

SYSTEMS FOR OUTER SEWAGE PVC AND PP



ecological solutions

ISO 14001

ISO 9001





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Intended use

Sewage pipes made of PVC-U are intended for following applications:

- In burial non-pressure drainage and sewage systems laid in soil of right-of-ways (under the roadways or out of it) or in other areas used for motor traffic engineering;
- For making protections for other cables and for penetration sleeves through road embankments;
- For dewatering bridge structures built along the road routes.

Pipes in versions with extended bell can be used in the areas of mining damages.

Standards, approvals

PN-EN 1401-1:2009 Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U). Part 1: Specifications for pipes, fittings and the system

PN-EN 476:2011 General requirements for components used in drains and sewers

PN-EN 681-1:2002/A3:2006 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1: Rubber

PN-EN 681-2:2003/A2:2006 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 2: Thermoplastic elastomers

Technical Approval **AT-15-7558/2012** Pipe and fittings KACZMAREK made of PVC-U with solid wall and laminated wall for outer non-pressure sewage systems, issued on 14 February 2008 by Building Research Institute in Warsaw;

Technical Approval **AT/2009-03-0530** Pipes and fittings KACZMAREK made of unplasticized poly(vinyl chloride) (PVC-U) with solid walls and structural walls (with foam and non-foam cores) for non-pressure sewage and drainage systems, issued in 2009 by Road and Bridge Research Institute.

Technical Opinion of GIG (Central Mining Institute) on the possibilities of the use of sewage pipes and fittings made of PVC-U with solid walls in the areas with mining effects issued on 30 June 2008 by the Central Mining Institute in Katowice.

Method of manufacture

Pipes for outer sewage systems are produced of PVC-U in the process of extrusion moulding, are of solid homogeneous construction in an entire profile of the pipe of smooth outer and inner surfaces of the wall.

During the process of manufacturing, at the end of pipe a bell/socket with a groove to insert an elastomeric seal is formed.

Durability

Unplasticized poly(vinyl chloride (PVC-U) is a highly resistant plastics to chemical compounds. A system of pipes and fittings made of PCV-U together with seals is resistant to the effect of wastewaters of pH = 2 (acids) up to pH = 12 (bases), to corrosion induced the effect of municipal wastewaters, rainwaters, surface waters and groundwaters. The information on the resistance of PVC to chemicals is defined in the Guidelines ISO/TR 10358, and of elastomeric seals - in ISO/TR 7620.

Sewage system made of PVC-U with seals is resistant to the wastewater maximum permanent temperature of more +40° C do +60° C, depending on pipe diameter, wall thickness and the method of pipeline laying out. Pipes and fittings are abrasion resistant. In the individual cases, the abrasibility can be tested in accordance with a method described in PN-EN 295-3.

Advantages of pipes and fittings made of PVC-U:

- The one of significant features of sewage system made of PVC-U pipes - including the facilities related with their structure - is to achieve a full tightness of the whole sewage system in a scope of both ex-filtration of wastewaters into soil (natural environment protection) and in-filtration groundwaters into sewage pipelines (the economic structure and the use of wastewater treatment plants);
 - High smoothness of the inner pipe surface that provides a key feature of the lack of deposits inside the pipes (there is no effect of decreasing of actual operating diameter of the pipeline);
 - the use of minimal of pipe drops;
 - no clogging pipelines;
 - lowering hydraulic resistance of wastewater flow;
 - High resistance to abrasion;
 - High resistance against the effects of chemicals;
 - Wide range of pipes of suitable stiffness (SN2, SN4, SN8, SN12, SN16) as a function of operation load soil conditions,
 - The application in communication engineering;
 - Total resistance of pipe surfaces against corrosion, i.e. a destructive effect of groundwater, therefore, the pipes do not require the use of protective coverings;
 - High chemical resistance to substances within the range of pH 2-12;
 - A substantial reduction in weight of PVC-U pipes with reference to stoneware, concrete and cast iron pipes (6m long PVC-U pipes of dia. 315 mm can be handles and installed manually by two workers);
- With a relatively low weight of PVC-U pipes and their lengths as well as with a type of joints a considerable reduction in transport costs is related to;
- The pipes are easy to lay out and install with no specialised equipment;
- No necessity to use air crane equipment;
- Lowering labour intensity of the erection works, therefore shorter installation times, lower costs of pumping groundwater etc.;
- Able to use in the areas of mining damages of 1 up to 4 category;
 - Marking pipe insides;
 - High durability of systems (more than 100 years).

Quality control

All types of offered pipes elements are laboratory tested for mechanical strength, water tightness as well as static and dynamic resistance. A strict quality supervision of our products is provided by the quality management system implemented in KACZMAREK Company that is based on the standard EN ISO 9001.



Technical characteristics

The system of PVC-U sewage pipes is manufactured within the scope of diameters DN/OD110 – 500 mm and in stiffness classes: SN2; SN4; SN8. SN12; SN16; Pipes for outer sewage systems are of orange-brown colour (RAL 8023) of the same shade and colour intensity, of a smooth outer and inner pipe surfaces. All types of sewage pipes and fittings are coupled with themselves and with smooth-wall pipes by bells with a groove and an elastomeric o-ring seal placed inside it.

Standard pipe bell

- With the elastomer SBR seal of type BL;
- With oil-resistant seal made of NBR elastomer of type BL.



Standard pipe bell

- With DIN-Lock seal
- Depending on the field of application and Investor's preferences, pipes may be equipped with seals with an additional stabilising o-ring. The construction of this type seals protects them against putting out of the pipe bell while coupling pipes. Besides, they are characterised of increased tightness under both over- and subpressure (seal of type: DIN-Lock or System-SK).



Extended pipe bell of type WK

- With the elastomer SBR seal of type BL;
- Pipe Bells can be extended when they are to be used in the areas of potential mining damages. The pipes can be used in the areas of mining damages when the following conditions are met:
- In pipe stiffness >SN 8 from 1 to 4 category of mining damages;
 - In pipe stiffness class >SN 4 from 1 to 3 category of mining damages.



Marking inside the pipes

Solid PVC pipes in a scope of diameters 200 to 500 mm for sewage systems are also marked inside, which allows identifying the pipes also during TV inspection. The inside inscription contains: =KACZMAREK; pipe diameter x wall thickness; material PVC-U; stiffness SN; pipe type e.g.: LITA (SOLID); intended use e.g.: mine damages=

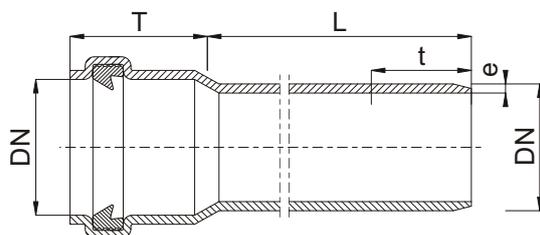
DN/OD	Normal bell standard seal					Seal DIN-Lock	Extended bell standard seal	
	SN 2	SN 4	SN 8	SN 12	SN 16	SN 8	SN 8	SN 12
110			x	x	x	x		
160	x	x	x	x	x	x	x	x
200	x	x	x	x	x	x	x	x
250	x	x	x	x	x	x	x	x
315	x	x	x	x	x	x	x	x
400	x	x	x	x	x	x	x	x
500	x	x	x	x	x	x	x	x

Detailed recommendations for the selection of pipe having suitable ring stiffness are contained in standard PN-ENV 1046. Ring stiffness marked acc. to PN-EN ISO 9969.

PVC pipes for outer sewage systems

SN 2; SDR 51

with seal



DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
160	3,2	500	74	74	1,5	032311L050
160	3,2	1000	74	74	2,7	032311L100
160	3,2	2000	74	74	5,0	032311L200
160	3,2	3000	74	74	7,4	032311L300
160	3,2	6000	74	74	14,5	032311L600
200	3,9	1000	90	90	4,1	032511L100
200	3,9	2000	90	90	7,8	032511L200
200	3,9	3000	90	90	11,4	032511L300
200	3,9	6000	90	90	22,2	032511L600
250	4,9	3000	125	125	18,1	032711L300
250	4,9	6000	125	125	35,2	032711L600
315	6,2	3000	158	158	29,1	032911L300
315	6,2	6000	158	158	56,3	032911L600
400	7,9	3000	178	178	49,0	033111L300
400	7,9	6000	178	178	93,0	033111L600
500	9,8	3000	340	340	78,3	033311L300
500	9,8	6000	340	340	147,5	033311L600

PVC pipes for outer sewage systems

SN 4; SDR 41

with seal

DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
160	4,0	500	74	74	1,8	032321L050
160	4,0	1000	74	74	3,3	032321L100
160	4,0	2000	74	74	6,3	032321L200
160	4,0	3000	74	74	9,2	032321L300
160	4,0	6000	74	74	18,1	032321L600
200	4,9	1000	90	90	5,2	032521L100
200	4,9	2000	90	90	9,7	032521L200
200	4,9	3000	90	90	14,2	032521L300
200	4,9	6000	90	90	27,8	032521L600
250	6,2	2000	125	125	15,6	032721L200
250	6,2	3000	125	125	22,8	032721L300
250	6,2	6000	125	125	44,2	032721L600
315	7,7	2000	158	158	24,8	032921L200
315	7,7	3000	158	158	36,0	032921L300
315	7,7	6000	158	158	69,6	032921L600
400	9,8	2000	178	178	42,4	033121L200
400	9,8	3000	178	178	60,5	033121L300
400	9,8	6000	178	178	114,8	033121L600
500	12,3	2000	340	340	69,3	033321L200
500	12,3	3000	340	340	97,7	033321L300
500	12,3	6000	340	340	182,9	033321L600

PVC pipes for outer sewage systems

SN 8; SDR 34

with seal

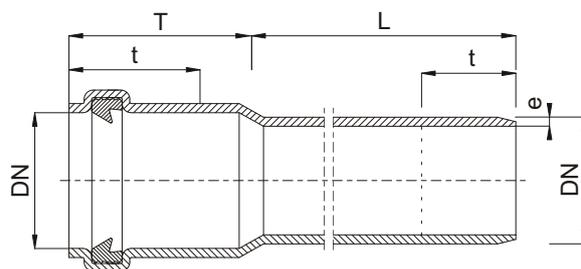
DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
110	3,2	500	58	58	1,0	032041L050
110	3,2	1000	58	58	1,8	032041L100
110	3,2	2000	58	58	3,4	032041L200
110	3,2	3000	58	58	5,0	032041L300
110	3,2	6000	58	58	9,9	032041L600
160	4,7	500	74	74	2,1	032341L050
160	4,7	1000	74	74	3,9	032341L100
160	4,7	2000	74	74	7,3	032341L200
160	4,7	3000	74	74	10,8	032341L300
160	4,7	6000	74	74	21,2	032341L600
200	5,9	1000	90	90	6,2	032541L100
200	5,9	2000	90	90	11,6	032541L200
200	5,9	3000	90	90	17,0	032541L300
200	5,9	6000	90	90	33,3	032541L600
250	7,3	2000	125	125	18,3	032741L200
250	7,3	3000	125	125	26,7	032741L300
250	7,3	6000	125	125	51,9	032741L600
315	9,2	2000	158	158	29,4	032941L200
315	9,2	3000	158	158	42,8	032941L300
315	9,2	6000	158	158	82,7	032941L600
400	11,7	2000	178	178	50,3	033141L200
400	11,7	3000	178	178	71,9	033141L300
400	11,7	6000	178	178	136,4	033141L600
500	14,6	2000	340	340	81,9	033341L200
500	14,6	3000	340	340	115,4	033341L300
500	14,6	6000	340	340	216,1	033341L600

PVC pipes for outer sewage systems

with extended pipe bell

SN 8; SDR 34

with seal



DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
160	4,7	3000	174	150	11,1	032342L300
160	4,7	6000	174	150	21,5	032342L600
200	5,9	3000	190	150	17,6	032542L300
200	5,9	6000	190	150	33,8	032542L600
250	7,3	3000	225	200	27,5	032742L300
250	7,3	6000	225	200	52,7	032742L600
315	9,2	3000	258	200	44,1	032942L300
315	9,2	6000	258	200	84,1	032942L600
400	11,7	3000	278	210	74,0	033142L300
400	11,7	6000	278	210	138,5	033142L600
500	14,6	3000	340	300	118,8	033342L300
500	14,6	6000	340	300	219,5	033342L600

PVC pipes for outer sewage systems

SN 8; SDR 34

with seal DIN-LOCK

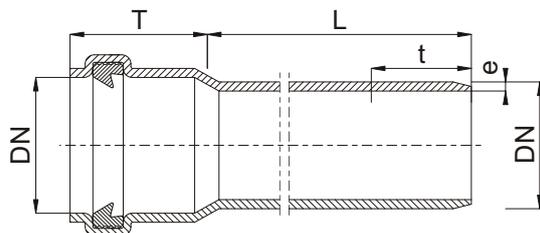


DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
160	4,7	3000	74	74	10,8	032343L300
160	4,7	6000	74	74	21,2	032343L600
200	5,9	3000	90	90	17,0	032543L300
200	5,9	6000	90	90	33,3	032543L600
250	7,3	3000	125	125	26,7	032743L300
250	7,3	6000	125	125	51,9	032743L600
315	9,2	3000	158	158	42,8	032943L300
315	9,2	6000	158	158	82,7	032943L600
400	11,7	3000	178	178	71,9	033143L300
400	11,7	6000	178	178	136,4	033143L600
500	14,6	3000	340	340	115,4	033343L300
500	14,6	6000	340	340	216,1	033343L600

PVC pipes for outer sewage systems

SN 12; SDR 31

with seal

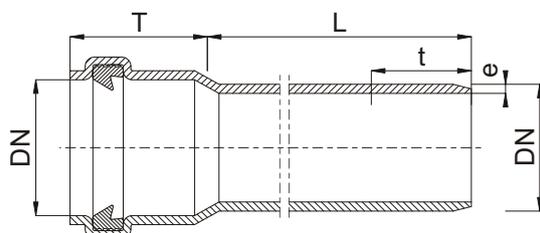


DN [mm]	e [mm]	L [mm]	T [mm]	t [mm]	Weight [kg]	Index -
160	5,2	3000	74	74	11,9	032362L300
160	5,2	6000	74	74	23,3	032362L600
200	6,5	3000	90	90	18,7	032562L300
200	6,5	6000	90	90	36,6	032562L600
250	8,1	3000	125	125	29,5	032762L300
250	8,1	6000	125	125	57,3	032762L600
315	10,2	3000	158	158	47,3	032962L300
315	10,2	6000	158	158	91,4	032962L600
400	13,0	3000	178	178	79,6	033162L300
400	13,0	6000	178	178	151,0	033162L600
500	16,2	3000	340	340	127,7	033362L300
500	16,2	6000	340	340	239,0	033362L600

PVC pipes for outer sewage systems

SN 16; SDR 26

with seal



DN [mm]	e [mm]	L [mm]	T [mm]	T [mm]	Weight [kg]	Index -
160	6,2	3000	74	74	14,1	032371L300
160	6,2	6000	74	74	27,6	032371L600
200	7,7	3000	90	90	22,0	032571L300
200	7,7	6000	90	90	43,1	032571L600
250	9,6	3000	125	125	34,8	032771L300
250	9,6	6000	125	125	67,5	032771L600
315	12,1	3000	158	158	55,7	032971L300
315	12,1	6000	158	158	107,8	032971L600
400	15,3	3000	178	178	93,1	033171L300
400	15,3	6000	178	178	176,7	033171L600
500	19,1	3000	340	340	149,6	033371L300
500	19,1	6000	340	340	280,1	033371L600

Intended use

Sewage pipes made of PVC-U are intended for following applications:

- In burial non-pressure drainage and sewage systems laid in soil of right-of-ways (under the roadways or out of it) or in other areas used for motor traffic engineering;
- For making protections for other cables and for penetration sleeves through road embankments;
- For dewatering bridge structures built along the road routes.

Pipes in versions with extended bell can be used in the areas of mining damages.

Standards, approvals

PN-EN 13476-2:2008 Plastic piping systems for non-pressure underground drainage and sewerage. Systems of pipelines of structural walls made of unplasticized poly(vinyl chloride) (PVC-U). Part 2: Specifications for pipes and fittings of smooth inner and outer surfaces and for the system type A.

PN-EN 681-1:2002 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1: Rubber

PN-EN 681-2:2003/A2:2006 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 2: Thermoplastic elastomers

Technical Approval **AT-15-7558/2012** PVC-U pipes and fittings KACZMAREK with solid wall and layered wall for outer non-pressure sewage systems, issued by Building Research Institute in Warsaw. Technical Approval **AT/2009-03-0530** Pipes and fittings KACZMAREK made of unplasticized poly(vinyl chloride) (PVC-U) with solid walls and structural walls (with foam and non-foam cores) for non-pressure sewage and drainage systems, issued in 2009 by the Road and Bridge Research Institute.

Technical Opinion on the possibilities of the use of sewage pipes SN-4, SN-8, SN>8 made of PVC-U in the areas with mining effects issued on 14 January 2009 by the Central Mining Institute in Katowice.

Method of manufacture

Multilayer construction of type A1 (three-layer pipes with foam core).

Pipes for outer sewage systems of structural walls are produced of PVC-U in the process of extrusion moulding. The pipe is constructed of three layers, the outer and inner of which is solid, whereas the middle is a foamed layer or a non-foamed one but forming a pipe core. During the process of manufacturing, at the end of pipe a bell/socket with a groove to insert an elastomeric seal is formed.

Durability

Unplasticized poly(vinyl chloride (PVC-U) is a highly resistant plastics to chemical compounds. A system of pipes and fittings made of PCV-U together with seals is resistant to the effect of wastewaters of pH = 2 (acids) up to pH = 12 (bases), to corrosion induced the effect of municipal wastewaters, rainwaters, surface waters and groundwaters. The information on the resistance of PVC to chemicals is defined in the Guidelines ISO/TR 10358, and of elastomeric seals - in ISO/TR 7620.

Sewage system made of PVC-U with seals is resistant to the wastewater maximum permanent temperature of more +40° C do +60° C, depending on pipe diameter, wall thickness and the method of pipeline laying out. Pipes and fittings are abrasion resistant. In the individual cases, the abrasibility can be tested in accordance with a method described in PN-EN 295-3.

Advantages of pipes and fittings made of PVC-U:

- The one of significant features of sewage system made of PVC-U pipes - including the facilities related with their structure - is to achieve a full tightness of the whole sewage system in a scope of both ex-filtration of wastewaters into soil (natural environment protection) and in-filtration groundwaters into sewage pipelines (the economic structure and the use of wastewater treatment plants);
 - High smoothness of the inner pipe surface that provides a key feature of the lack of deposits inside the pipes (there is no effect of decreasing of actual operating diameter of the pipeline);
 - the use of minimal of pipe drops;
 - no clogging pipelines;
 - lowering hydraulic resistance of wastewater flow;
 - High resistance against the effects of chemicals;
 - Wide range of pipes of suitable stiffness (SN2, SN4, SN8, SN12, SN16) as a function of operation load soil conditions;
 - The application in communication engineering;
 - Total resistance of pipe surfaces against corrosion, i.e. a destructive effect of groundwater, there fore, the pipes do not require the use of protective coverings;
 - High chemical resistance to substances within the range of pH 2-12;
 - A substantial reduction in weight of PVC-U pipes with reference to stoneware, concrete and cast iron pipes (6 m long PVC-U pipes of dia. 315 mm can be handles and installed manually by two workers);
- With a relatively low weight of PVC-U pipes and their lengths as well as with a type of joints a considerable reduction in transport costs is related to;
- The pipes are easy to lay out and install with no specialised equipment;
- No necessity to use air crane equipment;
- Lowering labour intensity of the erection works, therefore shorter installation times, lower costs of pumping groundwater etc.
- Able to use in the areas of mining damages of 1 up to 4 category;
 - Marking pipe insides;
 - High durability of systems (more than 50 years).

Quality control

All types of offered pipes elements are laboratory tested for mechanical strength, water tightness as well as static and dynamic resistance. A strict quality supervision of our products is provided by the quality management system implemented in KACZMAREK Company that is based on the standard EN ISO 9001.



Technical characteristics

Pipes of smooth inner and outer surfaces, the outer and inner walls of which are bonded with an intermediate thermoplastic foamed or non-foamed layer (marked as type A1).

The system of PVC-U sewage pipes is manufactured within the scope of diameters DN/OD110 – 500 mm and in stiffness classes: SN2; SN4; SN8. Pipes for outer sewage systems are of orange-brown colour (RAL 8023) of the same shade and colour intensity, of a smooth outer and inner pipe surfaces.

All types of sewage pipes and fittings are coupled with themselves and with smooth-wall pipes by bells with a groove and an elastomeric o-ring seal placed inside it.

Standard pipe bell

- With the elastomer SBR seal of type BL;
- With oil-resistant seal made of NBR elastomer of type BL.



Extended pipe bell of type WK

With a seal of type BL.

Pipe bells can be extended when they are to be used in the areas of potential mining damages.

The pipes can be used in the areas of mining damages when the following conditions are followed:

- In pipe stiffness >SN 8 from 1 to 4 category of mining damages;
- In pipe stiffness class >SN 4 from 1 to 3 category of mining damages.



Marking inside the pipes

PVC pipes in a scope of diameters 200 to 500 mm for sewage systems are also marked inside, which allows identifying the pipes also during TV inspection. The inside inscription contains: =KACZMAREK; pipe diameter x wall thickness; material PVC-U; stiffness SN; pipe type e.g.: ML; intended use e.g. mine damages=

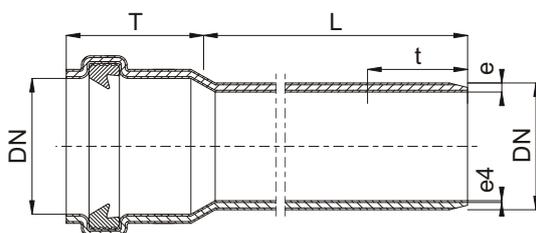
DN/OD	Normal bell standard seal			Extended bell standard seal
	SN 2	SN 4	SN 8	SN 8
110			X	
160	X	X	X	X
200		X	X	X
250		X	X	X
315		X	X	X
400		X	X	X
500		X	X	X

Detailed recommendations for the selection of pipe having suitable ring stiffness are contained in standard PN-ENV 1046. Ring stiffness marked acc. to PN-EN ISO 9969.

PVC pipes for outer sewage systems

SN 2; SDR 51

with seal



DN [mm]	e [mm]	e4, min. [mm]	L [mm]	T [mm]	Weight [kg]	Index -
160	3,2	0,5	500	74	1,2	0423113050
160	3,2	0,5	1000	74	2,3	0423113100
160	3,2	0,5	2000	74	4,3	0423113200
160	3,2	0,5	3000	74	6,3	0423113300
160	3,2	0,5	6000	74	12,4	0423113600

PVC pipes for outer sewage systems

SN 4; SDR 41

with seal

DN [mm]	e [mm]	e4, min. [mm]	L [mm]	T [mm]	Weight [kg]	Index -
160	4,0	0,5	500	74	1,5	0423213050
160	4,0	0,5	1000	74	2,6	0423213100
160	4,0	0,5	2000	74	5,0	0423213200
160	4,0	0,5	3000	74	7,3	0423213300
160	4,0	0,5	6000	74	14,4	0423213600
200	4,9	0,6	1000	90	4,2	0425213100
200	4,9	0,6	2000	90	7,8	0425213200
200	4,9	0,6	3000	90	11,4	0425213300
200	4,9	0,6	6000	90	22,3	0425213600
250	6,2	0,7	2000	125	12,4	0427213200
250	6,2	0,7	3000	125	18,1	0427213300
250	6,2	0,7	6000	125	35,1	0427213600
315	7,7	0,8	2000	158	20,4	0429213200
315	7,7	0,8	3000	158	29,6	0429213300
315	7,7	0,8	6000	158	57,3	0429213600
400	9,8	1,0	2000	178	34,9	0431213200
400	9,8	1,0	3000	178	49,9	0431213300
400	9,8	1,0	6000	178	94,7	0431213600
500	12,3	1,3	2000	340	57,1	0433213200
500	12,3	1,3	3000	340	80,6	0433213300
500	12,3	1,3	6000	340	150,8	0433213600

PVC pipes for outer sewage systems

SN 8; SDR 34

with seal

DN [mm]	e [mm]	e4, min. [mm]	L [mm]	T [mm]	Weight [kg]	Index -
110	3,2	0,5	500	58	0,8	0420413050
110	3,2	0,5	1000	58	1,5	0420413100
110	3,2	0,5	2000	58	2,8	0420413200
110	3,2	0,5	3000	58	4,1	0420413300
110	3,2	0,5	6000	58	8,1	0420413600
160	4,7	0,5	500	74	1,8	0423413050
160	4,7	0,5	1000	74	3,2	0423413100
160	4,7	0,5	2000	74	6,0	0423413200
160	4,7	0,5	3000	74	8,9	0423413300
160	4,7	0,5	6000	74	17,4	0423413600
200	5,9	0,6	1000	90	5,1	0425413100
200	5,9	0,6	2000	90	9,5	0425413200
200	5,9	0,6	3000	90	14,0	0425413300
200	5,9	0,6	6000	90	27,3	0425413600
250	7,3	0,7	2000	125	15,0	0427413200
250	7,3	0,7	3000	125	21,9	0427413300
250	7,3	0,7	6000	125	42,5	0427413600
315	9,2	0,8	2000	158	25,3	0429413200
315	9,2	0,8	3000	158	36,8	0429413300
315	9,2	0,8	6000	158	71,1	0429413600
400	11,7	1,0	2000	178	42,9	0431413200
400	11,7	1,0	3000	178	61,2	0431413300
400	11,7	1,0	6000	178	116,2	0431413600
500	14,6	1,3	2000	340	70,1	0433413200
500	14,6	1,3	3000	340	98,8	0433413300
500	14,6	1,3	6000	340	185,0	0433413600

PVC pipes for outer sewage systems

with extended pipe bell

SN 8; SDR 34

with seal



DN [mm]	e [mm]	e4, min. [mm]	L [mm]	T [mm]	Weight [kg]	Index -
160	4,7	0,5	3000	174	9,1	0423423300
160	4,7	0,5	6000	174	17,7	0423423600
200	5,9	0,6	3000	190	14,4	0425423300
200	5,9	0,6	6000	190	27,8	0425423600
250	7,3	0,7	3000	225	22,5	0427423300
250	7,3	0,7	6000	225	43,1	0427423600
315	9,2	0,8	3000	258	37,9	0429423300
315	9,2	0,8	6000	258	72,3	0429423600
400	11,7	1,0	3000	278	63,1	0431423300
400	11,7	1,0	6000	278	118,1	0431423600
500	14,6	1,3	3000	340	98,8	0433423300
500	14,6	1,3	6000	340	185,0	0433423600

Intended use

Pipes and fittings made of polypropylene (PP) are intended for buried non-pressure drainage and sewage systems; Gravity sewage systems stormwater and industrial effluent discharge systems, in difficult conditions e.g. low temperatures, high levels of ground water, exposed on heavy operational conditions, e.g.: high temperatures and chemical aggressiveness of the wastewaters, very shallow or deep foundation, high dynamic loads of the surcharge, elevated abrasiveness.

Standards, approvals

PN-EN 1852-1:2010 Plastic piping systems for non-pressure underground drainage and sewerage. Polypropylene (PP). Part 1: Specifications for pipes, fittings and the system.

AT-15-8429/2010 Sewage pipes and fittings PP SN 10, issued by Building Research Institute in Warsaw.

Technical Opinion of Central Mining Institute (GIG) Katowice, of 30 June 2008, on the possibilities of the use of sewage pipes and fittings made of PP in the areas with mining effects.

Technical Opinion of Central Mining Institute (GIG) Katowice, of 17 August 2009, on the ring stiffness of PP fittings for drainage and outer sewage systems.

Technical Opinion of Central Mining Institute (GIG) Katowice, of 28 August 2009, on meeting the criteria of the use of sewage pipes and fittings made of PP in the areas with mining effects.

Method of manufacture

Pipes for outer sewage systems are produced of PP in the process of extrusion moulding, are of solid homogeneous construction in an entire profile of the pipe of smooth outer and inner surfaces of the wall.

During the process of manufacturing, at the end of pipe a bell with a groove to insert an elastomeric seal is formed (it concerns pipe diameters from 110 to 200 mm). The pipes within the pipe range 250 - 500 mm are manufactured without pipe bells, with push-in plumbing fittings.

Durability

Polypropylene (PP) is a highly resistant plastics to chemical compounds. Systems of pipelines made of PP according to the norm, in range of pH from 2 (acid) to 12 (base) are resistant to the corrosion caused by the reaction of water in a form of municipal wastewaters, stormwaters, surface waters and groundwater. Information on chemical resistance of PP material is given in the Instruction ISC7TR 10358:1993, but concerning rubber materials - in ISO/TR 7620:2005. Sewage system made of PP with seals is resistant to the wastewater maximum permanent temperature of more +90°C. The pipes and fittings are resistant to abrasion. In the individual cases, the abrasibility can be tested in accordance with a method described in EN 295-3.

Advantages of pipes and fittings made of PP:

Pipes have their walls of relatively high thickness. They are manufactured according to the standard PN-EN 1852 with the use of only pure polypropylene, with no fillers and no foaming. The pipes made in that way, are characterised of:

- High impact strength, resistance to point stresses, high longitudinal stiffness;
- High hydraulic smoothness of pipe surfaces, which is related with: no formation of deposits on inner walls of the pipes, the use of minimum slopes, no clogging of the pipelines, the reduced flow resistances of wastewaters,
- A full tightness of the whole sewage system in a scope of both ex-filtration of wastewaters into soil (natural environment protection) and in-filtration groundwater into sewage pipelines (the economic structure and the use of wastewater treatment plants);
- The pipes are easy to lay out and install;
- Thermal resistance enables the installation of pipes at temperature down to -20°C , and the transport of wastewater of temperature 90°C continuously;

Chemical resistance in a wide range of pH to the corrosion caused by the reaction of media in a form of municipal wastewaters, stormwaters, surface waters and groundwater;

this feature enables transport of chemically aggressive effluents and the installation of pipes in chemically aggressive environments;

- Perfect abrasion resistance;
- Total resistance of pipe surfaces against corrosion, i.e. a destructive effect of groundwater, therefore, the pipes do not require the use of protective coverings;
- High smoothness of pipe wall surfaces, very low hydraulic resistances, impeded deposition of solid particles in wastewaters, the structure of joints and fittings provides achieving very good hydraulic parameters;
- Physiologically neutral, the pipes have no effect on live organisms, able to be recycled;
- High durability of the system (more than 100 years).

Thanks to it, the pipes of this type perfectly fit to

- lay out in very small and large depths under ground surface;
- high dynamic loads of surcharge caused by the road traffic;
- lay out with very small pipeline slopes;
- high-pressure flashing even up to 340 bar;
- elevated abrasion resistance of PP and high thickness of PP pipe wall;
- lay out under heavy ground conditions and with high groundwater table;
- transport and assembly at low temperatures up to -20°C ;
- inner surfaces of pipes and fittings compliant with this standard are hydraulically smooth. The structure of joints and fittings provides achieving very good hydraulic parameters.

Furthermore, thanks to their features, the pipes can be laid out with no fear with the use of parental soil to be used as haunching material. It gives considerable cost savings resulting from limitation of earthworks and transport of foreign material on the erection work site. Light weight of PP pipes induces lower costs of transport, eliminates the necessity of using crane equipment, lowers the intensity of the assembly work, which results in a shorter time of the conducted works.

Quality control

All types of offered pipes elements are tested in laboratory and at the erection site for mechanical strength, water tightness as well as static and dynamic resistance. A strict quality supervision of our products is provided by the quality management system implemented in KACZMAREK Company that is based on the standard EN ISO 9001.



Technical characteristics

The system of PVC-U sewage pipes is manufactured within the scope of diameters DN/OD 110 - 500 mm and in stiffness classes: SN 4; SN 10; SN 16; Pipes for outer sewage systems are of orange-brown colour (RAL 8023) of the same shade and colour intensity, of a smooth outer and inner pipe surfaces.

All types of sewage pipes and fittings are coupled with themselves and with smooth-wall pipes by bells with a groove and an elastomeric o-ring seal placed inside it.

Standard pipe bell

- **With a seal type of DIN-Lock**, with a sealing o-ring made of thermoplastic elastomer TPE and secured against pulling out with a stabilising clamping ring, made of polypropylene (PP). The construction of this type seals protects them against putting out of the pipe bell while coupling pipes. Besides, they are characterised of increased tightness under both over- and subpressure (seal of type: DIN-Lock or System-SK).
- **With oil-resistant seal made of NBR elastomer** of type BL.



Extended pipe bell of type WK - with a seal DIN-Lock

Pipe bells can be extended when they are to be used in the areas of potential mining damages.

The pipes can be used in the areas of mining damages when the following conditions are followed:

- In pipe stiffness >SN 8 from 1 to 4 category of mining damages;
- In pipe stiffness class >SN 4 from 1 to 3 category of mining damages.



Marking inside the pipes

Solid PP pipes in a scope of diameters 160 to 500 mm for sewage systems are also marked inside, which allows identifying the pipes also during TV inspection. The inside inscription contains: =KACZMAREK; pipe diameter x wall thickness; material PP; stiffness SN; pipe type e.g.: LITA (SOLID); intended use e.g.: mine damages=

DN/OD	Normal bell seal DIN-Lock			Extended bell seal DIN-Lock
	SN 4	SN 10	SN 16	SN 10
110	x	x	x	
160	x	x	x	x
200	x	x	x	x
250	x	x	x	x
315	x	x	x	x
400	x	x	x	x
500	x	x	x	x

PP pipes for outer sewage systems

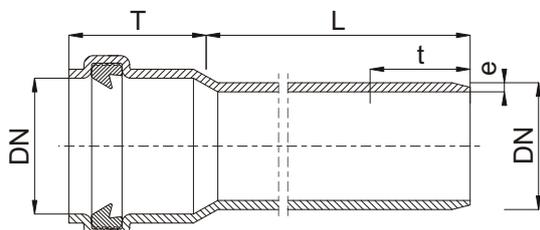
SN 4; S16

with DIN-LOCK seal

DN 110

DN 160

DN 200



DN 250

DN 315

DN 400

DN 500



DN [mm]	e [mm]	L [mm]	T [mm]	Weight [kg]	Index -
110	3,4	3000	60	3,4	0520233300
110	3,4	6000	60	6,6	0520233600
160	4,9	3000	85	7,2	0523233300
160	4,9	6000	85	14,0	0523233600
200	6,2	3000	106	11,5	0525233300
200	6,2	6000	106	22,2	0525233600
250	7,7	3000	122	18,0	0527233300
250	7,7	6000	122	34,6	0527233600
315	9,7	3000	146	29,0	0529233300
315	9,7	6000	146	55,3	0529233600
400	12,3	3000	159	48,5	0531233300
400	12,3	6000	159	90,9	0531233600
500	15,3	3000	173	73,5	0533233300
500	15,3	6000	173	139,5	0533233600

PP pipes for outer sewage systems

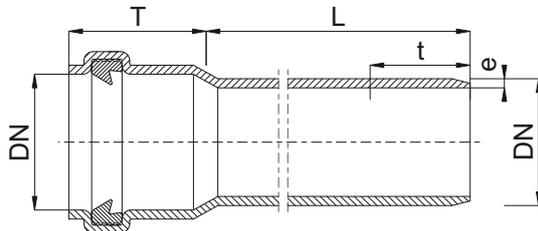
SN 10; S12,5

with DIN-LOCK seal

DN 110

DN 160

DN 200



DN 250

DN 315

DN 400

DN 500



DN [mm]	e [mm]	L [mm]	T [mm]	Weight [kg]	Index -
110	4,2	3000	60	4,1	0520533300
110	4,2	6000	60	8,1	0520533600
160	6,2	3000	85	8,9	0523533300
160	6,2	6000	85	17,4	0523533600
200	7,7	3000	106	14,0	0525533300
200	7,7	6000	106	27,1	0525533600
250	9,6	3000	122	22,0	0527533300
250	9,6	6000	122	42,5	0527533600
315	12,1	3000	146	35,2	0529533300
315	12,1	6000	146	67,8	0529533600
400	15,3	3000	159	58,4	0531533300
400	15,3	6000	159	110,8	0531533600
500	19,1	3000	173	89,3	0533533300
500	19,1	6000	173	171,0	0533533600

PP pipes for outer sewage systems

SN 16; S10,5

with DIN-LOCK seal

DN [mm]	e [mm]	L [mm]	T [mm]	Weight [kg]	Index -
160	7,3	3000	85	10,4	0523733300
160	7,3	6000	85	20,3	0523733600
200	9,1	3000	106	16,2	0525733300
200	9,1	6000	106	31,7	0525733600
250	11,4	3000	122	25,6	0527733300
250	11,4	6000	122	49,8	0527733600
315	14,4	3000	146	41,1	0529733300
315	14,4	6000	146	79,7	0529733600
400	18,2	3000	159	67,9	0531733300
400	18,2	6000	159	129,7	0531733600
500	22,8	3000	173	104,4	0533733300
500	22,8	6000	173	201,2	0533733600

Intended use

Sewage fittings made of PP, PVC-U are intended for following applications:

- In burial non-pressure drainage and sewage systems laid in soil of right-of-ways (under the roadway or out of it) or in other areas used for motor traffic engineering;
- For making protections for other cables and for penetration sleeves through road embankments;
- For dewatering bridge structures built along the road routes.

Standards, approvals

PN-EN 1852-1:2010 Plastic piping systems for non-pressure underground drainage and sewerage. Polypropylene (PP). Part 1: Specifications for pipes, fittings and the system.

PN-EN 1401-1:2009 Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U). Part 1: Specifications for pipes, fittings and the system.

PN-EN 681-1:2002 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1: Rubber.

PN-EN 681-2:2003/A2:2006 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 2: Thermoplastic elastomers.

Technical Approval AT/2009-03-0530 Pipes and fittings KACZMAREK made of unplasticized poly(vinyl chloride) (PVC-U) with solid walls and structural walls (with foam and non-foam cores) for non-pressure sewage and drainage systems, issued in 2009 by Road and Bridge Research Institute; Technical Approval **AT-15-7558/2012** Sewage pipes and fittings PP SN 10, issued by the Building Research Institute in Warsaw.

Technical Opinion of GIG (Central Mining Institute) on the possibilities of the use of sewage pipes and fittings made of PVC-U with solid walls in the areas with mining effects issued on 30 June 2008 by the Central Mining Institute in Katowice.

Method of manufacture

Fittings for outer sewage systems are produced of PP or PVC-U in the process of injection moulding, are of solid homogeneous construction in an entire profile of the pipe of smooth outer and inner surfaces of the wall.

Durability

Polypropylene (PP) is a highly resistant plastics to chemical compounds. Systems of pipelines made of PP according to the norm, in range of pH from 2 (acid) to 12 (base) are resistant to the corrosion caused by the reaction of water in a form of municipal wastewaters, stormwaters, surface waters and groundwater. Information on chemical resistance of PP material are given in the Instruction ISO/TR 10358:1993, but concerning rubber materials - in ISO/TR 7620:2005. Sewage system made of PP with seals is resistant to the wastewater maximum permanent temperature of more +90°C. Pipes and fittings are abrasion resistant. In the individual cases, the abrasibility can be tested in accordance with a method described in EN 295-3.

Technical characteristics

The system of sewage fittings made of PP, PVC-U is manufactured within the scope of diameters DN/OD 110 - 500 mm. Fittings for outer sewage systems are of orange-brown colour (RAL 8023) of the same shade and colour intensity, of a smooth outer and inner pipe surfaces.

The fittings are made by method of injection moulding or with the use of pre-cast elements of pipes or the injection moulded parts.

Joining fittings with other pipe systems

Sewage fittings are coupled with themselves and with smooth-wall pipes by bells with a groove and an elastomeric o-ring seal placed inside it.

According to the requirements of PN-EN 1852-1 and PN-EN 1401-1, the fittings may be used to make connections with elements made of other polymer or non-polymer materials, intended for burial non-pressure drainage or sewage systems. The fittings manufactured acc. to PN-EN 1852-1 can be used together with pipes and fittings compliant with the following standards:

PN-EN 1401-1:2009

PN-EN 13476-2:2008

PN-EN 13476-3+A1:2009

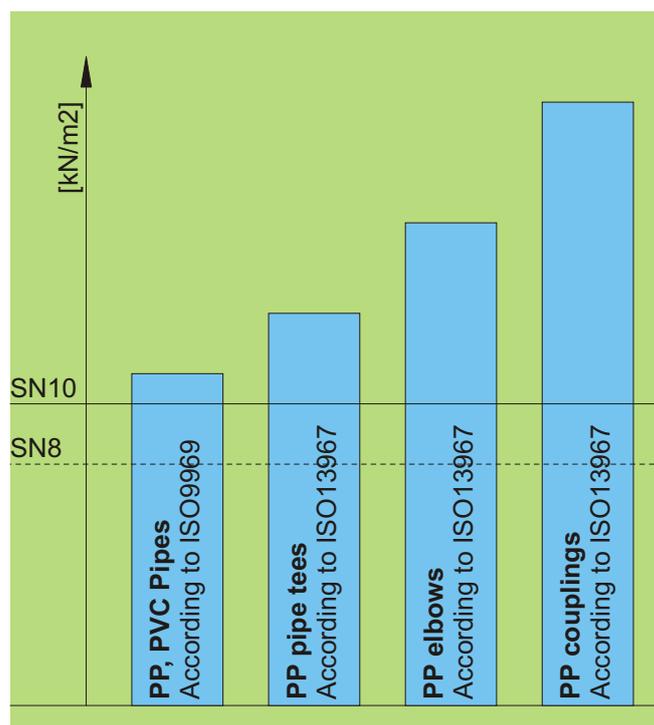
PN-EN 1451-1:2001

Class and stiffness of fittings

According to PN-EN 1852-1 and PN-EN1401-1, A fitting that follows the requirements of this standard and having the same thickness of wall as its pipe as regards its geometry, reveals its stiffness at least equal to the stiffness

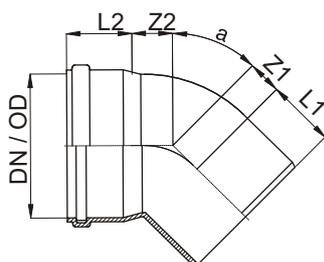
of such pipe.

Actual value of the stiffness of fitting can be determined acc. to PN-EN ISO 13967:2011: Fittings made of thermoplastics - Determination of ring stiffness. On that account the fittings classified in a dimensional series of suitable pipes in view of their geometry, have stiffness higher than the stiffness corresponding its pipe.



PP elbow for outer sewage systems

with seal



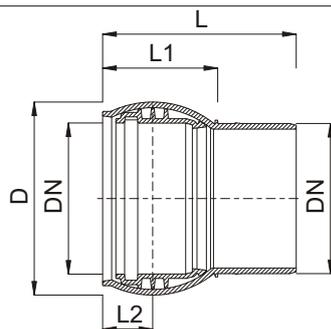
DN [mm]	- [o]	Z1 [mm]	Z2 [mm]	L1 [mm]	L2 [mm]	Weight [kg]	Index -
110	15	9	22	62	57	0,17	0710203330
110	30	17	29	62	57	0,18	0710203350
110	45	27	39	62	56	0,20	0710203360
110	67,5	41	53	62	56	0,21	0710203380
110	87,5	59	69	62	57	0,25	0710203390
160	15	14	28	82	80	0,48	0710233330
160	30	25	40	82	80	0,52	0710233350
160	45	37	50	82	80	0,57	0710233360
160	67,5	60	74	82	80	0,65	0710233380
160	87,5	84	100	83	80	0,70	0710233390
160 ²⁾	45	37	50	82	80	0,57	0720233360
160 ²⁾	90	84	100	83	80	0,70	0720233390
200	15	18	35	100	93	0,85	0710253330
200	30	30	49	100	93	0,95	0710253350
200	45	46	64	100	93	1,05	0710253360
200	67,5	73	88	100	93	1,22	0710253380
200	87,5	105	122	100	93	1,35	0710253390
250	15	19	38	134	121	1,70	0710273330
250	30	38	53	134	121	1,90	0710273350
250	45	59	73	134	121	2,10	0710273360
250	87,5	135	149	134	121	2,60	0710273390
315	15	24	47	150	140	3,10	0710293330
315	30	48	67	150	140	3,40	0710293350
315	45	74	92	150	140	3,70	0710293360
315	87,5	170	188	150	140	4,80	0710293390
400 ¹⁾	15	83	80	175	175	7,70	0710313330
400 ¹⁾	30	65	98	165	140	8,60	0710313350
400 ¹⁾	45	91	126	165	140	9,70	0710313360
400 ¹⁾	87,5	211	244	160	140	21,10	0710313390
500 ¹⁾	15	150	160	160	250	18,70	0710333330
500 ¹⁾	30	165	230	160	250	20,80	0710333350
500 ¹⁾	45	103	152	160	150	22,90	0710333360
500 ¹⁾	87,5	380	430	160	150	38,40	0710333390

¹⁾ made of PVC-U (made of PP, available at request)

²⁾ double socket bend made of PP

PP ball-and-socket joint

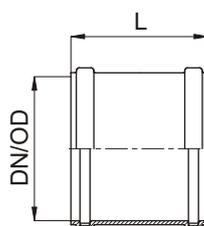
+/- 7,5°
with seal



DN [mm]	D [mm]	L1 [mm]	L2 [mm]	L [mm]	Weight [kg]	Index -
160	206	122	53	205	0,9	0718233310
200	254	146	63	245	1,7	0718253310
250	320	186	80	305	3,4	0718273310
315	395	217	92	362	6,1	0718293310

PP muff for outer sewage systems

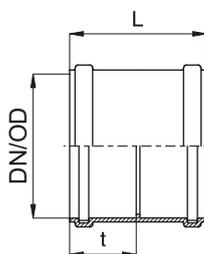
with seal



DN [mm]	L [mm]	Weight [kg]	Index -
110	124	0,15	0701203300
160	174	0,44	0701233300
200	217	0,78	0701253300
250	254	1,40	0701273300
315	300	2,60	0701293300
400	366	7,50	0701313300
500	398	14,80	0701333300

PP coupling for outage sewage systems

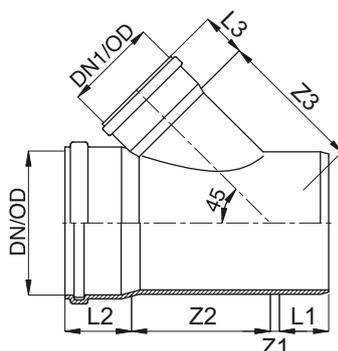
with seal



DN [mm]	t [mm]	L [mm]	Weight [kg]	Index -
110	60	124	0,15	0703203300
160	85	174	0,45	0703233300
200	106	217	0,78	0703253300
250	122	254	1,40	0703273300
315	146	300	2,60	0703293300
400	159	366	7,80	0703313300
500	173	398	15,10	0703333300

PP pipe tee for sewage systems

with seal

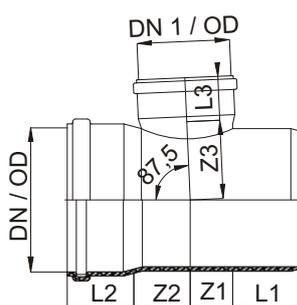


DN / OD [mm]	DN 1 / OD [mm]	Z1 [mm]	Z2 [mm]	Z3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Weight [kg]	Index -
110	110	25	140	140	62	61	61	0,42	0720103360
160	110	2	168	176	82	78	61	0,85	0720133360
160	160	38	205	205	82	78	78	1,20	0720153360
200	110	18	203	194	98	92	61	1,75	0720163360
200	160	17	218	223	98	92	78	1,90	0720183360
200	200	46	244	244	98	92	92	2,40	0720193360
250 ¹⁾	110	-47	251	271	175	103	56	3,70	0720201360
250	160	-12	274	264	149	121	80	3,70	0720223360
250	200	16	274	285	121	121	95	3,80	0720233360
250 ¹⁾	250	57	311	311	134	101	101	5,90	0720241360
315 ¹⁾	110	-79	287	315	190	117	55	5,95	0720251360
315	160	-44	312	299	174	140	80	5,60	0720273360
315	200	-16	312	320	146	140	95	6,20	0720283360
315 ¹⁾	250	28	335	344	156	114	99	8,50	0720291360
315 ¹⁾	315	73	392	392	144	114	114	10,80	0720301360
400 ¹⁾	110	-130	450	435	165	170	65	13,20	0720381360
400 ¹⁾	160	69	319	385	165	170	95	14,70	0720401360
400 ¹⁾	200	50	355	435	165	180	105	16,10	0720411360
400 ¹⁾	250	35	440	445	165	180	130	19,30	0720421360
400 ¹⁾	315	73	480	530	160	170	135	28,60	0720431360
400 ¹⁾	400	170	510	535	165	175	170	28,40	0720451360
500 ¹⁾	160	-65	450	680	200	250	90	28,70	0720571360
500 ¹⁾	200	87	400	575	200	250	110	31,40	0720581360
500 ¹⁾	250	-10	510	530	200	250	110	32,10	0720591360
500 ¹⁾	315	-45	475	503	200	250	135	34,30	0720601360
500 ¹⁾	400	115	615	640	200	250	180	39,40	0720621360
500 ¹⁾	500	240	665	675	200	250	255	51,00	0720641360

¹⁾ made of PVC-U (made of PP, available at request)

PP pipe tee for sewage systems

with seal

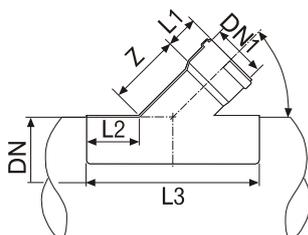


DN / OD [mm]	DN 1 / OD [mm]	Z1 [mm]	Z2 [mm]	Z3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Weight [kg]	Index -
110	110	55	69	69	62	61	61	0,33	0720103390
160	110	59	69	87	82	78	61	0,70	0720133390
160	160	76	98	98	82	78	78	0,95	0720153390
200	110	58	73	106	98	92	61	1,25	0720163390
200	160	85	97	112	98	92	78	1,55	0720183390
200	200	107	116	116	98	92	92	1,85	0720193390
250 ¹⁾	110	90	100	132	144	99	51	3,70	0720201390
250 ¹⁾	160	90	100	134	117	126	85	4,20	0720223390
250 ¹⁾	200	132	143	136	123	120	116	5,10	0720233390
250 ¹⁾	250	120	152	152	135	101	101	5,90	0720241390
315 ¹⁾	160	75	150	180	155	116	73	7,30	0720273390
315 ¹⁾	200	95	150	185	135	116	87	8,30	0720283390
315 ¹⁾	250	166	178	174	128	140	110	10,10	0720291390
315 ¹⁾	315	166	185	174	146	114	114	11,50	0720301390
400 ¹⁾	160	120	205	135	215	160	87	13,60	0720401390
400 ¹⁾	200	145	240	145	215	175	104	15,40	0720411390
400 ¹⁾	250	186	227	270	180	145	105	18,30	0720421390
400 ¹⁾	315	186	227	260	180	145	125	19,50	0720431390
400 ¹⁾	400	250	270	230	215	175	175	23,70	0720451390
500 ¹⁾	160	163	205	300	210	170	85	23,70	0720571390
500 ¹⁾	200	163	205	300	210	170	95	23,30	0720581390
500 ¹⁾	250	-	-	-	210	170	105	24,40	0720591390
500 ¹⁾	315	-	-	-	210	170	125	28,20	0720601390
500 ¹⁾	400	-	-	-	210	170	145	34,20	0720621390
500 ¹⁾	500	265	355	345	295	245	245	40,30	0720641390

¹⁾ made of PVC-U (made of PP, available at request)

PVC saddle tee for outer sewage systems

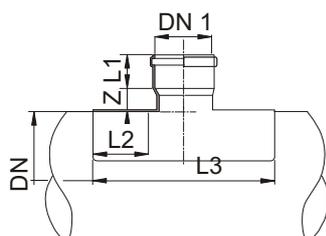
with seal



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Z [mm]	Weight [kg]	Index -
200	160	73	85	390	165	2,00	0727181360
250	160	73	92	400	165	2,50	0727221360
315	160	73	110	432	165	3,70	0727271360
315	200	95	86	513	236	4,40	0727281360
400	160	73	92	400	165	4,70	0727401360
500	160	73	92	400	165	6,40	0727571360

PVC saddle tee for outer sewage systems

with seal

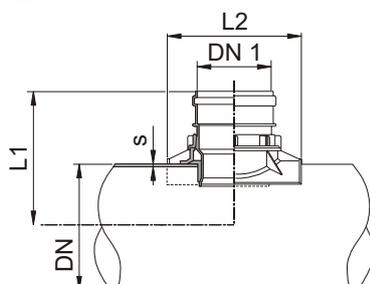


DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Z [mm]	Weight [kg]	Index -
200	160	58	77	322	34	2,00	0727181390
250	160	58	77	322	34	2,50	0727221390
315	200	86	75	390	45	4,40	0727281390

PVC saddle tee for outer sewage systems

mechanical coupling

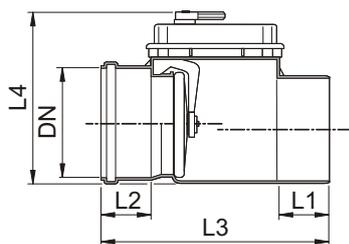
with seal



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	s max [mm]	Weight [kg]	Index -
250	160	285	290	8,3	2,60	0728181390
315	160	315	290	10,4	3,10	0728271390
400	160	360	290	13,1	4,20	0728401390

Stormwater gate valve, made of PVC

with seal

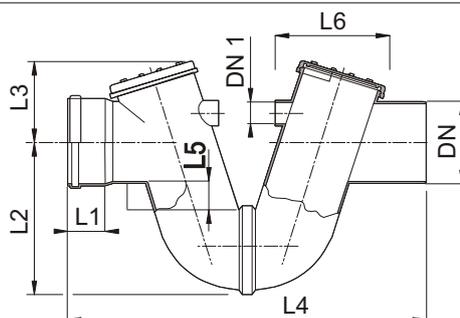


DN [mm]	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]	Weight [kg]	Index -
110 ¹⁾	61	61	307	230		0745208300
160 ¹⁾	74	74	337	255		0745238300
110	61	61	307	230		0745201300
160	74	74	337	255		0745231300
200	100	86	451	300		0745251300
250	130	102	520	374		0745271300
315	160	125	615	440		0745291300
400	205	140	800	480		0745311300

¹⁾ made with ABS

Trap M/F 0-0 REDI PVC

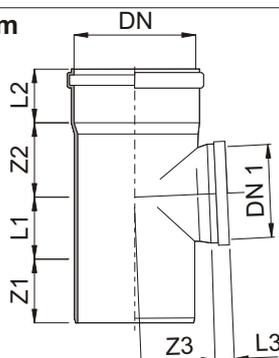
with seal



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]	L5 [mm]	L6 [mm]	Weight [kg]	Index -
110	40	61	202	88	495	35	153		0744201300
160	50	72	295	158	655	50	210		0744231300
200	63	84	345	198	795	50	270		0744251300

PP cleanout opening of outer sewage system

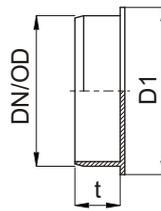
with seal



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Z1 [mm]	Z2 [mm]	Z3 [mm]	Weight [kg]	Index -
110	110	60	55	55	59	69	-		0747203300
160	110	85	72	72	83	99	-		0747233300
200 ¹⁾	200	105	119	119	100	86	28		0747253300
250 ¹⁾	250	120	152	152	135	101	70		0747273300
315 ¹⁾	315	166	185	185	146	114	90		0747293300
400 ¹⁾	400	227	227	260	180	145	30		0747313300

¹⁾ made of PVC-U

PP plug for outer sewage systems

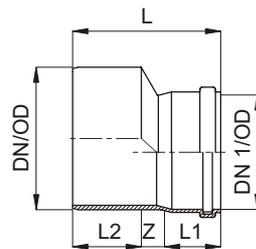


DN [mm]	D1 [mm]	L1 [mm]	Weight [kg]	Index -
110	126	38	0,10	0741203300
160	180	49	0,22	0741233300
200	223	59	0,45	0741253300
250	282	90	0,90	0741273300
315	350	93	1,60	0741293300
400	440	95	2,10	0741313300
500 ¹⁾	558	120	2,60	0741331300

¹⁾ made of PVC-U (made of PP, available at request)

PP bushing for outer sewage systems

with seal

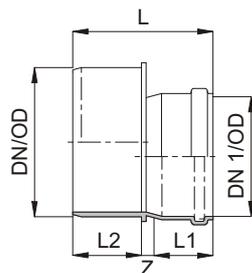


DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	Z [mm]	L [mm]	Weight [kg]	Index -
160	110	62	82	37	181	0,32	0730133300
200	160	80	99	34	214	0,70	0730183300
250	160	80	122	57	260	1,20	0730223300
250	200	93	134	41	268	1,30	0730233300
315	160	80	146	62	288	2,00	0730273300
315	200	95	146	78	319	2,10	0730283300
315	250	120	150	54	324	2,40	0730293300
400 ¹⁾	315	118	156	88	-	7,00	0730431300
500 ¹⁾	400	-	-	-	-	20,20	0730621300

¹⁾ made of PVC-U (made of PP, available at request)

PVC bushing for outer sewage systems

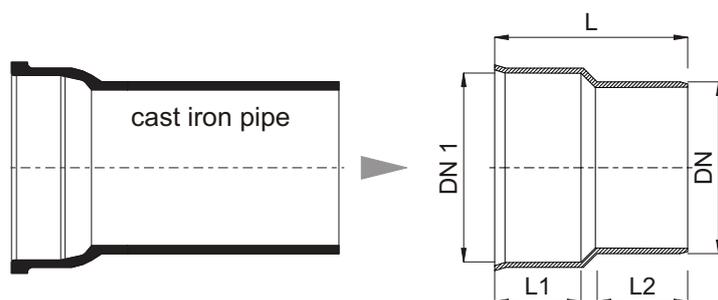
with seal



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	Z [mm]	L [mm]	Weight [kg]	Index -
250	110	56	90	7	-	1,10	0730201300
400	200	95	95	50	-	6,00	0730411300
400	250	105	95	50	-	6,30	0730421300

Joint iron cast - PVC

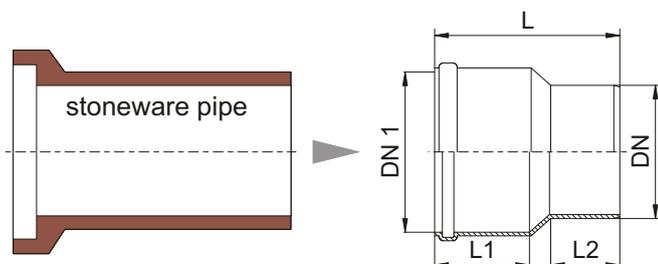
with seal



DN 1 [mm]	DN [mm]	L1 [mm]	L2 [mm]	L [mm]	Weight [kg]	Index -
124	110	58	61	132	0,15	0734203300
176	160	80	83	178	0,40	0734233300
226	200	86	100	206	0,80	0734253300

Joint stoneware - PVC

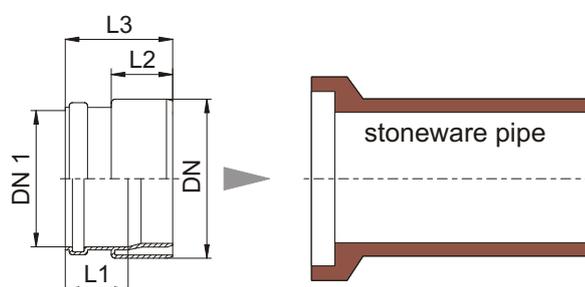
with seal



DN 1 [mm]	DN [mm]	L1 [mm]	L2 [mm]	L [mm]	Weight [kg]	Index -
136	110	81	63	164	0,50	0736203300
190	160	101	84	208	1,10	0736233300
242	200	116	100	250	2,00	0736253300

Joint PVC - stoneware

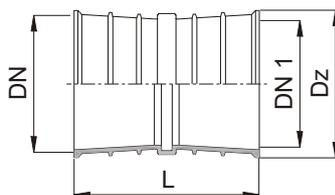
with seal



DN 1 [mm]	DN [mm]	L1 [mm]	L2 [mm]	L [mm]	Weight [kg]	Index -
110	136	56	70	114	0,30	0737201300
160	190	72	70	123	0,50	0737231300

PS protective sleeve

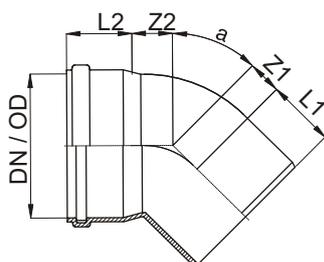
Tight passageway
through a concrete well/chamber



DN [mm]	L [mm]	Dz [mm]	Weight [kg]	Index -
110	110	130	0,30	0749207010
160	110	184	0,42	0749237010
200	110	226	0,55	0749257010
250	110	286	1,00	0749277010
315	110	354	1,50	0749297010
400	110	442	2,10	0749317010
500	110	546	2,70	0749337010
110	240	136	0,60	0749207050
160	240	190	0,82	0749237050
200	240	232	1,05	0749257050
250	240	292	1,10	0749277050
315	240	358	1,40	0749297050
400	240	448	2,20	0749317050
500	240	552	3,30	0749337050

Bend for outer sewage systems

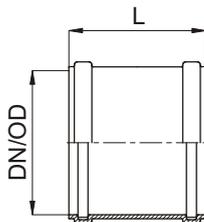
with seal
SN 12



DN [mm]	- [o]	Z1 [mm]	Z2 [mm]	L1 [mm]	L2 [mm]	Index -
160	15	14	28	82	80	0710234330
160	30	25	40	82	80	0710234350
160	45	37	50	82	80	0710234360
160	87,5	84	100	83	80	0710234390
200	15	18	35	100	93	0710254330
200	30	30	49	100	93	0710254350
200	45	46	64	100	93	0710254360
200	87,5	105	122	100	93	0710254390
250	15	19	38	134	121	0710274330
250	30	38	53	134	121	0710274350
250	45	59	73	134	121	0710274360
250	87,5	135	149	134	121	0710274390
315	15	24	47	150	140	0710294330
315	30	48	67	150	140	0710294350
315	45	74	92	150	140	0710294360
315	87,5	170	188	150	140	0710294390
400	15	83	80	175	175	0710314330
400	30	65	98	165	140	0710314350
400	45	91	126	165	140	0710314360
400	87,5	211	244	160	140	0710314390
500	15	150	160	160	250	0710334330
500	30	165	230	160	250	0710334350
500	45	103	152	160	150	0710334360
500	87,5	380	430	160	150	0710334390

Push-fit muff for sewage systems

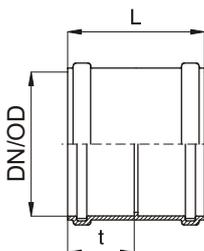
with seal
SN 12



DN [mm]	L [mm]	Index -
160	174	0701233300
200	217	0701253300
250	254	0701273300
315	300	0701293300
400	350	0701313300
500	480	0701333300

Coupling for outage sewage systems

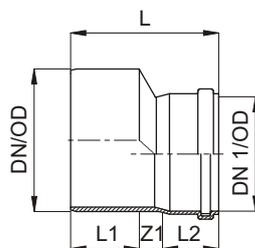
with seal
SN 12



DN [mm]	t [mm]	L [mm]	Index -
160	85	174	0703233300
200	106	217	0703253300
250	123	254	0703273300
315	144	300	0703293300
400	160	350	0703313300
500	236	480	0703333300

Bushing/adapter for outer sewage systems

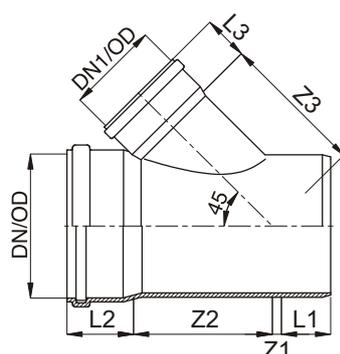
with seal
SN 12



DN [mm]	DN 1 [mm]	L1 [mm]	L2 [mm]	Z1 [mm]	Index -
160	110	56	82	43	0730133300
200	160	74	100	39	0730183300
250	200	74	90	8	0730223300
315	250	96	134	39	0730233300
400	315	74	93	7	0730273300

Pipe tee for sewage systems

with seal
SN 12

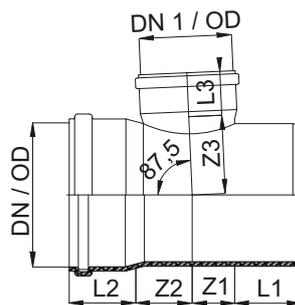


DN / OD [mm]	DN 1 / OD [mm]	Z1 [mm]	Z2 [mm]	Z3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Index -
160	110	2	168	176	82	78	61	0720133360
160	160	38	205	205	82	78	78	0720153360
200	110	18	203	194	98	92	61	0720163360
200	160	17	218	223	98	92	78	0720183360
200	200	46	244	244	98	92	92	0720193360
250	110	-47	251	271	175	103	56	0720201360
250	160	-12	274	264	149	121	80	0720223360
250	200	16	274	285	121	121	95	0720233360
250	250	57	311	311	134	101	101	0720241360
315	110	-79	287	315	190	117	55	0720251360
315	160	-44	312	299	174	140	80	0720273360
315	200	-16	312	320	146	140	95	0720283360
315	250	28	335	344	156	114	99	0720291360
315	315	73	392	392	144	114	114	0720301360
400	110	-130	450	435	165	170	65	0720381360
400	160	69	319	385	165	170	95	0720401360
400	200	50	355	435	165	180	105	0720411360
400	250	35	440	445	165	180	130	0720421360
400	315	73	480	530	160	170	135	0720431360
400	400	170	510	535	165	175	170	0720451360
500	160	-65	450	680	200	250	90	0720571360
500	200	87	400	575	200	250	110	0720581360
500	250	-10	510	530	200	250	110	0720591360
500	315	-45	475	503	200	250	135	0720601360
500	400	115	615	640	200	250	180	0720621360
500	500	240	665	675	200	250	255	0720641360

Pipe tee for sewage systems

with seal

SN 12



DN / OD [mm]	DN 1 / OD [mm]	Z1 [mm]	Z2 [mm]	Z3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	Index -
160	110	59	69	87	82	78	61	0720133390
160	160	76	98	98	82	78	78	0720153390
200	110	58	73	106	98	92	61	0720163390
200	160	85	97	112	98	92	78	0720183390
200	200	107	116	116	98	92	92	0720193390
250	110	90	100	132	144	99	51	0720201390
250	160	90	100	134	117	126	85	0720223390
250	200	132	143	136	123	120	116	0720233390
250	250	120	152	152	135	101	101	0720241390
315	160	75	150	180	155	116	73	0720273390
315	200	95	150	185	135	116	87	0720283390
315	250	166	178	174	128	140	110	0720291390
315	315	166	185	174	146	114	114	0720301390
400	160	120	205	135	215	160	87	0720401390
400	200	145	240	145	215	175	104	0720411390
400	250	186	227	270	180	145	105	0720421390
400	315	186	227	260	180	145	125	0720431390
400	400	250	270	230	215	175	175	0720451390
500	160	163	205	300	210	170	85	0720571390
500	200	163	205	300	210	170	95	0720581390
500	250	-	-	-	210	170	105	0720591390
500	315	-	-	-	210	170	125	0720601390
500	400	-	-	-	210	170	145	0720621390
500	500	265	355	345	295	245	245	0720641390

Sewage systems

Under the notion of outer sewage pipelines made of sewage pipes is considered a system of gravity pipelines from a place of which the wastewaters are discharged outside the building from its inner sewerage system or possibly from the places of the reception of rainwaters to a wastewater treatment plant or another wastewater receiver, where their disposal is performed. Rainwater pipelines or sewage pipelines under buildings may be classified to the outer sewage system, if they are not a part of inner installation of the building.

General design requirements

Those requirements that concern elastic pipes are defined in standards: PN-EN 752, PN-EN 1295-1 and PN-EN 1610.

- The pipeline laid in soil shall be planned to take into account inner and outer loads that will be present during the erection and operation works without any risks of excessive deformation or tightness loss, and not create any hazards for the environment by not fulfilling their functions.

- Respecting outer static and dynamic loads, soil conditions, thoroughness and supervision while laying out of them, the on-pressure (gravity) sewage pipelines shall be of suitably selected nominal ring stiffness guaranteeing respecting permissible momentary and long lasting deformations.

- Low- and high-pressure pipelines shall have determined nominal operational pressure assumed by the designer, taking into account the ability to occur overloads.

With loads of outer pipelines made of plastics, a nominal ring stiffness of the pipeline shall be included together with an elasticity of the co-operating soil as well as the effect of trench construction and groundwater as a function of the action time. Thrusts on the pipeline through focused surface loads from the vehicle wheels shall be calculated according to Boussinesq's method and the effect of this load shall be taken into account.

- Limit states shall be defines at which the pipeline is able to behave inappropriately (e.g. leakages, deformations of pipe cross-section may be occurred). The project shall ensure that such cases are not able to occur.

- The depth of covering the pipelines (the vertical distance from the top of pipe up to the soil surface) is dependent on the freeze depth of the ground (hz) for a given zone of country (PN-B-03020) and for sewage pipelines it is $h_z + 0.2$ m.

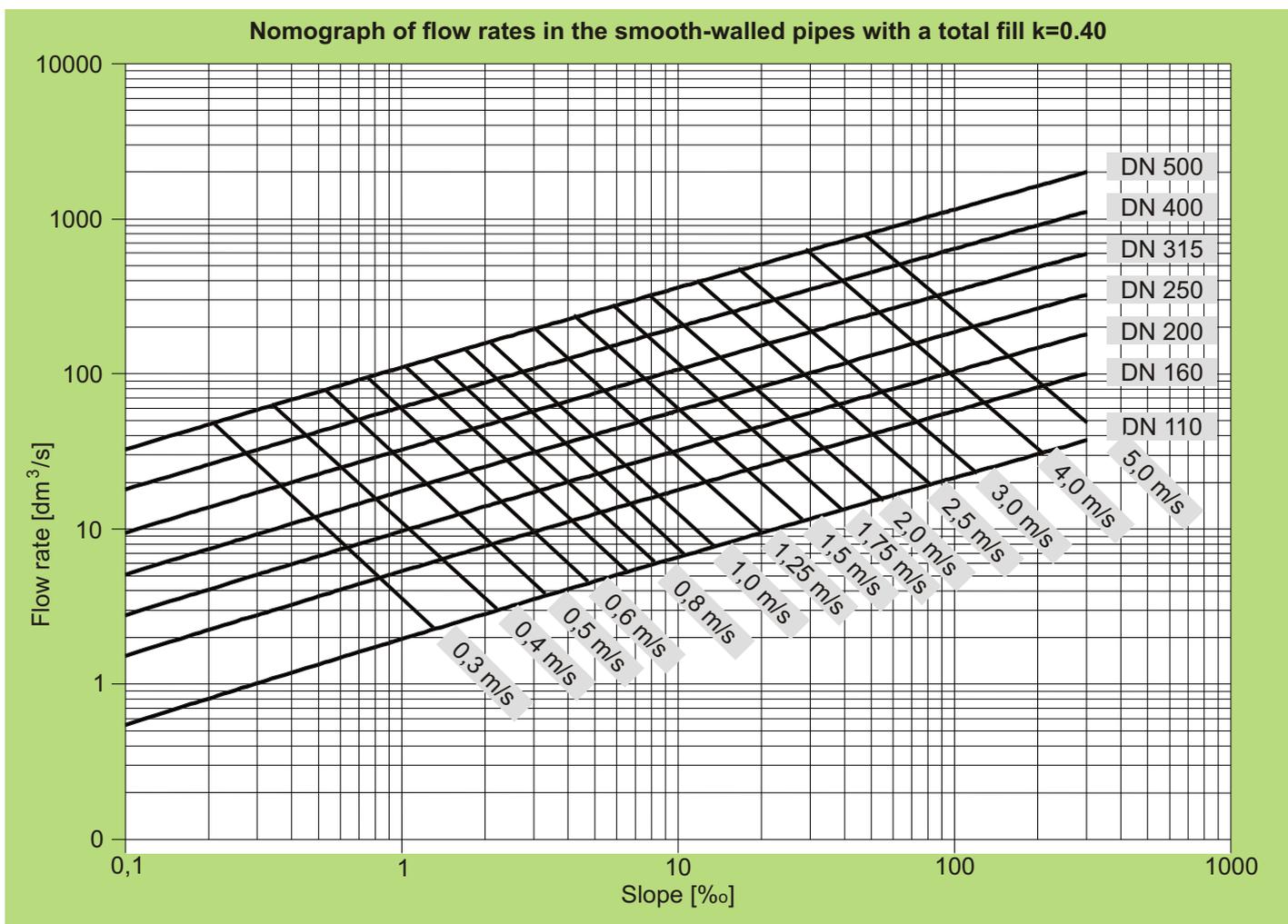
Hydraulic calculations of gravity pipelines and the selection of pipe diameters and slopes

Hydraulic calculations

To enable you making hydraulic calculations, we have developed a software that is available through our website. Thanks to it and on the basis of the assumed calculating flows and ground levels, it can be possible to calculate in a simple and prompt way the pipe diameter, its slope, a fill and the wastewater flow rate.

Before starting the calculations, the input data in the software should be established:

- A friction factor (surface roughness) $k = 0.4$ mm as a standard for pipelines with side laterals and revision chambers, and $k = 0.25$ mm for transit sewage pipelines.
- A minimal covering of the pipe (distance from the pipe top up to the ground surface) - the software selects pipe slopes to keep a minimal covering height in every point of network.
- The maximum flow rate for wastewaters is 5 m/s as a standard and 7 m/s for rainwaters. - Maximum fill of pipes with the transport medium as a standard is 60% for diameters up to 315 mm, 70% for diameters from 400 mm up to 630 mm, 80% for diameters above 630 mm; those values are for sewages, for rainwaters it should be assumed 99%.
- A density of sewage (sludge) applies only the shear stresses method for calculating minimal slopes and is normally equal 2650 kg/m³.
- A (limiting) shear stress of sewage (sludge) applies only the shear stresses method for calculating minimal slopes and is normally equal 2.2 N/m² for sanitary sewage and 1.5 N/m² for rainwaters.



The use

Smooth-walled PVC, PP systems are intended for the erection of gravity sewage, rainwater and industrial effluent systems. The use of pipes and fittings of a definite ring stiffness depends on a few factors that are defined in the standard PN-EIW 1046:2007 "Plastic pipeline systems. Systems outside building structures for transporting water or wastewaters. Practice for the installation under- and over the ground surface." There are: a burying depth, a type of parental soil and a type of soil used for haunching, a soil compaction class, a load of road traffic. Below are tables from the standard PN-EIW 1046, on the basis of which a minimal ring stiffness for pipes and pipe fittings can be selected.

Recommended minimal ring stiffness for the areas loaded with road traffic.

Backfill Group Material	Soil compaction Classes	Pipe ring stiffness [N/m ²]					
		Soil burying depth >1m a <3m Group of undisturbed parental soil					
		1	2	3	4	5	6
1		4000	4000	6300	8000	10000	**
2			6300	8000	10000	**	**
3				10000	**	**	**
4					**	**	**

		Soil burying depth >3m a <6m					
1	W	2000	2000	2500	4000	5000	6300
2	W		4000	4000	5000	8000	8000
3	W			6300	8000	10000	**
4	W				**	**	**

** - Static and strength calculations shall be made

Classification of soil into groups

		Groups of soil	The use as the backfill
Granular	1	Gravel of homogeneous grain-size distribution	Yes
		Gravels of good grain-size distribution, gravel-sand mixtures	
		Gravel-sand mixtures of bad grain-size distribution	
Granular	2	Sands of homogeneous grain-size distribution	Yes
		Sands of good grain-size distribution, sand-gravel mixtures	
		Zone mixtures sand-gravel of bad grain-size distribution	
Loose (non-cohesive)	3	Clay gravels, gravel-sand-clay mixtures of bad grain-size distribution	Yes
		Clayey gravels, gravel-sand-clayey sand mixtures of bad grain-size distribution	
		Clayey sands, sand-clay mixtures of bad grain-size distribution	
		Slightly clayey sands, sand-clayey sand mixtures of bad grain-size distribution	
Cohesive	4	Inorganic clays, very fine sands, stone dust	Yes
		Clays or clayey fine sands	
		Inorganic slightly clayey sands, clearly plastic clayey sands	
Organic	5	Soil with addition of humus, clay or clayey sand with organic additions	No
Soft organic	6	Peats and mud	No

Static-strength calculations shall also be made in the case of burying pipes less than 1 m or more than 6m for the case of the occurrence of high groundwater table. We recommend implementing the calculations acc. (Scandinavian) Molin's method. For this purpose you can use a software from our website or you can award these calculation to our Company to be made.

The use

Below are the tables supplementary to the tables for selecting ring stiffness. This is a table that presents the relation between the soil compaction class and the required to obtain it standard Proctor's density index for different groups of material, and a table containing the distribution of soils into groups depending on their susceptibility to compaction and usability to make backfill in the pipeline zone (haunching). The soil groups are classified from the best to the worst. The last two ones are unsuitable as the backfill.

Standard Proctor's density indexes for soil compaction classes

Compaction class	Main description	Group of backfill material			
		1	2	3	4
		SPD %	SPD %	SPD %	SPD %
Not	Nie	90 to 94	84 to 89	79 to 85	75 to 80
Moderate	Umiarkowane	95 to 97	90 to 95	86 to 92	81 to 89
Well	Dobre	98 to 100	96 to 100	93 to 96	90 to 95

Recommended thickness of layers and number of passages done

Equipment	Number of passages for compaction class		max. thickness of layer in m, after compaction for soil group				minimum thickness above the pipe top before the compaction
	well	moderate	1	2	3	4	[m]
	Food or hand tamper						
min. 15 kg	3	1	0,15	0,10	0,10	0,10	0,20
Vibration tamper							
min. 70 kg	3	1	0,30	0,25	0,20	0,15	0,30
Vibrator plate compactor							
min. 50 kg	4	1	0,10	-	-	-	0,15
min. 100 kg	4	1	0,15	0,10	-	-	0,15
min. 200 kg	4	1	0,20	0,15	0,10	-	0,20
min. 400 kg	4	1	0,30	0,25	0,15	0,10	0,30
min. 600 kg	4	1	0,40	0,30	0,20	0,15	0,50
Vibrating roller							
min. 15 kN/m	6	2	0,35	0,25	0,20	-	0,60
min. 30 kN/m	6	2	0,60	0,50	0,30	-	1,20
min. 45 kN/m	6	2	1,00	0,75	0,40	-	1,80
min. 65 kN/m	6	2	1,50	1,10	0,60	-	2,40
Double vibrating roller							
min. 5 kN/m	6	2	0,15	0,10	-	-	0,20
min. 10 kN/m	6	2	0,25	0,20	0,15	-	0,45
min. 20 kN/m	6	2	0,35	0,30	0,20	-	0,60
min. 30 kN/m	6	2	0,50	0,40	0,30	-	0,85
Heavy vibrating roller (no vibration)							
min. 50 kN/m	6	2	0,25	0,20	0,20	-	1,00

Earthworks

Earthworks shall be conducted in accordance with guidelines of implementing and the acceptance of building and assembly works and health and safety rules. The most commonly used are continuous narrow-spaced trenches of vertical walls with expanded formwork. If the area is not densely developed and there is enough place, it is also possible to use trenches of slope trench walls, however, not deeper than to a zone of the laid pipeline, i.e. 30 cm above the pipe top. A zone of the pipeline should be made as the narrow-spaced trench with a tight formwork. It is not permissible to apply wide-spaced excavation in the pipeline zone, because then it is not practically possible to achieve a well soil compaction in the pipeline zone. Selection of the excavation type and a necessity to protect its walls depend on the excavation depth, an occurrence and a level of groundwater table, a cohesion and a type of soil and a local road traffic.

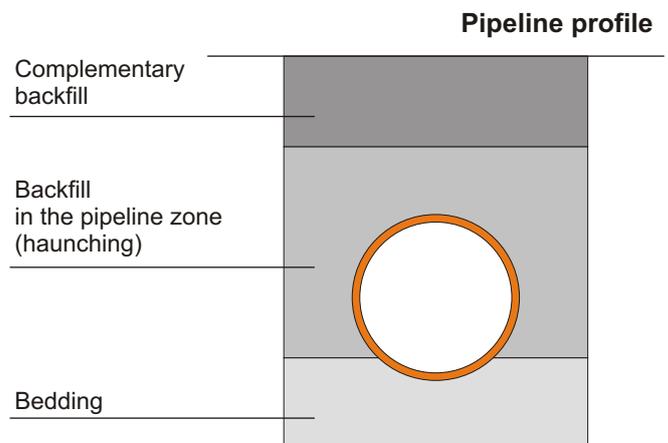
Laying out pipelines in trenches

Bedding

The bedding layer shall be thick from 100 to 150 mm. The applied soil material should be grained (gravel, sand, aggregate) of maximum size of particles as in table below.

It is recommended to spread evenly the bedding material on the entire width of trench and to level to the pipeline slope, but not to compact the soil.

Nominal diameter of the pipe DN [mm]	maximum value [mm]
DN < 100	15
100 < DN < 300	20
300 < DN < 600	30



Backfill in the pipeline zone (haunching)

The backfill should be made up to the height of 30 cm above the pipeline top. To make the backfill the parental soil can be used, if it is classified to the soil groups form 1 to 4 acc. to Table 4. It additionally depends on the following soil criteria:

- It does not contain particles larger than suitable limit value given in Table 5;
- It does not contain lumps of soil twice larger than suitable max. size of particle given in Table 5;
- It does not contain any frozen material;
- It does not contain any wastes (e.g. asphalt, bottles, cans, wood);
- In the cases, where compaction is required, the material should be prone to compaction.

If parental soil belongs to group 5 or 6, the bedding shall be made of foreign soil delivered on the erection site; it is suggested to apply soil of group 1 or 2.

Crucial is to compact the bedding in the pipeline zone. Standard PN-ENV 1046 assumes three classes of compaction: "W"-well, "M"-moderate, "N"- no compaction. Obtaining the target class of compaction by the Contractor is dependent on the applied equipment, thickness of the compacted soil layers, the amount of made passages of the equipment and the quality of work made. Approximate values of the individual parameters of compaction process is given in Table 6.

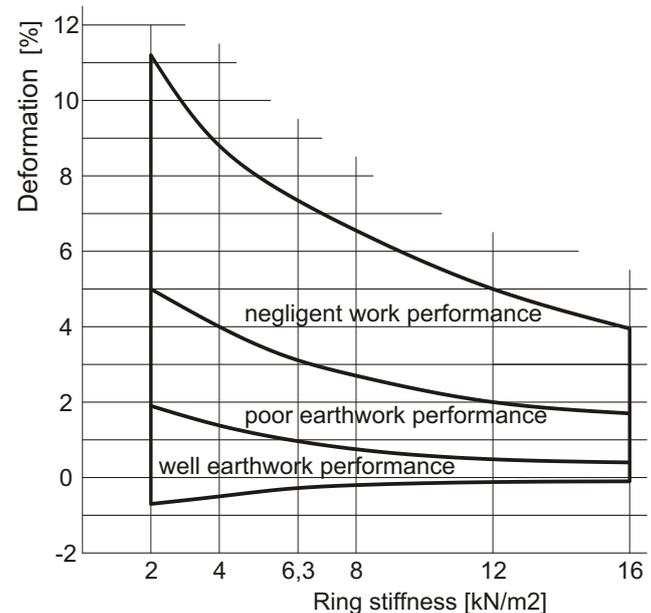
Complementary backfill

Bedding above the pipe zone (complementary bedding) can be made of parental soil material of maximum particle size up to 300 mm under the condition that the pipe covering is at least 300mm high. If used soil material is required to be compacted, it should be suitable to make compaction and it shall have soil particles of maximum size not larger than 2/3 of the thickness of the layer being compacted.

In the areas not loaded with road traffic, the compaction of class "N" for the complementary backfill is regarded as suitable. In the areas loaded with road traffic, the compaction of class "W" shall be applied.

Final assessment

Soil material in a zone of laid pipeline an Contractor's qualifications are of great significance for laying out sewage pipelines. In the project practice, the pipeline deflection should be provided not higher than 5%. However, according to the guidelines of the projected standard PN-EN 1852-1; PN-EN 1401-1 concerning the recommendations for laying out non-pressure structural pipes, the deflection arisen after the completion of earthwork for pipes of ring stiffness SN (4-16) kN/m² should not be higher than 8%. Pipe distortions will be practically dependent on quality of completing the earthwork and of the selection of ring stiffness of used pipes. Figure shows in a form of diagram (acc. to the standard mentioned above) pipe distortions in relation to the quality of completing the earthwork and the ring stiffness of the used pipes. However, the deformation to 15%, e.g. induced by the motion of soil, shall not have any effect on a correct functioning of the system of pipelines.



Technical acceptance

Technical acceptances of sewage pipelines shall be carried out in compliance with the technical design in coordination with the Investor and Factory who will operate them.

Valid regulations (standard PN-EN 1610: Erection and testing sewage pipelines) contain testing procedures including:

- Visual control regarding checking the pipeline route and the depth of laid out pipeline.
- Testing tightness if pipelines including wells and manhole chambers;
- The control of the correctness of the performance of pipeline laying zone - the soil compaction and the selection of soils.
- Checking soil compaction under the pipeline;
- Measurement of pipe deformations.

Tightness testing

Tests of tightness of sewage pipelines and wells can be made alternately: with the use of air (method L) or with the use of water (method W). It is possible to carry out separate tests of tightness for pipes and fittings as well as wells, e.g. the tests of pipes with the use of air, whereas the tests of wells - with water. The method with the use of air can be made unlimited number of times and then the found defects can be repaired. If the test with the use of air is doubtful, water test should be made and its results should be crucial. The preliminary test with air or water can be made directly after completing the pipeline laying out. However, a final confirmation of tightness should be made after completion of the pipeline trench backfill and dewatering the trench formwork.

Shipping and storage

Pipes should be transported in their vertical position. Be careful while loading and unloading in order to avoid damage the pipes. Do not use steel ropes and chains. Pipes shall not be thrown, but transferred.

Store the pipes in their horizontal position on even subbase on wooden sleepers of thickness not smaller than 5 cm and spaced from 1 to 2 m. While arranging in pipe layers, apply wooden interlayers. Pipes and pipe fittings should be stored under roofing protecting against direct sunlight and precipitation.

Pipe fittings on the erection site should be stored in original factory packages.

It is allowable to store pipes and fittings on open stack squares, however, the time of storage should not exceed two years. The discolourations arisen in this time have no effect on parameters and operational lifetime of the pipes. In the case of longer storage, you can ask the manufacturer to issue his opinion basing on the tests carried out about the possibility of using the pipes to built pipeline systems.



POLISH RELIABLE SYSTEMS



Kaczmarek Malewo spółka jawna

Malewo 1; 63-800 Gostyń

tel. (+48 65) 57 23 555

fax (+48 65) 57 23 530

www.kaczmarek2.pl