291
	110/50/110	83	66	67	77	217	0.61	02838

POLO-KAL NG Reducer PKR
with factory-fitted lip ring



DN/OD1	DN/OD2	Z1	L	kg/pc.	A. no.
50	40	20	65	0.05	02282
75	50	31	79	0.09	02283
90	40	95	203	0.16	01511
90	50	34	90	0.13	02885
90	75	19	76	0.14	02886
110	50	47	113	0.19	02284
110	75	32	99	0.20	02285
110	90	26	88	0.21	02887
125	110	18	92	0.31	02286
160	110	39	124	0.51	02287
160	125	32	117	0.54	02288
200	160	47	171	1.31	02981

Subject to technical alterations

PRODUCT RANGE

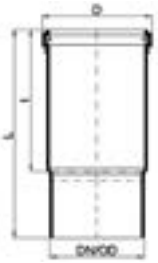
Dimensions in mm

POLO-KAL NG Reducer for Vacuum breaker

DN/OD1	DN/OD2	L1	L2	kg/pc.	A. no.
75	40	57	940	0.35	01510

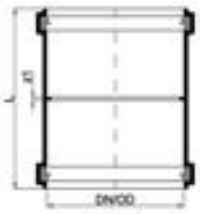
POLO-KAL NG Long sleeve PKL
with factory-fitted double lip ring

DN/OD	L	D	t	kg/pc.	A. no.
40	158	53	107	0.06	02331
50	174	63	119	0.07	02332
75	198	89	136	0.18	02333
90	212	105	143	0.23	02338
110	243	127	165	0.37	02334
125	316	144	187	0.63	02335
160	328	182	215	1.02	02336
200	502	229	280	2.77	02339



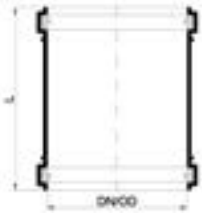
POLO-KAL NG Double socket PKD
with factory-fitted lip ring

DN/OD	L	Z1	kg/pc.	A. no.
40	96	2	0.07	02301
50	104	2	0.06	02302
75	118	2	0.13	02303
90	127	2	0.17	02307
110	145	3	0.28	02304
125	157	4	0.40	02305
160	180	4	0.69	02306
200	240	4	1.53	02986



POLO-KAL NG Sleeve socket PKU
with factory-fitted double lip ring

DN/OD	L	kg/pc.	A. no.
40	96	0.05	02311
50	104	0.06	02312
75	118	0.13	02313
90	127	0.17	02319
110	145	0.28	02314
125	157	0.39	02315
160	180	0.68	02316
200	240	1.50	02984



Subject to technical alterations

PRODUCT RANGE

Dimensions in mm

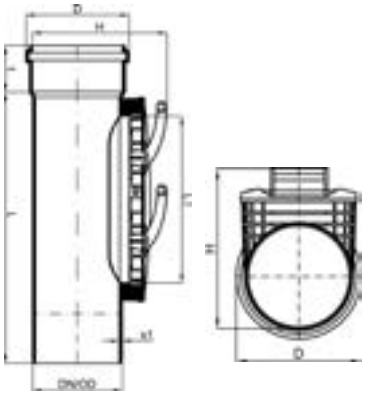
POLO-KAL NG Socket plug PKM

DN/OD	L	kg/pc.	A. no.
40	40	0.02	02321
50	44	0.02	02322
75	51	0.06	02323
90	55	0.08	02327
110	62	0.14	02324
125	81	0.19	02325
160	92	0.36	02326
200	122	0.85	02990

POLO-KAL NG Cleanout pipe

Branch with socket plug secured with POLO-KAL NG ASV see section 3.8.

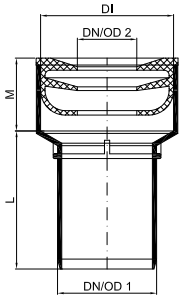
POLO-EHP control in blue for POLO-KAL NG PKEHP



DN/OD	L	s1(min)	t	D	H	L1	kg/pc.	A. no.
110	468	3.6	65	129	196	301	2.3	01900
125	474	4.0	73	146	222	301	2.5	01901
160	488	5.1	84	185	251	301	3.2	01902
200	518	7.0	120	231	295	301	4.6	01903

POLO-KAL NG Siphon fitting PKS

with push-fit seal*



DN/OD1	DN/OD2		L	M	DI	kg/pc.	A. no.
32	5/4"	32 mm	54	32	46	0.05	02350
40	5/4"	40 mm	54	32	46	0.05	02351
40	6/4"	40 mm	54	32	46	0.04	02352
50	5/4"	32 mm	48	38	46	0.05	02353
50	6/4"	40 mm	48	38	46	0.04	02354
50	2"	50 mm	60	29	67	0.08	02355

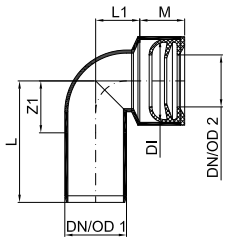
* Push-fit seal provided, unassembled

Subject to technical alterations

PRODUCT RANGE

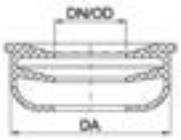
Dimensions in mm

POLO-KAL NG
Siphon bend PKSW
with push-fit seal*



DN/OD1	DN/OD2		L	Z1	L1	M	DI	kg/pc.	A. no.
32	5/4"	32 mm	76	36	27	31	46	0.05	02360
40	5/4"	32 mm	79	34	28	31	46	0.06	02361
40	6/4"	40 mm	79	34	29	29	46	0.05	02362
50	5/4"	32 mm	88	41	30	30	46	0.07	02363
50	6/4"	40 mm	88	41	34	26	46	0.06	02364
50	2"	50 mm	89	42	35	29	67	0.09	02365

POLO-KAL NG Push-fit seal PKNI



DN/OD		DA	kg/pc.	A. no.
5/4"	32 mm	47	0.02	01552 new
5/4"	32 mm	54	0.04	02378 old
6/4"	40 mm	47	0.01	01553 new
6/4"	40 mm	54	0.03	02379 old
2"	50 mm	67	0.04	02380

POLO-KAL NG Replacement lip ring EPDM
PKLI

DN/OD	kg/pc.	A. no.
40	0.01	02751
50	0.01	02752
75	0.01	02753
90	0.01	02754
110	0.02	02755
125	0.02	02756
160	0.05	02757
200	0.07	02937

POLO-KAL NG lip ring NBR
PKNL
oil and grease resistant, impervious to radon

DN/OD	kg/pc.	A. no.
50	0.00	00149
75	0.01	00150
90	0.01	00151
110	0.02	00152
125	0.03	00153
160	0.05	00154
200	0.07	00155

POLO-KAL NG Replacement double lip ring SBR
PKDL
for slip-on sleeve

DN/OD	kg/pc.	A. no.
75	0.01	02942
90	0.01	02946
110	0.02	02943
125	0.03	02944
160	0.04	02945
200	0.07	02947

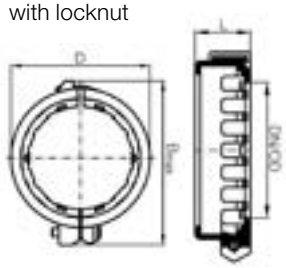
* Push-fit seal provided, unassembled

Subject to technical alterations

PRODUCT RANGE

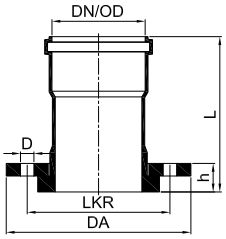
Dimensions in mm

POLO-KAL NG ASV
with locknut



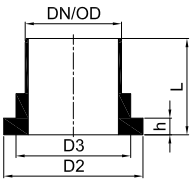
DN/OD	L	D	B-max	Max admissible extraction force in kg	Max admissible pressure load in bar	kg/pc.	A. no.
40	24	61	73	100	2.5	0.04	01561
50	28	76	92	100	2.5	0.05	01562
75	30	99	116	130	2.5	0.06	01563
90	32	115	132	130	2.0	0.11	01564
110	37	138	153	180	2.0	0.15	01565
125	39	158	196	440	2.0	0.23	01566
160	43	197	234	550	2.0	0.30	01567
200	67	243	281	650	1.5	0.53	01568

POLO-KAL NG
flange piece
with socket and flange compatible to gasket acc. EN 1514-1



	DN/OD	L	LKR	DA	D	h	No. Holes	DN/OD flange	kg/pc.	A. no.
PN 6	40	160	100	130	14	26	4	40	1.59	01497
	50	165	110	140	14	29	4	50	1.74	01498
	75	180	130	160	14	32	4	65	2.23	01499
	90	185	150	190	18	35	4	80	3.36	01500
	110	195	170	210	18	36	4	100	3.75	01501
	125	230	200	240	18	36	8	125	4.55	01476
	160	250	225	265	18	38	8	150	5.44	01502
PN 16	40	160	100	140	18	28	4	32	0.88	01503
	50	165	110	150	18	32	4	40	0.97	01504
	75	180	145	185	18	36	4	65	1.38	01505
	90	185	160	200	18	39	8	80	1.62	01506
	110	195	180	220	18	42	8	100	1.90	01507
	160	250	240	285	22	52	8	150	4.50	01508

POLO-KAL NG
flange sleeve
with spigot compatible to gasket acc. EN 1514-1, compatible to flange acc. EN 1092-1, type 4



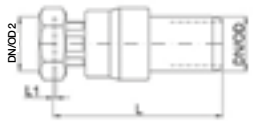
	DN/OD	D2	D3	L	h	DN/OD flange	kg/pc.	A. no.
PN 6	40	79	50	90	10	40	0.13	01485
	50	88	61	90	13	50	0.15	01486
	75	110	91	110	16	65	0.26	01487
	90	125	96	110	17	80	0.30	01488
	110	145	116	125	18	100	0.38	01489
	160	200	166	185	18	150	0.60	01490
	200	255	224	245	32	200	1.56	01482
PN 16	40	79	50	90	10	32	0.13	01491
	50	88	61	90	13	40	0.15	01492
	75	122	91	110	16	65	0.26	01493
	90	139	107	110	17	80	0.30	01494
	110	157	131	125	18	100	0.38	01495
	160	213	175	165	18	150	0.60	01496
	200	268	232	205	32	200	1.56	01484

Subject to technical alterations

PRODUCT RANGE

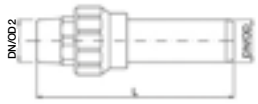
Dimensions in mm

POLO-KAL NG Adaptor union
with external screw thread, with long spigot



DN/OD	DN/OD 2	L	kg/pc.	A. no.
32	1"	194	0.29	01733
40	1 1/4"	189	0.45	01735
50	1 1/2"	189	0.51	01736

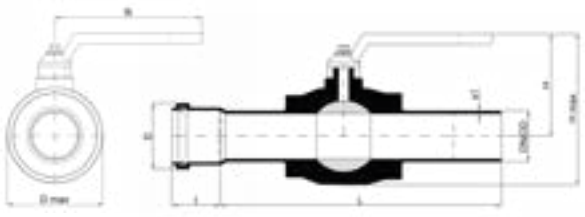
POLO-KAL NG Adaptor union
with screw nut, with long spigot



DN/OD	DN/OD 2	L	kg/pc.	A. no.
32	1"	184	0.22	01732
40	1 1/4"	125	0.33	01734
50	1 1/2"	179	0.45	01737

POLO-KAL NG Vacuum ball valve

DN/OD	D	D max	L	R	t	s1	kg/pc.	A. no.
32	41	58	277	100	41	1.8	–	03641
50*	65	95	277	146	47	2.7	0.90	03643
75	89	125	277	146	53	3.4	1.68	03644



*consistant cross section

Subject to technical alterations

3.1 General information

3.1.1 Couplings

3.1.1.1 Lubricant specification

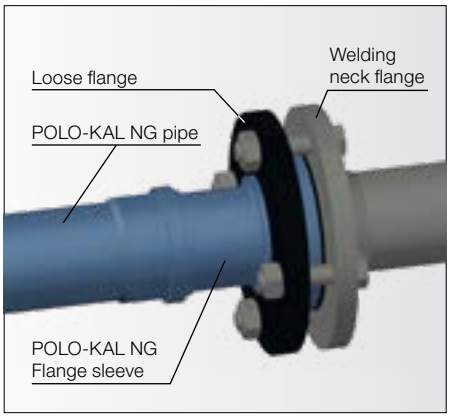
POLOPLAST lubricant is only designed for POLOPLAST products and must not be used for stainless steel or any other steel pipe connections.

3.1.1.2 Coupling PP pipes

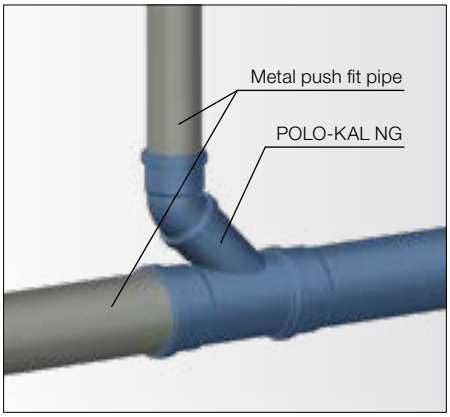
The POLO-KAL NG is a demountable and re-usable push-fit pipe system.
When setting up the plug connection make sure to always use an appropriate lubricant.

3.1.1.3 Coupling PP pipes to flanged fittings or components

Flanged couplings are used for coupling of PP with:
- Pipes of different material
- Valves or other flanged fittings
- PP pipes where needed for installation requirements.



By means of POLO-KAL NG Flange sleeve and loose flange. Suitable for coupling of POLOKAL NG pipe system and pipe systems of different materials.



The POLO-KAL NG Pipe system can be coupled to metallic push-fit pipe systems which have the same outer diameter.

3.1.1.4 Coupling PP pipes and threaded accessories

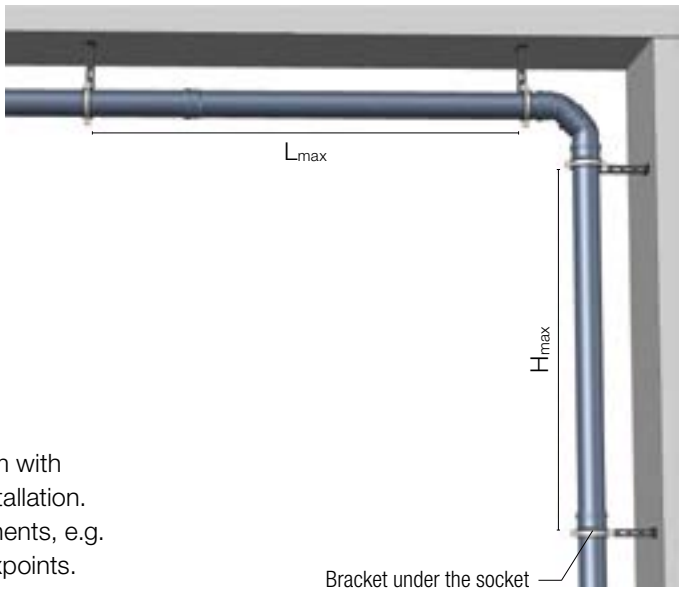
In some cases it is necessary to couple PP pipe elements to threaded accessories.
Adapters are available in the dimension DN 40 and DN 50 with a male or a female thread.

3.2 Fastening

3.2.1 Maximum distance between brackets

To maintain sagging within the limits of applicable standard (EN 1451-1 and EN 1055) the following maximum distance between fastening points are recommended for POLO-KAL NG and POLO-KAL NG Vacuum.

Nominal outer diameter DN/OD	Distance between fixed brackets	
	Horizontal pipe routing L_{max}	Vertical pipe routing H_{max}
40 mm	0.90 m	1.40 m
50 mm	1.00 m	1.80 m
75 mm	1.40 m	2.70 m
90 mm	1.55 m	2.70 m
110 mm	1.80 m	2.70 m
125 mm	1.90 m	2.70 m
160 mm	2.00 m	2.70 m
200 mm	2.40 m	2.70 m

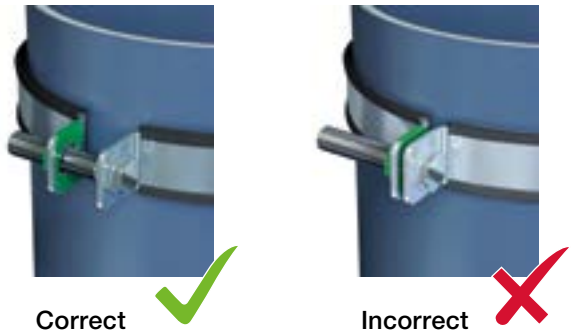


To avoid the sinking of vertical pipes fasten them with brackets under the socket immediately after installation. Directly besides heavy fittings and pipe components, e.g. flange piece or valves, there must be suitable fixpoints.

3.2.2 Brackets

Customary galvanized steel brackets with rubber insert can be used. Be sure that the brackets and the cantilever can withstand any forces which may occur. All brackets are fix-brackets, so no sliding between the pipe and the bracket is allowed. It is important to not deform the pipes when tightening the brackets.

The following additional points must be observed during the professional installation of pipes using brackets with variable diameter: **Due to the span tolerance (e.g. 108–114 mm in the case of Bismat 2000, DN 110) the fixed bracket must not be fully tightened!** This represents an installation flaw, which – amongst other things – leads to a significant increase of flow noise transmission to adjacent rooms.



3.3 Installation guideline

1. Use brackets to hold the weight of the pipe. To avoid sagging of the pipe the distance between the fix-brackets must not exceed the distances which are defined in section 3.2.1.

2. To avoid pull out of the push-fit connection, the fixing system has to be designed to absorb ship hull vibrations, axial forces due to unexpected inside pressure or due axial impulse caused from vacuum discharge. Fix the push-fit system with the support of brackets to a wall or rigid elements. It is recommended to use brackets before and after each change in direction.

3. During the construction each pipe section must be checked with a pressure test (water with max 1.5 bar) to ensure the tightness of the pipeline and the quality of the fixing system. If parts of installation can't be fixed by brackets, POLO-KAL NG ASV is to be used. The pressure test should be made for each deck separate.

4. To secure socket plugs against pull out, POLO-KAL NG ASV collar is to be used.

5. For vacuum discharge, it is recommended to use the POLO-KAL NG ASV at every push-fit connection. In case of straight lines without change in direction between two brackets, no POLO-KAL NG ASV is necessarily needed. In the case of directional change of the pipe line every socket between the fixing points has to be secured with POLO-KAL NG ASV collar.

3.4 Transport and storage

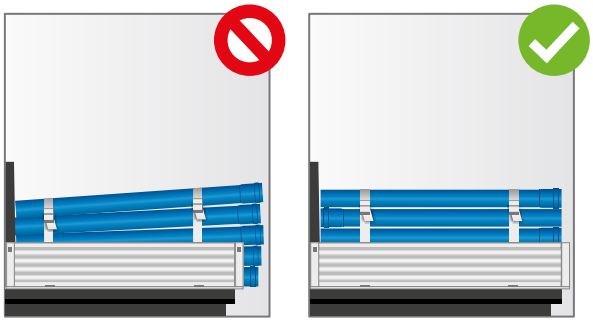
Take care that no damage occurs during transportation when loading pipes and fittings.

During transportation the pipes should rest on top of each other at full length (when no longer in the original packing) to avoid sagging. The sleeves have to be placed offset. Avoid sudden and abrupt stresses on pipes and fittings, especially concerning temperatures around and below 0 °C.

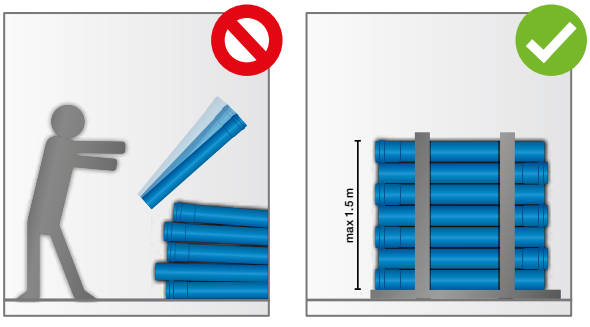
Storage temperature down to –20 °C possible
Installation temperature –5 °C to 40 °C

The outdoor storage under direct sunlight of pipes (with pre-installed gasket) has to be limited to 24 months from the date of production. Fittings must not be exposed to direct sunlight for a period greater than 6 months. Such exposure can lead to discoloration but technical performance won‘t be affected.

The pipes have to be stored on smooth, flat surfaces.



Loading and transportation



Unloading

3.5 Cutting to length and bevelling

3.5.1 Cutting to length

Pipes must be cut to length at right angles to the pipe‘s axis, and can be cut to the required installation length using the following tools:

- Suitable pipe cutter
- Angle grinder
- Fine-toothed saw

The cut edges must be cleanly trimmed with a pipe scraping tool or a knife.

Fittings may not be shortened!

Cutting to length with a cutting and chamfering tool like this product from the company Rothenberger: ROCUT® 110/160

Cutting to length with fine-toothed saw

3.5.2 Bevelling

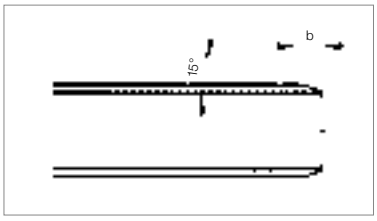
Expert bevelling is essential for connections with double lip ring seals (e.g. when slip-on or long sleeves are used).

Bevelling of the shortened pipe is necessary when using pipes with a factory installed lip ring, in order to establish a connection quickly and safely.

When not using a cutting and chamfering tool for plastic pipes, the bevelling of the pipe ends can be effected using a suitable chamfering tool or coarse-cut file at an angle under approx. 15° according to the following table:

DN	40	50	75	90	110	125	160	200
b ca. mm	4	4	4	5	6	6	7	8

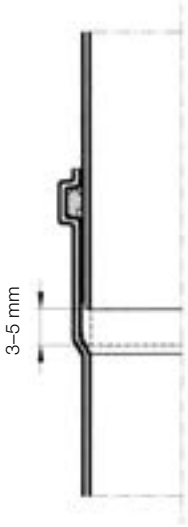
Bevelling with a bevelling tool



Bevelling at an angle of approx. 15°

3.6 Establishing the push-fit connection

- Before assembling, check the pipes, fittings and gasket for damage.
- Check the position and the intactness of the lip ring in the socket flange. Clean lip ring seal if necessary.
- Clean the push-in ends of the pipe and fitting.
- Apply a thin, even coat of POLOPLAST lubricant over the push-in ends.
- Slide push-in end in, turning slightly, until sleeve base is reached.
- Push-in end of pipes has to be retract from the socket by 3 to 5 mm. It will be helpful to mark the pipe at the socket edge with a felt pen.
- Connections between fittings can remain fully inserted.
- If using the extraction-proof connection POLO-KAL NG ASV, also fittings have to be retracted from the push-fit connection by 5 mm.



3.7 POLO-KAL NG ASV – Extraction-proof connection

3.7.1 Fields of application

In combination with the POLO-KAL NG ASV extraction-proof connection, POLO-KAL NG, which has been approved as pressureless building drainage system, allows the absorption of intermittent dynamic strain, caused by excess pressure, low pressure, and/or vibration.
POLO-KAL NG ASV is approved to be used exclusively in combination with the POLO-KAL NG and POLO-KAL NG Vacuum pipe system.

The POLO-KAL NG ASV extraction-proof connection opens up new fields of application for the POLO-KAL NG pipe system:

- **As vacuum pipe system** using POLO-KAL NG Vacuum pipes of the dimensions DN/OD 40 to DN/OD 75.

- **As pressure line for water raising systems** using POLO-KAL NG pipes and bends of the dimensions DN/OD 40 to DN/OD 90. Maximum pressure surges must be established in advance through communication with the equipment manufacturer and must be taken into consideration with regard to the maximum admissible pressure load.

- **For interior downpipes** to ensure safety conforming to standards in the case of a backwater level of up to 20 m.

- **To secure socket plugs.** Prior to the assembly of the POLO-KAL NG ASV, the plug must be pulled out of the socket by 10 mm.

- **To secure against the elements sliding apart** due to mechanical loads and vibrations.

3.7.2 Assembly of POLO-KAL NG ASV DN/OD 40–200 mm

Before fitting the POLO-KAL NG ASV over the socket, disassemble it.

Fit the half shells together over the socket connection.

Now tighten the screw. The maximum admissible torque is 7 Nm. Fittings in the dimensions DN/OD 40–90 must be pulled apart by 5 mm before the POLO-KAL NG ASV is installed.

Brackets with dimensions equalling DN/OD 90 or larger are equipped with 2 screws. The maximum admissible torque is 7 Nm.

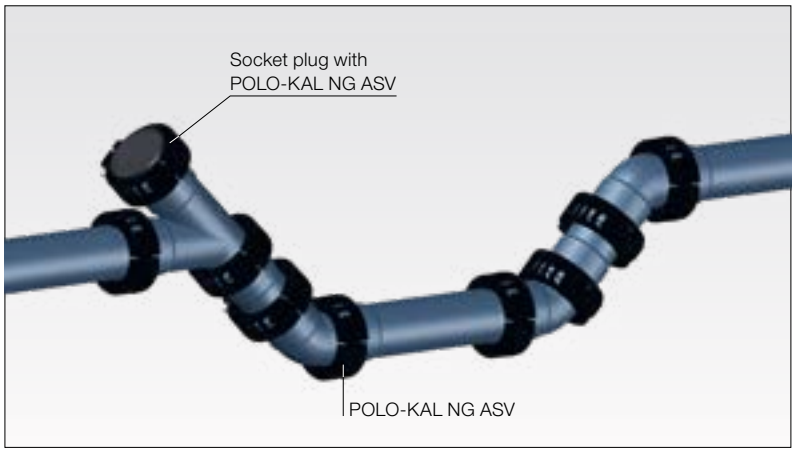
3.8 Assembling of the cleaning pipe

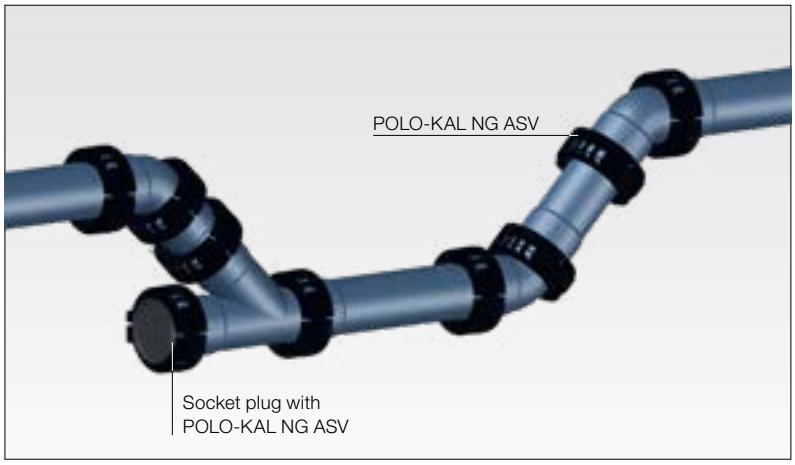
The cleaning pipe consists of three parts which are delivered separately and have to be assembled locally.

Part 1: Single branch 45°
Part 2: Socket plug
Part 3: POLO-KAL NG ASV

Insert the socket plug into the branch and pull it 1 cm back. Mount the connection with POLO-KAL NG ASV. Ensure that the claws of the POLO-KAL NG ASV are located on the spigot but just after the top cover of the socket plug.

3.9 Assembling of transport pockets





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