



# AGRU Piping systems for underground fire protection

PRODUCTS APPROVED  
ACCORDING TO FM 1613





OUR  
PRODUCTS  
ARE AS  
MANIFOLD  
AS YOUR  
DEMANDS.



## Competence in Plastics

AGRU Kunststofftechnik GmbH is an Austrian company. AGRU proves its competence and innovation in the development and production of high-quality products which are made of thermo-plastic polymers, for almost 50 years.

The product group AGRULINE offers a complete and first-class range of pipes, fittings, valves and special parts made of polyethylene for the environmentally friendly and safe supply of natural gas and potable water as well as the disposal of sewerage. The most modern machinery and well-trained special staff ensure production of highest grade products.



## FM approved PE 100(-RC) pipes and fittings

Many industrial companies operate special fire-fighting systems to prevent property losses. A complete fire-fighting system needs underground pipelines (main lines) with easy accessible fire hydrant connections. The material PE 100(-RC) is slowly advancing to one of the most used materials for fire-fighting applications. AGRU offers one of the most complete product ranges of FM approved PE 100(-RC) pipes and fittings for underground fire service mains worldwide. Customers from various business fields trust into AGRU's high quality products and its years of experience. Both of it leads to a perfect solution. That makes AGRU the reliable partner when it comes to prevent property loss.

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# 1 Factory Mutual

## 1.1 Ensuring Quality, Dependability and Performance

FM global is the world's largest commercial and industrial property insurance and risk management organisation specialising in property protection. FM Approvals certifies products and services for thousands of companies worldwide to help improve and advance property loss prevention. Globally recognized and respected, the FM APPROVED mark assures a product or service has been objectively tested and conforms to appropriate FM Approvals, national and international standards. Customers rely on FM Approvals for assurance that FM Approved products and services will perform as intended and support property loss prevention.

## 1.2 Benefits of FM approved products:

- Tested under extreme conditions
- Reliable performance due to regular quality audits of producers
- Technical product support by local representatives
- Product approval can help manufacturers and service providers:
  - // Meet client demands
  - // Accordance to code and jurisdictional installation requirements worldwide
  - // Achieve competitive advantage, whether at home or in the global marketplace
  - // Move products to market fast on a global basis

## 1.3 Standard

Agru offers a broad product range that is tested and certified for fire protection systems. The performed and approved standards for these high quality products are:

**Approval standard for Polyethylene (PE) Pipe and Fittings for Underground Fire Protection Class Number 1613**

**Date: February 2006. EN 12201, ISO 4427, AWWA C 906**

Information about installation and maintenance of FM pipe systems can be found at:

**Information about installation and maintenance of private fire service mains and their appurtenances.**

**FM data sheet 3-10, NFPA 24**

# 2 Material PE 100(-RC)

Agru produces FM approved pipes and fittings from high quality PE 100(-RC) resin material. This material is perfect suitable for fire fighting systems and has been successfully used since many years. From the easy and cost saving installation to the maintenance free and safe operation there are only positive references from both installers and operators.

**The features of PE 100(-RC) summarized:**

- Lightweight – easy and fast installation
- Flexible
  - // Cost saving due to less fittings are needed for installation
  - // No damages at seismic activities like soil settlements (e.g. earthquakes)
  - // High resistance against pressure surge (water hammer)
- Smooth surface
  - // No corrosion, less abrasion or incrustation
- Secure connection due to homogeneous welding techniques
- Environmentally friendly because 100 % recyclable
- UV resistance (with carbon black)
- Low microbial growth
- Application at a broad temperature range

**Material properties of the used high-grade resins (with regression curves acc. to ISO 4427) are stated in the following table 1:**

	Properties	Standard	Unit	PE 100(-RC)
mechanical / physical	MRS Classification	ISO 9080	N/mm <sup>2</sup>	10
	Specific density at 23 °C	ISO 1183	g/cm <sup>3</sup>	0,96 <sup>2</sup>
	Melt flow rate (MFR 190/5)	ISO 1133-1	g/10min	~0,3 <sup>1</sup>
	MFI range			T003
	Tensile stress at yield	ISO 527	MPa	≥23
	Elongation at yield	ISO 527	%	≥9
	Elongation at break	ISO 527	%	>350 <sup>2</sup>
	Impact strength unnotched	ISO 179	kJ/m <sup>2</sup>	no break
	Impact strength notched (at +23 °C)	ISO 179	kJ/m <sup>2</sup>	≥13 <sup>3</sup>
	Impact strength notched (at -30 °C)	ISO 179	kJ/m <sup>2</sup>	10
	Shore-D hardness (3 sec)	ISO 868	1	~60
	Flexural strength (3.5% flexural stress)	ISO 178	MPa	≥21
Young's Modulus	ISO 527	MPa	≥1000	
Stress cracking resistance (FNCT)	ISO 16770	h	≥300 <sup>3</sup>	
thermal	Heat deflection temperature HDT/B	ISO 75	°C	75
	Linear coefficient of thermal expansion	DIN 53752	K-1 × 10-4	1,8 <sup>4</sup>
	Thermal conductivity (at 20 °C)	DIN 52612	W/(m×K)	~0,4
	Flammability	UL 94 DIN 4102	- -	94-HB B2
electric	Volume resistivity	VDE 0303	Ω × cm	>10 <sup>16</sup>
	Surface resistivity	VDE 0303	Ω	>10 <sup>13</sup>
	Dielectric coefficient at 1 MHz	DIN 53483	-	2,3
	Electric strength	VDE 0303	kV/mm	70
general	Physiologically inert	EEC 90/128	-	yes
	UV stabiliser	-	-	Carbon black
	Color	-	-	black

**Table 1: Properties of materials used for Agru FM approved products**

Guidelines from:

- 1) DVS 2207-1
- 2) EN 12201
- 3) DVS 2205-1 BB1
- 4) DVS 2210-1

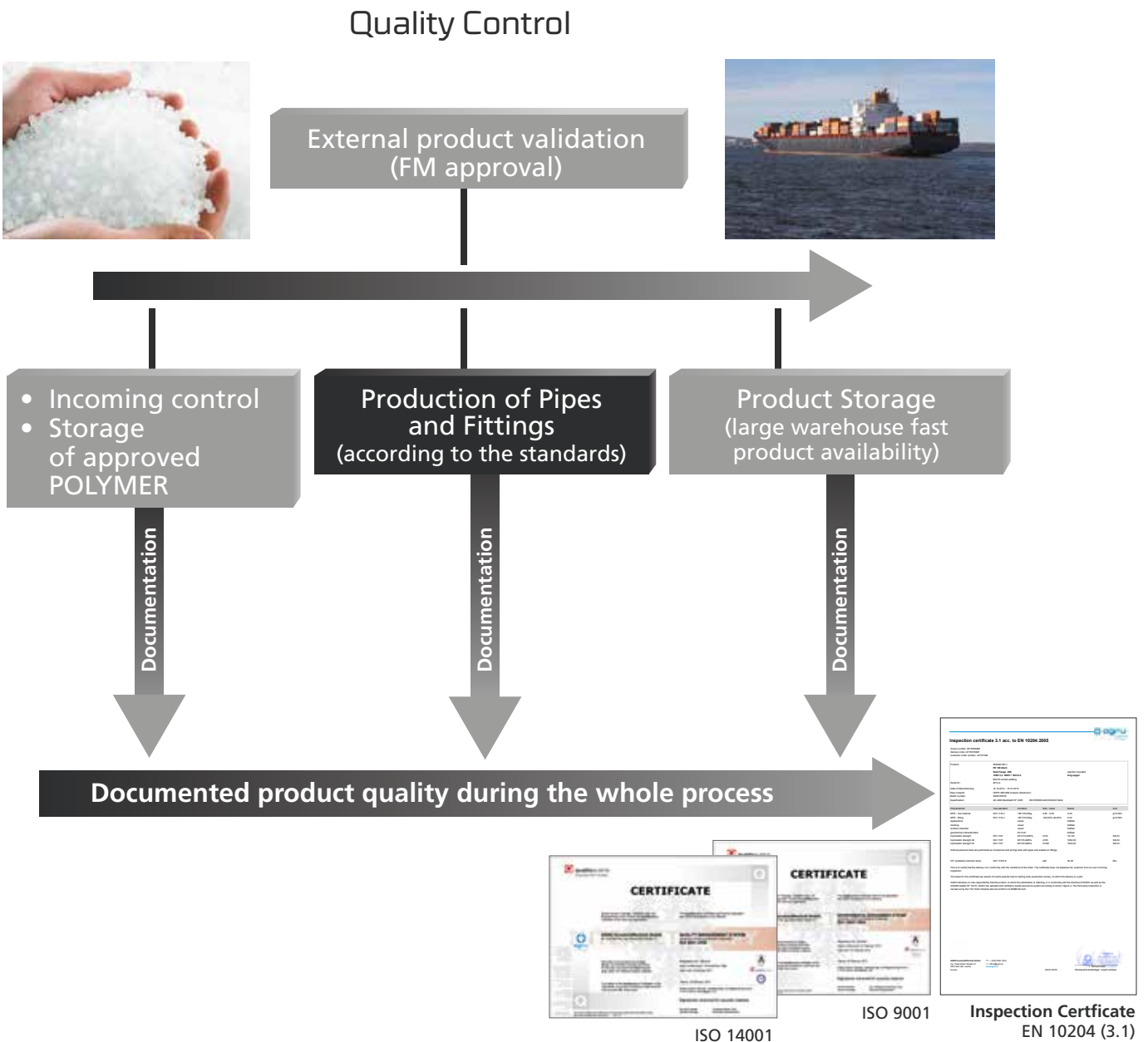
\* depending on the application area and operating time

### 3 Chemical resistance

PE 100(-RC) pipes are chemical resistant against inorganic/organic acids, inorganic salts and media with basic character (pH>12) even up to high concentrations. Organic chemicals and the molecular chain of the PE 100(-RC) polymer are very similar, they are structurally related to each other. The organic media might have a swelling effect on PE 100(-RC). Swelling means, that the distance between the molecular chains increases. There is a change in volume and shape due to the influence of the organic media. Swelling is a invertible process, in case that there is no contact between the organic media and the HDPE polymer, the swelling effect disappears. The organic media, which are present in foams for fire-fighting do not have a significant chemical effect on PE 100(-RC).

### 4 Quality assurance

**AGRU certified products by FM** are produced according to ISO 9001, ISO 14001, EN 12201 and FM approval standard 1613. There are standardized inspections for all incoming raw materials as well as during the production and at the finish product before shipment. Inspection certificates according to EN 10204 can be forwarded for each item on request.





## 5 Marking

As required by FM approval standard 1613, all FM approved pipes and fittings shall bear the Approval Mark clearly visible. The Approval Mark shall be displayed visibly and permanently on the products.

### 5.1 Marking of fittings

FM approved fittings are marked according to EN 12201-3. Additionally the FM approved certification mark including the maximum operating pressure and maximum water velocity is attached on the fittings.



### 5.2 Marking of pipes

FM approved pipes are marked according to EN 12201-2. Additionally the FM certification mark including the maximum operating pressure is printed on the pipes.



## 6 Connection of FM approved pipes and fittings

Agru pipes and fittings for firefighting systems are generally joined by heated tool butt welding, electrofusion welding or mechanically through the use of flanges. The appropriate connection technique depends on the location and the project requirements itself. Detailed guidelines for all connection techniques are available on request.

### 6.1 Heated tool butt welding

At the heated tool butt welding process, the joining zones of the components to be welded are aligned under pressure on the heated tool (alignment), heated up to the welding temperature with reduced pressure (heating up) and joined under pressure (joining) after removal of the heated tool (changeover).



### 6.2 Electrofusion welding

Agru FM Electro-fusion fittings can be used to weld the required components using resistance wire (heating wire). The heating wire is completely embedded in the fitting. This provides a smooth inner surface and allows an easy cleaning and insertion of the pipe ends/spigots. Universal welding machines are suitable and provide the required power supply.

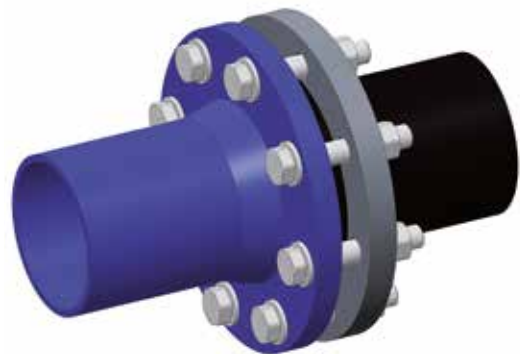


### 6.3 Flange connections:

Flange connections are used to create detachable connections between PE – PE, or as transition from PE to other materials (e.g steel, ductile iron. For example when pipes are connected to valves).



**PE-PE Flange connection**



**Steel-PE Flange connection**

To implement valves into Agru fire fighting pipelines, the valve must be supplied with flanges. To establish a suitable and reliable connection it is essential that the flanges of the valve and the pipeline are designed according to the same standards. The following Flange designs are available from Agru:

<b>DIN</b>	Design according to EN 1092-1:2013 PN 10
<b>ANSI</b>	Design according to ASME B16.5:2013 class 150



### Valve connection

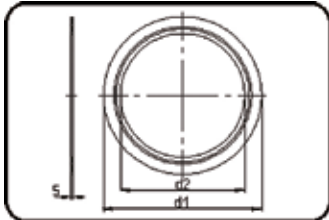
**The recommendations below should be considered to ensure a durable and leak proof flange connection:**

- It is recommended to coat the bolts for the flange connection with molybdenum sulfide grease to ensure a smooth operation, even during a long operation period.
- When choosing a seal material, consider its thermal and chemical suitability.
- The bolts shouldn't protrude further than two to three thread lengths after the nut.
- Washers have to be placed at the bolt head and also at the nut.
- Before applying the bolt initial pre-stress, the sealing faces have to be aligned coplanar to each other and fit tight to the sealing.
- Adjusting the position of the sealing faces by means of bolt pre-tensioning using a spanner is not permissible.
- The required bolt-tightening torque depends on the shape and the selected material of the seal (Shore A hardness) as well as on the friction in the screw thread and on the nut contact face (average friction coefficient of 0.15 can be expected). Please find guide values in table 2.
- The connecting bolts have to be screwed diagonally by means of a torque key (torque values see table D.8).
- The bolting torque must induce a certain amount of compressive stress on the elastomeric seal ( $\geq 0,5 \text{ N/mm}^2$ ). Below this minimum compressive stress a leak may occur. Otherwise, an excessive compressive stress may cause damage and deformation of the seal area (seal, stub end, backing ring, etc.).
- Flange connections which are exposed to alternating stresses and heavy impacts, have to be checked within prescribed maintenance intervals and retightened if necessary.

### 6.3.1 Gaskets

Based on our experience we recommend the use of the following gasket types:

From **OD 63 up to OD 315** seal clean PTFE gaskets are perfect suitable for firefighting systems. Seal Clean gaskets exhibits outstanding pressure and creep resistance combined with high stability. In comparison to other gaskets, the Seal Clean provides significant less settlement because of its better creep behaviour and therefore a better leak tightness even with occuring temperature- and pressure changes.



- Seal Clean Gasket
- Flange connection
- ePTFE white

Dim.	Code	Detail	da (OD) mm	da inch	s mm	d1 mm	d2 mm	DN mm	Weight
63	88.372.0063.11	63 - SDR 11 DIN	63	2	3	102	50,2	50	0.012
75	88.372.1075.11	75 - SDR 11 ANSI	75	2,5	3	117	60,5	65	0.015
90	88.372.0090.11	90 - SDR 11 DIN	90	3	3	138	73,1	80	0.028
90	88.372.1090.11	90 - SDR 11 ANSI	90	3	3	132,4	73,1	80	0.018
110	88.372.0110.11	110 - SDR 11 DIN/ANSI	110	4	3	158	88,9	100	0.035
140	88.372.0140.11	140 - SDR 11 DIN	140	5	3	188	114,1	125	0.033
160	88.372.0160.11	160 - SDR 11 DIN/ANSI	160	6	3	212	129,8	150	0.042
180	88.372.0180.11	180 - SDR 11 DIN	180	7	3	212	148	150	0.034
200	88.372.0200.11	200 - SDR 11 DIN/ANSI	200	8	3	268	162,5	200	0.067
250	88.372.0250.11	250 - SDR 11 DIN/ANSI	250	10	3	320	201,7	250	0.092
280	88.372.0280.11	280 - SDR 11 DIN	280	11	3	320	226,5	250	0.076
315	88.372.0315.11	315 - SDR 11 DIN/ANSI	315	12	3	370	253,3	315	0.172

From **OD 355 up to OD 500** profiled gaskets with steel inserts are recommended.

Detailed information is available on request.



Profiled gasket



Cross section of profiled gasket with steel insert

### 6.3.2 Tightening torques for bolts:

The following tightening torques are recommendations according to long term experiences:

OD	BOLTING TORQUE [NM]	GASKET TYPE
63	40	Seal Clean
75	55	
90	50	
110/125	45	
140	50	
160/180	80	
200/225	110	
250/280	110	
315	110	
355	70	
400	80	
450	90	
500	100	

**Table 2: Recommended tightening torque for bolts  
(for installation of the Seal Clean gasket follow the installation guideline)**



Flange connection with valve

## 7 System pressure rating

There are 2 complete product ranges for firefighting systems available from Agru: FM approved per approval standard 1613 for 175 psi (12 bar, SDR 11), and for 200 psi (14 bar, SDR 9). This pressure designation means maximum operating pressure for firefighting systems, at 23°C. It is calculated and tested that all the system components can handle 4 times of the specified pressure in case of a water hammer without any failure.

According to the EN 12201 standard, the maximum operating pressure for SDR 11 is 16 bar and for SDR 9 20 bar at 20 °C and 50 years operating time. Agru pipes and fittings are certified for this pressure. According the test requirements of FM 1613 approval standard (short term hydrostatic strength test at 4x certified pressure) Agru pipes and fittings used for firefighting systems are limited to the pressure rates as shown in **Table 3** (certified pressure) .

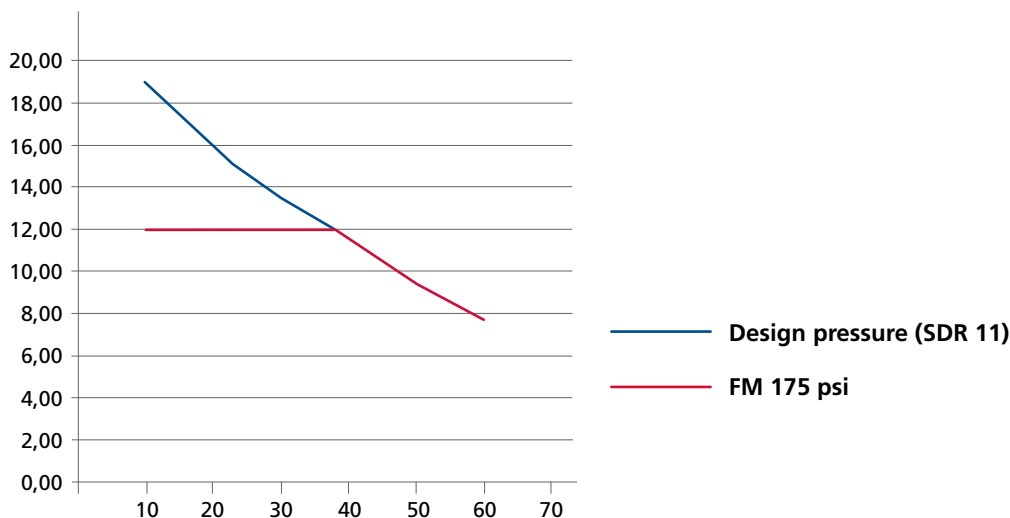
### Recommended pressure calculation for Agru firefighting pipes and fittings:

- As a design basis the values of the EN 12201 standard can be used (design pressure).
- The actual operating pressure should not exceed the certified pressure values in the **Table 3** and **Table 4** below.
- As temperature increases, a de-rating of the service pressure has to be considered. The calculated and tested pressure ratings depending on temperature and operating time are also stated in **Table 3** and **Table 4**.

### 7.1 Maximum operating pressure of approved pipes and fittings for 175 psi

Temperature (°C)	Operating period (years)	Design pressure according to EN 12201 (SDR 11) (bar)	Certified pressure for firefighting systems (175 psi) (operating pressure) (bar)
10	50	19.0	12.0
20	50	16.0	12.0
23	50	15.1	12.0
30	50	13.5	12.0
40	50	11.6	11.6
50	15	9.4	9.4
60	5	7.7	7.7

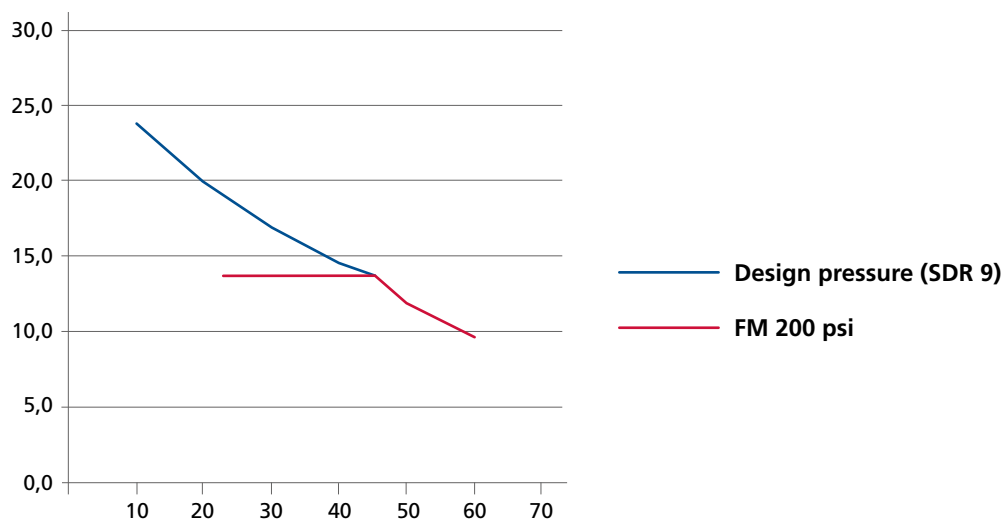
Table 3: Mop of Agru products 175 psi for firefighting systems



## 7.2 Maximum operating pressure of approved pipes and fittings for 200 psi

Temperature (°C)	Operating period (years)	Design pressure according to EN 12201 (SDR 9) (bar)	Certified pressure for firefighting systems (200 psi) (operating pressure) (bar)
10	50	23,9	14,0
20	50	20,0	14,0
23	50	19,1	14,0
30	50	17,0	14,0
40	50	14,6	14,0
50	15	11,9	11,9
60	5	9,7	9,7

**Table 4: Mop of Agru products 200 psi for firefighting systems**



## 8 Hydraulic pressure losses

PE 100(-RC) pipes and fittings have a smooth abrasion- and incrustation resistant surface. Furthermore water does not corrode PE 100(-RC) pipes and fittings so that the Hazen-Williams flow coefficient "C" of 150 remains practically constant throughout the whole service lifetime. This saves energy costs (pump operating costs) and ensures a reliable and efficient performance in case of a fire emergency.

**The main factors for losses are:**

- Length of the piping system
- Pipe cross section
- Roughness of the pipe surface
- Geometry of fittings, mountings and finished joints or couplings
- Viscosity and density of the fluid

The whole pressure loss results from the sum of the following individual losses:

$$\Delta p_{ges} = \Delta p_R + \Delta p_{RF} + \Delta p_{RA} + \Delta p_{RV}$$

Formula 1: Total pressure loss

$\Delta p_{ges}$  total pressure loss [bar]

$\Delta p_R$  pressure loss in straight pipes [bar]

$\Delta p_{RA}$  pressure loss in mountings [bar]

$\Delta p_{RF}$  pressure loss in fittings [bar]

$\Delta p_{RV}$  pressure loss in finished joints or couplings [bar]

### 8.1 Pressure loss in straight pipes

Pressure loss in straight pipes is inversely proportional to the pipe cross section.

$$\Delta p_R = \lambda \cdot \frac{L}{ID} \cdot \frac{\rho}{2 \cdot 10^2} \cdot v^2$$

**Formula Pressure loss in straight pipes.**

ID inside diameter of pipe [mm]

L length of piping system [m]

$\Delta p^R$  pressure loss in straight pipes [bar]

$\lambda$  pipe frictional index 0.02 (sufficient in most cases) [1]

v flow velocity [m/s]

$\rho$  medium density [kg/m<sup>3</sup>]



Pressure loss in pipes can also be calculated with the empirical Hazen-Williams equation.

$$h = \frac{10,67 \cdot q^{1,85}}{c^{1,85} \cdot d_h^{4,8655}}$$

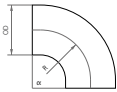
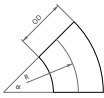
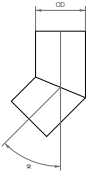
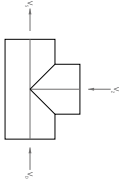
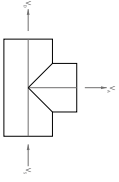


- h head loss per unit pipe [mh20/m pipe]
- c design coefficient (PE-HD = 150)
- q flow rate [m3/s]
- d<sub>h</sub> inside hydraulic diameter [m]

## 8.2 Pressure loss in fittings

Inside the fittings friction, deflection and detachment cause considerable pressure losses. The resistance coefficients, used for the calculation can be taken from the following chapter.

$$\Delta p_{RF} = \zeta \cdot \frac{\rho}{2 \cdot 10^5} \cdot v^2$$

- $\Delta p_{RF}$  pressure loss in fittings [bar]
- $\zeta$  resistance coefficient for fittings [1]
- v flow velocity [m/s]
- $\rho$  medium density [kg/m<sup>3</sup>]

Fitting	Parameter	Resistance coefficient [1]			Flow
Bend 90°	R	$\zeta$			
	1.0×OD	0.51			
	1.5×OD	0.41			
	2.0×OD	0.34			
	4.0×OD	0.23			
Bend 45°	R	$\zeta$			
	1.0×OD	0.34			
	1.5×OD	0.27			
	2.0×OD	0.20			
	4.0×OD	0.15			
Elbow	$\alpha$	$\zeta$			
	90°	~ 1.20			
	45°	0.30			
	30°	0.14			
	20°	0.05			
	15°	0.05			
	10°	0.04			
Tee 90° (confluence)	$V_z / V_s$	$\zeta_z$	$\zeta_A$		
	0.0	-1.20	0.06		
	0.2	-0.40	0.20		
	0.4	0.10	0.30		
	0.6	0.50	0.40		
	1.0	0.90	0.60		
Tee 90° (bifurcation)	$V_A / V_s$	$\zeta_z$	$\zeta_A$		
	0.0	0.97	0.10		
	0.2	0.90	-0.10		
	0.4	0.90	-0.05		
	0.6	0.97	0.10		
	1.0	1.30	0.35		
FITTING	PARAMETER	RESISTANCE COEFFICIENT [1]			FLOW
Reduction (pipe extension)	$OD_1 / OD_2$	$4^\circ > \alpha < 8^\circ$	$\alpha < 16^\circ$	$\alpha < 24^\circ$	
	1.2	0.10	0.15	0.20	
	1.4	0.20	0.30	0.50	
	1.6	0.50	0.80	1.50	
	2.0	1.20	1.80	3.00	
Reduction (pipe throat)	$OD_2 / OD_1$	$\alpha < 4^\circ$	$\alpha < 8^\circ$	$\alpha < 20^\circ$	
	1.2	0.046	0.023	0.010	
	1.4	0.067	0.033	0.013	
	1.6	0.076	0.038	0.015	
	2.0	0.031	0.041	0.016	
		0.034	0.042	0.017	

Positive  $\zeta$ -values represent a pressure drop, whereas negative  $\zeta$ -values represent a pressure increase.

- VA outgoing volume flow
- VD continuous volume flow
- VS total volume flow
- VZ additional volume flow

## 9 Installation of firefighting pipe systems

Polyethylene pipe systems should be installed according to the national requirements and laws, the manufacturer's instructions and FM Global Property Loss Prevention Data Sheets (FM data sheet 3-10: Installation and maintenance of private fire service mains and their appurtenances).

**FM Approved PE pipes and fittings according to the approval standard 1613 are for underground installed use only!**

### 9.1 Trench design for buried FM pipelines

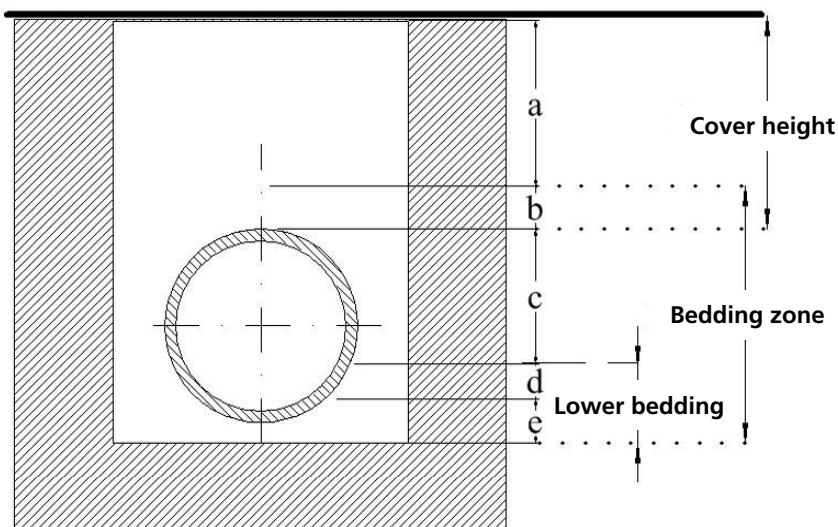
The following recommendation is according to EN 805 and ÖVGW G E100. For the pipe trench construction and the installation of the pipes corresponding national and regional regulations have to be taken into account.

The following influence factors on the installation technique and –depth have to be considered:

- Depth of frost or heat penetration (local conditions)
- Flow rate, pressure and temperature of the media in the pipeline
- Insulation of the pipeline
- Traffic and soil loads
- Soil type, soil moisture and the surface condition
- Crossing lines
- Sufficient compressability of the soil around the pipeline

**A structural analysis considering all influence factors should be performed by a professional engineer before each installation. For this purpose acknowledged calculation guidelines (e.g. AWWA M55, ÖNORM B5012, ATV 127) have to be used. It has to be ensured that the soil around the pipe can be properly compacted to fix the pipe in the trench.**

The trench depth should be excavated considering national standards. In doing so the crown of the pipe should be located underneath the depth of the frost. The trench bottom should be planar, stable and free of stones. A bedding layer of at least 10 cm (rocky ground: 15 cm) should be placed on the trench bottom. The pipeline should be lowered into the trench carefully. Additionally an all-side cover has to be created (at least 10 cm) to avoid scratches and point-loads on the pipe.



#### OD

Outside pipe diameter

#### Trench width

minimum OD + 40 cm

#### Cover height

minimum 80 - 100 cm (at least 2 x OD and underneath the depth of frost)

#### Lower bedding

minimum 10 cm, out of embedding material like sand (particle size 0...4 mm, fine quota 15%)

#### Bedding zone

embedding of the pipe should achieve minimum 10 cm out of the same potting material;

## 9.2 Thrust blocks

PE 100(-RC) pipes and fittings are connected homogenously and are force-locked longitudinally. The welded joints can take the same longitudinal forces than the pipe.

If the pipeline is properly installed and the bedding material is compacted according to common standards, it is not necessary to install thrust blocks (there is no European standard which requires thrust blocks for welded PE pipelines). Due to the flexibility of the PE100(-RC) materials, the thermal expansion/contraction (caused by temperature difference during the operation) is compensated by properly compressed soil around the pipe.

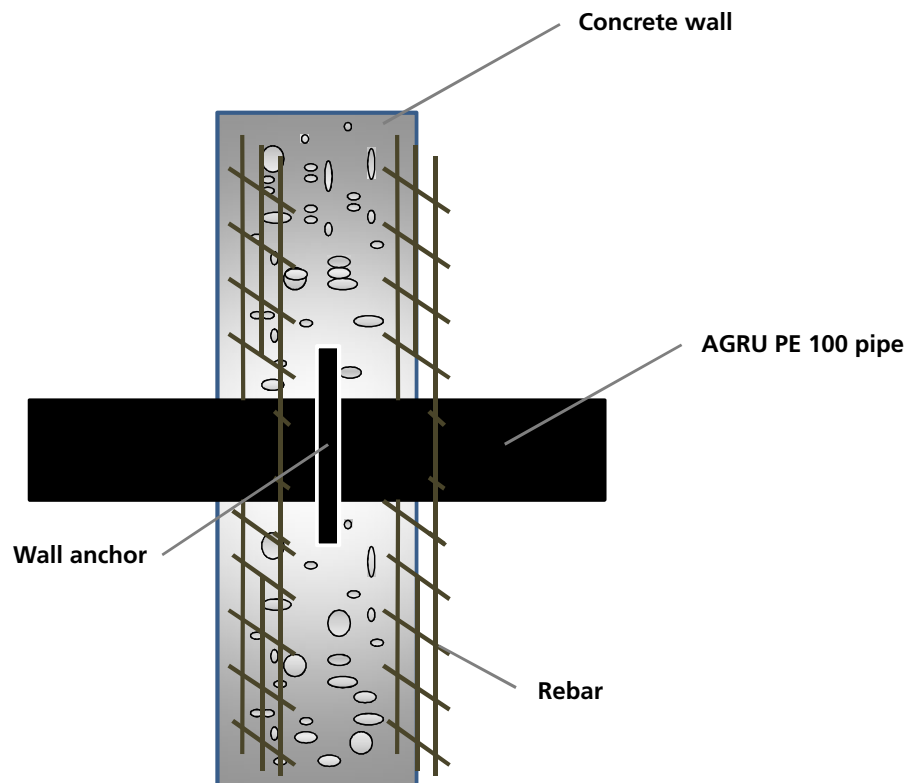
Long term field experiences have shown that thrust blocks aren't needed for PE 100(-RC) pipelines and that PE pipelines resist soil settlements. Also according to AWWA Manual M55, welded and flanged PE connections are fully restrained and do not require external joint restraints of thrust block joint anchors.

If sufficient soil conditions are not given (no proper soil stability), geotextile fabrics, and / or cement stabilized sand should be used for supporting the trench bottom .

An experienced engineer (in soils) is responsible for evaluating the soil conditions and defining the correct installation parameters to ensure perfect operation of the system.

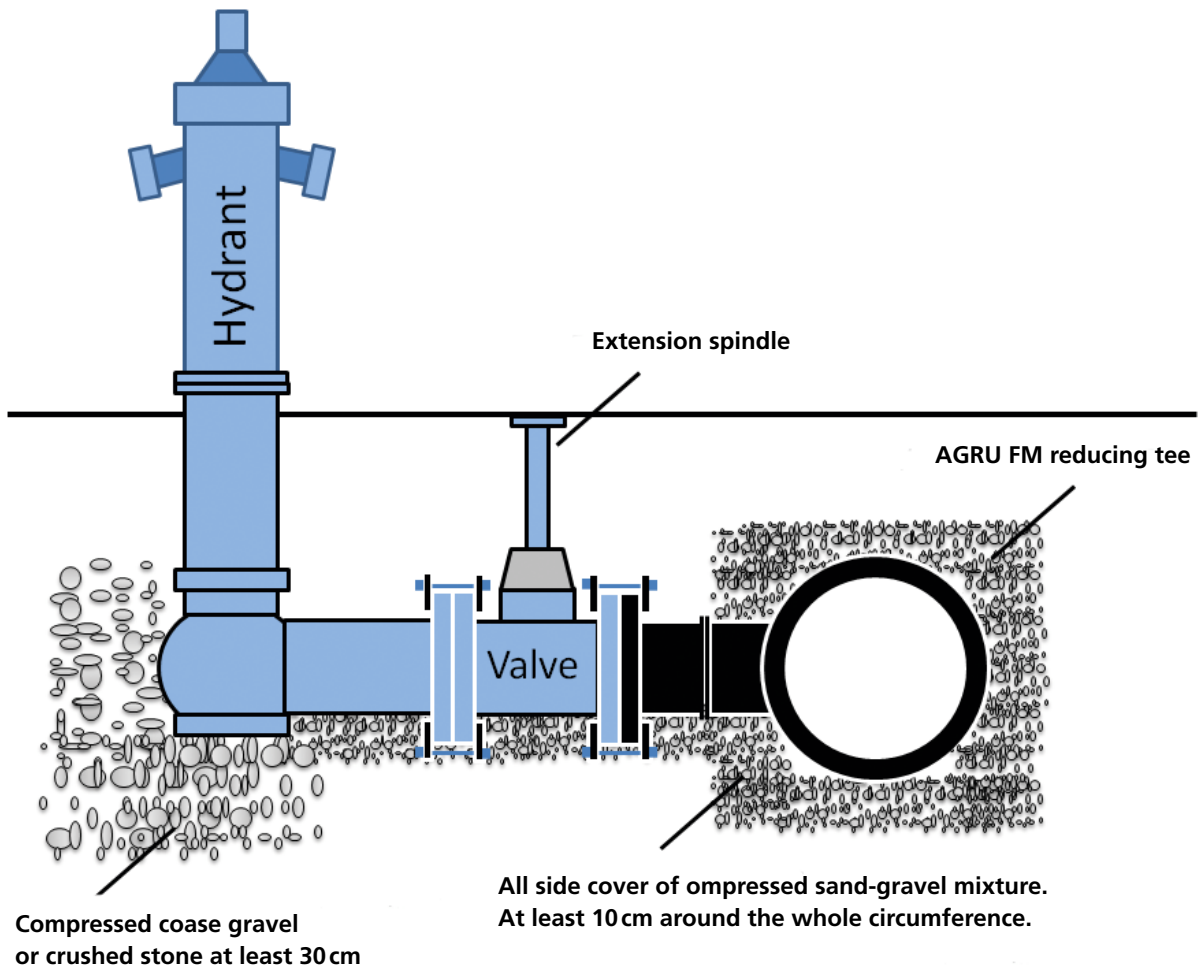
## 10 Anchor

Anchors can be created under certain circumstances to limit the movement of HDPE when transitioned with other types of pipe or connected to a pump or valve. The drawing below shows steel reinforcement located near the puddle flange (fix point) to compensate the forces of expansion and contraction which un-reinforced concrete might not handle.



## 11 Hydrant Connection

Connection to a hydrant requires flanges. Due to its weight it is recommended to support the hydrant at the bottom with compressed coarse gravel or crushed stone for at least 30 cm. If the soil around the hydrant does not provide sufficient stability, it is recommended to use geotextile fabrics to stabilize the area around the hydrant bottom. This prevents soil settlements which can lead to high bending moments on the pipe and the connections.



## 12 Hydrostatic pressure test

In order to check the entire finished pipe system for leaks, a hydrostatic pressure test according to EN 805 and/or national standards is recommended. For safety reasons it is not recommended to test with compressed air, only water is suitable!

### 12.1 Filling and checking

The filling of the pipeline with clean water should be conducted with open air valves and adequate venting. Calibration of the testing equipment should be carried out, before the equipment is connected to the pipe and the pressure test is started. During the test all venting devices should be closed.

### 12.2 Preparation pressure test

To prevent the pipeline from moving, it should be covered with enough back-fill material before the pressure test. The joints may be left uncovered. The anchors and the bearings must verifiably withstand the forces caused by the test pressure. The test should be conducted either on the complete pipeline or in sections. When the pipeline is filled, the system test pressure (STP) must be reached at the lowest part of the pipeline. At the same time the system working pressure (MDP) must be reached at least at the highest point of each testing section. Before the pressure test the pipe has to be cleaned from any kind of contamination and has to be ventilated.

### 12.3 Test pressure

The system test pressure (STP) can be calculated with following formula by taking the highest system working pressure MDP into account:

$$STP = MDP_c + 100 \text{ kPa}$$

**By not considering the pressure surge:**

$$STP = MDP_a \cdot 1,5$$

**or**

$$STP = MDP_a + 500 \text{ kPa}$$

The lower of the two values is valid.

The pressure surge should be calculated with appropriate basic equations and assumptions of the engineer (worst case).

The testing equipment should be connected to the pipeline at its the lowest part.

For the calculation of short pipe sections and branch lines  $\leq$  DN 80 and shorter than 100 m, the operating pressure can be assumed as system working pressure, if not otherwise specified.

### 12.4 Types of pressure tests

The type of pressure test is determined depending on the type of the pipe and the material.

The pressure test can consist of up to three parts:

**Pressure pre-test**

**Integrated pressure loss test**

**Main pressure test**

## 12.5 Pressure pre-test

The pressure pre-test is carried out to avoid incorrect test results during the main pressure test. During the pre-test following steps are carried out:

- Relaxation phase (min. 1h) after the purging and venting of the pipeline. In the process the air must not get into the test sections.
- Continuous pressure increase (within 10 min) to the system pressure (STP) and subsequent holding of the pressure (30 min). During that period the pipeline should be inspected for leakages.
- Wait the rest period (1h) without re-pressurising and measure the residual pressure. If the pressure drop is higher than 30% of the STP, then the pressure test has to be stopped to search for the cause of the failure. The rerun of the test is only possible 1h after relaxation phase at the earliest.
- When the pre-test is completed successfully, the main pressure test can be started.

## 12.6 Integrated pressure loss test

The pressure loss test is used to determine the residual air volume in the pipeline. It allows to improve the precision of the main pressure test. During the pressure loss test the following steps are performed:

- Rapid pressure reduction ( $\Delta p$ : 10 – 15% of STP) by draining the water
- Measuring the volume of the drained water
- Calculating the allowable loss of water  $\Delta V_{max}$  according to the following equation:

$$\Delta V_{max} = 1,2 \cdot V \cdot \Delta p \cdot \left( \frac{1}{E_w} \frac{1D}{e \cdot E_r} \right)$$

$\Delta V_{max}$  allowable loss of water [l]

V volume test section [l]

$\Delta p$  measured pressure drop [kPa]

$E_w$  compressive modulus water [kPa]

D inner diameter of the pipe [m]

e wall thickness of the pipe [m]

$E_r$  Young's Modulus pipe wall in circumferential direction [kPa]

1,2 factor: allowable amount of air before the main pressure test

Checking if  $\Delta V > \Delta V_{max}$ . If  $\Delta V$  is higher, the pressure test has to be stopped and repeated after the relaxation phase.

## 12.7 Main pressure test

The integrated pressure loss test interrupts the viscoelastic expansion of the pipe and leads to a contraction of the pipeline. The resulting pressure rise is monitored and recorded in the period of 30 minutes. If the pressure curve doesn't drop during the monitoring period, the main pressure test is considered as passed. A drop of the pressure curve indicates a leakage in the pipeline. When uncertainty exists, the test duration can be extended to 90 minutes. In doing so the pressure drop cannot exceed 25 kPa, otherwise the main pressure test is considered as failed. The repeat of the main pressure test is only possible if the complete test process (+1h relaxation phase) is repeated.

# 13 Specification of AGRU PE 100 pipes and fittings for underground fire protection systems

## 1. Scope

Requirements on FM approved pipes and fittings made of PE100 for underground fire protection systems.

## 2. Materials

High quality and virgin PE 100 and PE 100-RC materials that are listed by the PE 100+ association.

## 3. Pipes

Pipes should be produced according to ISO 4427, EN 12201 and/or AWWA C906. As required by FM approval standard 1613, all FM approved pipes shall bear the Approval Mark. The Approval Mark shall be displayed visibly and permanently on the products.

## 4. Fittings

Fittings should be produced according to ISO 4427 and EN 12201, and certified according to EN 12201 and FM 1613. As required by FM approval 1613, all FM approved fittings shall bear the Approval Mark. The Approval Mark shall be displayed visibly and permanently on the products. Whenever available, injection molded fittings should be used preferably.

## 5. Approved Manufacturer

FM approved PE 100 or PE 100-RC Fittings should be provided by AGRU, FM approved PE 100 or PE 100-RC pipes should be provided by AGRU-FRANK. Pipes and fittings should be produced and supplied by the same company as a complete system. Manufacturer must be ISO-9001 and ISO 14001 certified. An inspection certificate acc. to EN 10204 (3.1) must be provided by the manufacturer on request.

## 6. Pressure rating

FM approved pipes and fittings shall have a pressure rating at 20 °C of:

CERTIFIED PRESSURE FOR FIRE PROTECTION SYSTEMS (Operating pressure)		DESIGN PRESSURE ACCORDING TO EN 12201
175 psi	12 bar	16 bar
200 psi	14 bar	20 bar

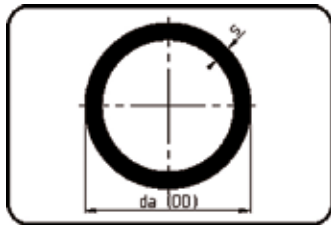
## 8. Installation procederes

Product information and installation procedure data must be available by the producer/supplier. This data must be released by FM approvals as well/or in accordance to FM global property loss prevention data sheet 3-10 and/or NFPA 24.



14 Product range

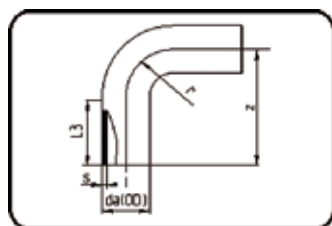
# 175 psi



- Pipe
- Extruded
- PE 100(-RC) black
- SDR 11, ISO S-5



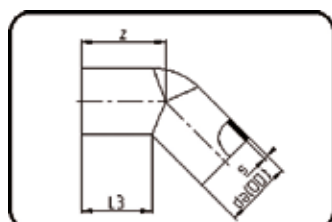
Dim.	Code	da (OD) mm	s mm	Weight (kg)
63	70.722.0063.11	63	5.8	1.06
75	70.722.0075.11	75	6.8	1.48
90	70.722.0090.11	90	8.2	2.14
110	70.722.0110.11	110	10	3.18
125	70.722.0125.11	125	11.4	4.12
140	70.722.0140.11	140	12.7	5.13
160	70.722.0160.11	160	14.6	6.74
180	70.722.0180.11	180	16.4	8.51
200	70.722.0200.11	200	18.2	10.5
225	70.722.0225.11	225	20.5	13.3
250	70.722.0250.11	250	22.7	16.3
280	70.722.0280.11	280	25.4	20.5
315	70.722.0315.11	315	28.6	25.9
355	70.722.0355.11	355	32.2	32.9
400	70.722.0400.11	400	36.3	41.7
450	70.722.0450.11	450	40.9	52.8
500	70.722.0500.11	500	45.4	65.2
560	70.722.0560.11	560	50.8	81.7
630	70.722.0630.11	630	57.2	103



- 90° Elbow
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



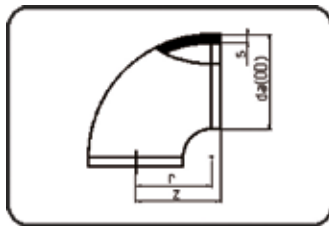
Dim.	Code	da (OD) mm	s mm	z mm	r mm	L3 mm	Weight
63	25.068.0063.11	63	5.8	129.5	63	66.5	0.263
75	25.068.0075.11	75	6.8	150	75	75	0.416
90	25.068.0090.11	90	8.2	168	90	76	0.685
110	25.068.0110.11	110	10	189	110	82	1.144
125	25.068.0125.11	125	11.4	218	125	92	1.681
140	25.068.0140.11	140	12.7	241	140	95	2.38
160	25.068.0160.11	160	14.6	260	160	100.5	3.34
180	25.068.0180.11	180	16.4	285	180	109	4.58
200	25.068.0200.11	200	18.2	318.5	200	118.5	6.18
225	25.068.0225.11	225	20.5	353	225	125	8.52
250	25.061.0250.11	250	22.7	304	4.5	175	9.44
280	25.061.0280.11	280	25.4	340	4.5	197	12.86
315	25.061.0315.11	315	28.6	370	4.5	205	18.1



- 45° Elbow
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



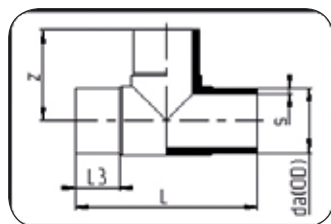
Dim.	Code	da (OD) mm	s mm	z mm	L3 mm	Weight
63	25.060.0063.11	63	5.8	80	65.5	0.172
75	25.060.0075.11	75	6.8	90	70	0.274
90	25.060.0090.11	90	8.2	104	82	0.44
110	25.060.0110.11	110	10	108	82	0.679
125	25.060.0125.11	125	11.4	132.5	99.5	1.06
140	25.060.0140.11	140	12.7	135	100	1.4
160	25.060.0160.11	160	14.6	156.5	116.5	2.06
180	25.060.0180.11	180	16.4	176.5	131.5	2.86
200	25.060.0200.11	200	18.2	167	122	3.58
225	25.060.0225.11	225	20.5	182.5	125.5	4.76
250	25.060.0250.11	250	22.7	217	158	6.96
280	25.060.0280.11	280	25.4	238	168	9.31
315	25.060.0315.11	315	28.6	248	176	12.9



- 90° Elbow
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



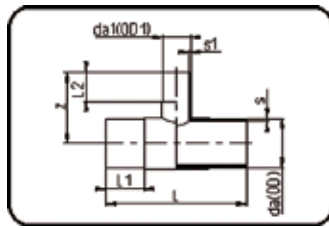
Dim.	Code	da (OD) mm	s mm	z mm	r mm	Weight
63	25.001.0063.11	63	5.8	70	63	0.12
75	25.001.0075.11	75	6.6	85	75	0.21
90	25.001.0090.11	90	8.2	100	90	0.37
110	25.001.0110.11	110	10.0	124	110	0.66
125	25.001.0125.11	125	11.4	140	125	0.93
140	25.001.0140.11	140	12.7	150	140	1.28
160	25.001.0160.11	160	14.6	180	155	2.1
180	25.001.0180.11	180	16.4	200	180	2.82
200	25.001.0200.11	200	18.2	220	200	4.02
225	25.001.0225.11	225	20.5	243	225	5.24
250	25.001.0250.11	250	22.7	290	265	8.02
280	25.001.0280.11	280	25.4	290	265	9.75
315	25.001.0315.11	315	28.6	340	300	14.36
355	25.001.0355.11	355	32.2	340	300	18.46
400	25.001.0400.11	400	36.3	345	300	23.5
450	25.001.0450.11	450	40,9	445	400	38,8
500	25.001.0500.11	500	45.5	445	400	48.34



- Equal Tee
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



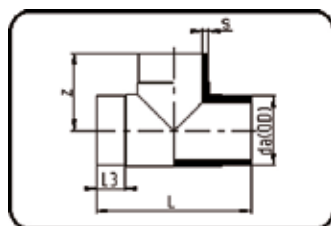
Dim.	Code	da (OD) mm	s mm	z mm	L mm	L3 mm	Weight
63	25.066.0063.11	63	5.8	114	226	64	226
75	25.066.0075.11	75	6.8	128	260	70	260
90	25.066.0090.11	90	8.2	143	286	79	286
110	25.066.0110.11	110	10	158	317	85	317
125	25.066.0125.11	125	11.4	177	356	91	356
140	25.066.0140.11	140	12.7	190	380	96.5	380
160	25.066.0160.11	160	14.6	202.5	405	99	405
180	25.066.0180.11	180	16.4	260	521	136	521
200	25.066.0200.11	200	18.2	245	490	112	490
225	25.066.0225.11	225	20.5	271	548	124	548
250	25.066.0250.11	250	22.7	310	622	147	622
280	25.066.0280.11	280	25.4	347	694	158	694
315	25.066.0315.11	315	28.6	375	752	168	752
355	25.066.0355.11	355	32.2	437	874	188	694
400	25.066.0400.11	400	36.3	470	940	198	752



- Reducing Tee
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



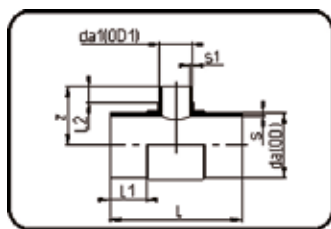
Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	z mm	L mm	L1 mm	L2 mm	s1 mm	Weight
63/50	25.065.6350.11	63	50	5.8	102.5	216	60	56	4.6	0.318
75/63	25.065.7563.11	75	63	6.8	117	252	70	63	5.8	0.552
90/63	25.065.9063.11	90	63	8.2	136	266	79	64	5.8	0.76
90/75	25.065.9075.11	90	75	8.2	138	272	73	68	6.8	0.821
110/63	25.065.1163.11	110	63	10	155	305	85	65	5.8	1.24
110/75	25.065.1175.11	110	75	10	149	305	83	68	6.8	1.22
110/90	25.065.1190.11	110	90	10	155	310	84	79	8.2	1.303
125/90	25.065.1290.11	125	90	11.4	168	332	109	89	8.2	1.7
125/110	25.065.1211.11	125	110	11.4	167	340	90	83	10	1.92
160/63	25.065.1663.11	160	63	14.6	172	340	99.5	66	5.8	2.62
160/75	25.065.1675.11	160	75	14.6	179	344	101	76	6.8	2.68
160/90	25.065.1690.11	160	90	14.6	177	343	101	80	8.2	2.7
160/110	25.065.1611.11	160	110	14.6	196	392	98	84.5	10	3.26
180/90	25.065.1890.11	180	90	16.4	200	420	136	97	8.2	4.42
180/110	25.065.1811.11	180	110	16.4	220	455	145	101	10	4.72
180/160	25.065.1816.11	180	160	16.4	204	412	105	94	14.6	4.7
200/63	25.065.2063.11	200	63	18.2	226	553	134	82	5.8	7.14
200/90	25.065.2090.11	200	90	18.2	229	550	134.5	96	8.2	7.16
200/110	25.065.2011.11	200	110	18.2	242	550	134	103	10	7.34
200/125	25.065.2012.11	200	125	18.2	245	550	134	110	11.4	7.34
200/160	25.065.2016.11	200	160	18.2	270	550	134	114	14.6	8.6
225/75	25.065.2275.11	225	75	20.5	226	440	120	75	6.8	6.82
225/90	25.065.2290.11	225	90	20.5	224	442	120	79	8.2	6.86
225/110	25.065.2211.11	225	110	20.5	226	439	120	85	10	6.9
225/160	25.065.2216.11	225	160	20.5	246	486	120	98	14.6	8.46
225/180	25.065.2218.11	225	180	20.5	274	546	132	135	16.4	9.32
315/110	25.065.3111.11	315	110	28.6	290	546	170	100	10	15.9
315/160	25.065.3116.11	315	160	28.6	310	575	170	120	14.6	17.52
315/225	25.065.3122.11	315	225	28.6	335	638	170	145	20.5	20
315/250	25.065.3125.11	315	250	28.6	333	670	170	150	22.7	21.46



- Equal Tee
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



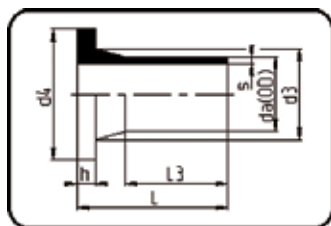
Dim.	Code	da (OD) mm	s mm	z mm	L mm	L3 mm	Weight
63	25.006.0063.11	63	5.8	72	144	25	0.239
75	25.006.0075.11	75	6.8	75	152	15	0.408
90	25.006.0090.11	90	8.2	105	213	38	0.701
110	25.006.0110.11	110	10	122	253	51	1.24
125	25.006.0125.11	125	11.4	140	277	52	1.763
140	25.006.0140.11	140	12.7	152	304	53	2.48
160	25.006.0160.11	160	14.6	170	340	57	3.44
180	25.006.0180.11	180	16.4	182.5	365	57	4.6
200	25.006.0200.11	200	18.2	200	400	57	6.32
225	25.006.0225.11	225	20.5	220	440	57	8.56
250	25.006.0250.11	250	22.7	235	470	72	11.16
280	25.006.0280.11	280	25.4	270	536	80	16.2
315	25.006.0315.11	315	28.6	270	540	80	19.7
355	25.006.0355.11	355	32.2	340	680	105	31.32
400	25.006.0400.11	400	36.3	350	695	103	39.3
450	25.006.0450.11	450	40.9	450	900	130	65.52
500	25.006.0500.11	500	45.4	450	900	130	73.72



- Reducing Tee
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	z mm	L mm	L1 mm	L2 mm	s1 mm	Weight
125/63	25.016.1263.11	125	63	11.4	112	275	75	31	5.8	1.42
140/63	25.016.1463.11	140	63	12.7	120	302	87	32	5.8	1.88
140/75	25.016.1475.11	140	75	12.7	130	302	87	35	6.8	1.85
140/90	25.016.1490.11	140	90	12.7	130	305	88	42	8.2	1.967
140/110	25.016.1411.11	140	110	12.7	141	305	54	47	10	2.28
160/125	25.016.1612.11	160	125	14.6	150	325	62	52	11.4	2.82
180/63	25.016.1863.11	180	63	16.4	139	358	132	32	5.8	3.16
180/75	25.016.1875.11	180	75	16.4	144	362	119	31	6.8	3.18
180/125	25.016.1812.11	180	125	16.4	166	362	100	52	11.4	3.36
225/125	25.016.2212.11	225	125	20.5	178	456	143	40	11.4	6.4

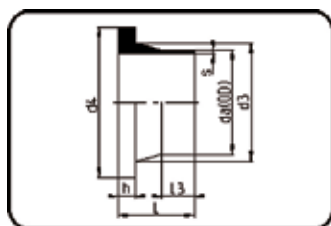


- Stub flange
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h mm	Weight
63	25.062.0063.11	63	5.8	122	78	75	102	14	0.217
75	25.062.0075.11	75	6.8	125	86	89	122	16	0.319
90	25.062.0090.11	90	8.2	140	101	105	138	17	0.454
110	25.062.0110.11	110	10	159	115	125	158	18	0.729
125	25.062.0125.11	125	11.4	169	122	132	158	25	0.885
140	25.062.0140.11	140	12.7	188	128.5	155	188	25	1.296
160	25.062.0160.11	160	14.6	200	148	175	212	25	1.76
180	25.062.0180.11	180	16.4	209	155	183	212	30	2.04
200	25.062.0200.11	200	18.2	210	140	232	268	32	3.22
225	25.062.0225.11	225	20.5	210	145	235	268	32	3.32
250	25.062.0250.11	250	22.7	204	132	285	320	35	4.7
280	25.062.0280.11	280	25.4	218	145	291	320	35	5.2
315	25.062.0315.11	315	28.6	238	154	335	370	35	7.58
355	25.062.0355.11	355	32.2	257	176	373	430	40	10,64
400	25.062.0400.11	400	36.3	274	185	427	482	46	14.42

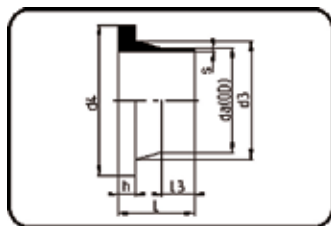




- Stub flange DIN
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



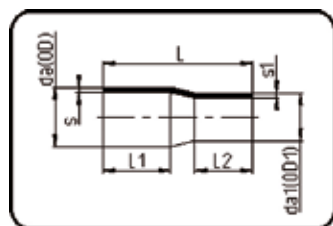
Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h mm	Weight
63	25.012.0063.11	63	5.8	50	20	75	102	14	0.127
75	25.012.0075.11	75	6.8	50.5	18	89	122	16	0.204
90	25.012.0090.11	90	8.2	80	40	105	138	17	0.332
110	25.012.0110.11	110	10	80	38	125	158	18	0.461
125	25.012.0125.11	125	11.4	80	38	132	158	25	0.513
140	25.012.0140.11	140	12.7	92	37	155	188	25	0.817
160	25.012.0160.11	160	14.6	92	38	175	212	25	1.026
180	25.012.0180.11	180	16.4	93	43	183	212	30	1.06
200	25.012.0200.11	200	18.2	114	40	232	268	32	2.14
225	25.012.0225.11	225	20.5	113	52	235	268	32	2.1
250	25.012.0250.11	250	22.7	130	58	285	320	35	3.56
280	25.012.0280.11	280	25.4	128	58	291	320	35	3.42
315	25.012.0315.11	315	28.6	136	65	335	370	35	5
355	25.012.0355.11	355	32.2	150	70	373	430	40	6.88
400	25.012.0400.11	400	36.3	155	69	427	482	46	9.04
450	25.012.0450.11	450	40.9	166	63	514	585	60	16.22
500	25.012.0500.11	500	45.4	175	70	530	585	60	15.76



- Stub flange ANSI
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



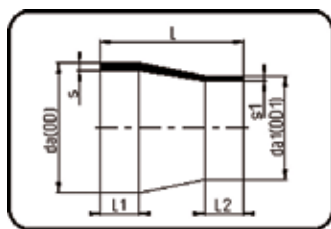
Dim.	Code	da (OD) mm	da mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h	Weight
20	25.012.1020.11	20	0.5	1.9	52	30	27	44.5	7	0.016
25	25.012.1025.11	25	0.75	2.3	50	25	33	54.1	9	0.026
32	25.012.1032.11	32	1	3	50	25	40	63.5	10	0.042
40	25.012.1040.11	40	1.25	3.7	50	24	50	71.5	11	0.064
50	25.012.1050.11	50	1.5	4.6	53	22	61	82.55	12	0.094
63	25.012.1063.11	63	2	5.8	50	20	75	100.4	14	0.125
75	25.012.1075.11	75	2.5	6.8	50.5	18	89	117	16	0.188
90	25.012.1090.11	90	3	8.2	80	40	105	132.4	17	0.31
110	25.012.1110.11	110	4	10	80	38	125	158	18	0.469
125	25.012.1125.11	125	4.5	11.4	80	38	132	158	25	0.515
160	25.012.1160.11	160	6	14.6	92	38	175	212	25	1.02
200	25.012.1200.11	200	8	18.2	114	40	232	268	32	2.18
225	25.012.1225.11	225	9	20.5	113	52	235	268	32	2.08
250	25.012.1250.11	250	10	22.7	130	58	285	320	35	3.56
315	25.012.1315.11	315	12	28.6	136	65	335	370	35	5
355	25.012.1355.11	355	14	32.2	150	70	373	430	40	6.88
400	25.012.1400.11	400	16	36.3	155	69	427	482	46	9.04
450	25.012.1450.11	450	18	40.9	166	63	514	545	60	16.22
500	25.012.1500.11	500	20	45.4	175	70	530	585	60	15.76



- Reducer concentric
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



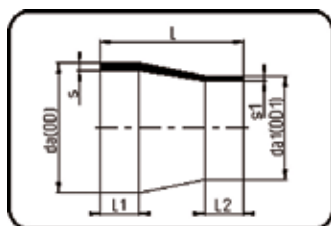
Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	L mm	L1 mm	L2 mm	s1 mm	Weight
90/63	25.067.9063.11	90	63	8.2	172	79	63	5.8	0.29
110/63	25.067.1163.11	110	63	10	178	82	63	5.8	0.425
110/90	25.067.1190.11	110	90	10	177	82	79	8.2	0.499
125/63	25.067.1263.11	125	63	11.4	195	87	63	5.8	0.56
125/90	25.067.1290.11	125	90	11.4	200	87.5	79	8.2	0.635
125/110	25.067.1211.11	125	110	11.4	200	87.5	82	10	0.739
140/125	25.067.1412.11	140	125	12.7	211	94.5	88.5	11.4	0.992
160/90	25.067.1690.11	160	90	14.6	217	100.5	79	8.2	1.06
160/110	25.067.1611.11	160	110	14.6	225	98	85.5	10	1.18
160/125	25.067.1612.11	160	125	14.6	231	98	89.5	11.4	1.32
160/140	25.067.1614.11	160	140	14.6	229	98	92	12.7	1.36
180/125	25.067.1812.11	180	125	16.4	270	129.5	94.5	11.4	1.82
180/160	25.067.1816.11	180	160	16.4	276	129.5	105.5	14.6	2.11
200/160	25.067.2016.11	200	160	18.2	252	112	98.5	14.6	2.27
250/160	25.067.2516.11	250	160	22.7	314	153.5	111.5	14.6	3.98
250/225	25.067.2522.11	250	225	22.7	315	153	131.5	20.5	4.74
280/250	25.067.2825.11	280	250	25.4	355	163.5	153.5	22.7	6.64
315/225	25.067.3122.11	315	225	28.6	375	170.5	131.5	20.5	7.84
315/250	25.067.3125.11	315	250	28.6	375	173.5	153.5	22.7	8.32



- Reducer concentric
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



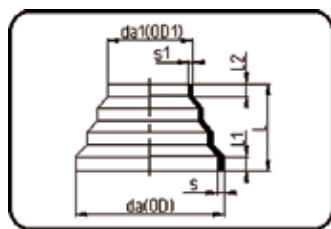
Dim.	Code	da (OD) mm	da (OD1) mm	s mm	L mm	L1 mm	L2 mm	s1 mm	Weight
75/63	25.009.7563.11	75	63	6.8	59	19	18	5.8	0.08
90/50	25.009.9050.11	90	50	8.2	76	22	14	4.6	0.125
90/63	25.009.9063.11	90	63	8.2	70	22	18	5.8	0.116
90/75	25.009.9075.11	90	75	8.2	68	22	19	6.8	0.129
100/50	25.009.1150.11	110	50	10	90	28	14	4.6	0.202
110/63	25.009.1163.11	110	63	10	84	28	18	5.8	0.2
110/75	25.009.1175.11	110	75	10	85	28	19	6.8	0.239
110/90	25.009.1190.11	110	90	10	73	28	22	8.2	0.22
125/63	25.009.1263.11	125	63	11.4	100	32	18	5.8	0.293
125/75	25.009.1275.11	125	75	11.4	100	32	19	6.8	0.274
125/90	25.009.1290.11	125	90	11.4	89	32	22	8.2	0.304
125/110	25.009.1211.11	125	110	11.4	89	32	28	10	0.329
140/75	25.009.1475.11	140	75	12.7	110	35	19	6.8	0.459
140/90	25.009.1490.11	140	90	12.7	110	35	22	8.2	0.493
140/110	25.009.1411.11	140	110	12.7	100	35	28	10	0.472
140/125	25.009.1412.11	140	125	12.7	92	35	32	11.4	0.445
160/90	25.009.1690.11	160	90	14.6	108	40	22	8.2	0.552
160/110	25.009.1611.11	160	110	14.6	108	40	28	10	0.639
160/125	25.009.1612.11	160	125	14.6	114	40	32	11.4	0.686
160/140	25.009.1614.11	160	140	14.6	114	40	35	12.7	0.66
180/90	25.009.1890.11	180	90	16.4	157	45	22	8.2	0.99
180/110	25.009.1811.11	180	110	16.4	157	45	28	10	1.091
180/125	25.009.1812.11	180	125	16.4	120	45	32	11.4	0.82
180/140	25.009.1814.11	180	140	16.4	136	45	35	12.7	1.03
180/160	25.009.1816.11	180	160	16.4	123	45	40	14.6	0.96



- Reducer concentric
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



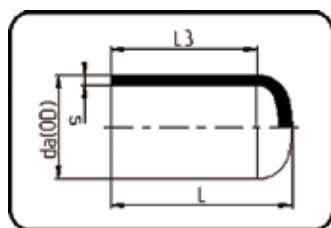
Dim.	Code	da (OD) mm	da (OD1) mm	s mm	L mm	L1 mm	L2 mm	s1 mm	Weight
200/140	25.009.2014.11	200	140	18.2	137	50	35	12.7	1.277
200/160	25.009.2016.11	200	160	18.2	134	50	40	14.6	1.24
200/180	25.009.2018.11	200	180	18.2	137	50	45	16.4	1.361
225/140	25.009.2214.11	225	140	20.5	162	55	35	12.8	1.9
225/160	25.009.2216.11	225	160	20.5	137	55	40	14.6	1.59
225/180	25.009.2218.11	225	180	20.5	162	55	45	16.4	1.91
225/200	25.009.2220.11	225	200	20.5	162	55	50	18.2	2.1
250/160	25.009.2516.11	250	160	22.7	160	60	45	14.6	2
250/180	25.009.2518.11	250	180	22.7	177	60	45	16.4	2.52
250/200	25.009.2521.11	250	200	22.7	144	60	50	18.2	2.12
250/225	25.009.2522.11	250	225	22.7	144	60	55	20.5	2.26
280/200	25.009.2820.11	280	200	25.4	202	70	50	18.2	3.64
280/200	25.009.2822.11	280	225	25.4	202	70	55	20.5	3.76
280/200	25.009.2825.11	280	250	25.4	165	70	60	22.7	3.2
315/200	25.009.3120.11	315	200	28.6	193	80	50	18.2	4.1
315/225	25.009.3122.11	315	225	28.6	209	80	55	20.5	4.56
315/250	25.009.3125.11	315	250	28.6	185	80	60	22.7	4.34
315/280	25.009.3128.11	315	280	28.6	227	80	70	25.4	5.66



- Reducer concentric
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



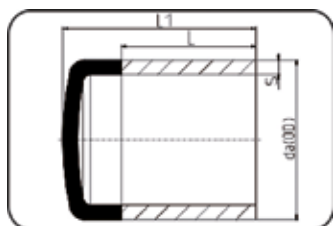
Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	L mm	L1 mm	L2 mm	s1 mm	Weight
110/63	25.007.1163.11	110	63	10	62	9	6	5.8	0.139
125/75	25.007.1275.11	125	75	11.4	72	13	8	6.8	0.225
160/110	25.007.1611.11	160	110	14.6	83	13	13	10	0.429
225/160	25.007.2216.11	225	160	20.5	90	15	12	14.6	1.02
315/225	25.007.3122.11	315	225	28.6	130	25	20	20.5	2.68
450/315	25.007.4531.11	450	315	40.9	181	40	20	28.6	7.82



- Endcap
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



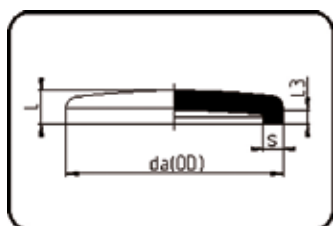
Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	Weight
63	25.064.0063.11	63	5.8	80.5	64	0.092
75	25.064.0075.11	75	6.8	91	75	0.149
90	25.064.0090.11	90	8.2	107	84	0.253
110	25.064.0110.11	110	10	133	105	0.476
125	25.064.0125.11	125	11.4	132	100	0.586
140	25.064.0140.11	140	12.7	144	106	0.83
160	25.064.0160.11	160	14.6	167.5	123.5	1.198
180	25.064.0180.11	180	16.4	160	111	1.46
200	25.064.0200.11	200	18.2	181.5	117	2.06
225	25.064.0225.11	225	20.5	202.5	130	2.94
250	25.064.0250.11	250	22.7	225	160	3.91
280	25.064.0280.11	280	25.4	248	162	5.36
315	25.064.0315.11	315	28.6	269	167	7.1



- Endcap
- Long spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



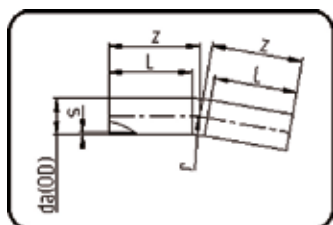
Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	Weight
355	25.004.6355.11	355	32.2	300	420	16.23
400	25.004.6400.11	400	36.3	300	430	21.2



- Endcap
- Short spigot
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	Weight
450	25.004.0450.11	450	40.9	140	64	11.55
500	25.004.0500.11	500	45.4	148	65	14.8

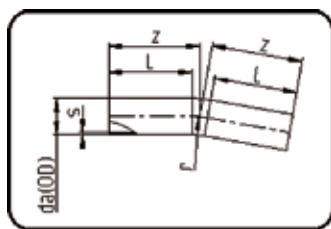


- Sweep bend 11°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.394.0090.11	90	8.2	340	135	150	1.42
110	25.394.0110.11	110	10	330	165	150	2.07
125	25.394.0125.11	125	11.4	380	188	150	3.08
140	25.394.0140.11	140	12.7	395	210	150	3.96
160	25.394.0160.11	160	14.6	415	480	150	5.54
180	25.394.0180.11	180	16.4	450	270	150	7.49
200	25.394.0200.11	200	18.2	480	300	150	9.88
225	25.394.0225.11	225	20.5	510	338	150	13.36
250	25.394.0250.11	250	22.7	540	375	250	17.66
280	25.394.0280.11	280	25.4	450	420	250	22.2
315	25.394.0315.11	315	28.6	500	496	300	32.51

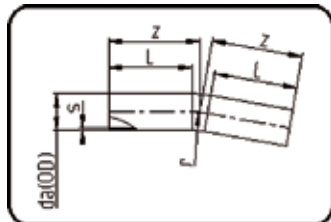
Product range 175 psi



- Sweep bend 22°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.395.0090.11	90	8,2	340	135	150	1.5
110	25.395.0110.11	110	10	330	165	150	2.07
125	25.395.0125.11	125	11,4	380	188	150	3.06
140	25.395.0140.11	140	12,7	395	210	150	3.96
160	25.395.0160.11	160	14,6	420	480	150	5.66
180	25.395.0180.11	180	16,4	450	270	150	7.6
200	25.395.0200.11	200	18,2	480	300	150	10
225	25.395.0225.11	225	20,5	510	338	150	12.5
250	25.395.0250.11	250	22,7	540	375	250	17.66
280	25.395.0280.11	280	25,4	450	420	250	22.2
315	25.395.0315.11	315	28,6	500	496	300	32.51

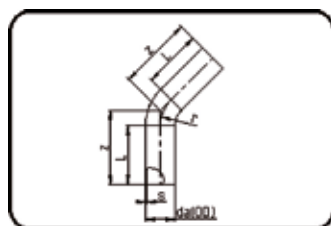


- Sweep bend 30°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.396.0090.11	90	8,2	340	135	150	1.42
110	25.396.0110.11	110	10	330	165	150	2.07
125	25.396.0125.11	125	11,4	380	188	150	3.06
140	25.396.0140.11	140	12,7	400	210	150	3.96
160	25.396.0160.11	160	14,6	420	480	150	5.66
180	25.396.0180.11	180	16,4	450	270	150	7.82
200	25.396.0200.11	200	18,2	480	300	150	9.88
225	25.396.0225.11	225	20,5	520	338	150	13.36
250	25.396.0250.11	250	22,7	560	375	250	17.66
280	25.396.0280.11	280	25,4	450	420	250	22.2
315	25.396.0315.11	315	28,6	500	496	300	32.51

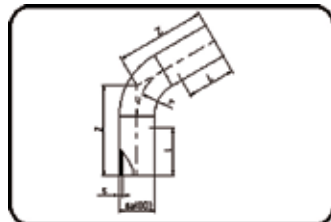




- Sweep bend 45°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



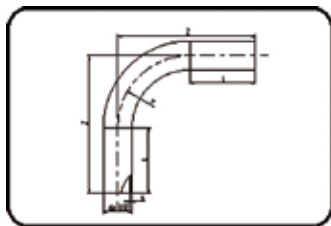
Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.397.0090.11	90	8,2	340	135	150	1.42
110	25.397.0110.11	110	10	340	165	150	2.07
125	25.397.0125.11	125	11,4	380	188	150	3.08
140	25.397.0140.11	140	12,7	405	210	150	3.96
160	25.397.0160.11	160	14,6	425	240	150	5.64
180	25.397.0180.11	180	16,4	460	270	150	7.76
200	25.397.0200.11	200	18,2	495	300	150	9.79
225	25.397.0225.11	225	20,5	525	338	150	13.36
250	25.397.0250.11	250	22,7	570	375	250	17.66
280	25.397.0280.11	280	25,4	510	420	250	21.6
315	25.397.0315.11	315	28,6	560	496	300	31.6



- Sweep bend 60°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



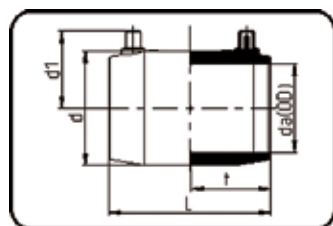
Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.398.0090.11	90	8,2	250	135	150	1.22
110	25.398.0110.11	110	10	280	165	150	1.96
125	25.398.0125.11	125	11,4	300	188	150	2.884
140	25.398.0140.11	140	12,7	350	210	150	4.617
160	25.398.0160.11	160	14,6	380	240	150	6
180	25.398.0180.11	180	16,4	410	270	150	8.51
200	25.398.0200.11	200	18,2	430	300	150	12.6
225	25.398.0225.11	225	20,5	450	338	150	15.96
250	25.398.0250.11	250	22,7	570	375	250	22.82
280	25.398.0280.11	280	25,4	580	420	250	28.7
315	25.398.0315.11	315	28,6	690	496	300	44.03



- Sweep bend 90°
- Long spigot
- Formed out of a pipe
- PE 100(-RC) black
- SDR 11, ISO S-5



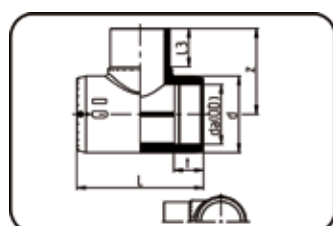
Dim.	Code	da (OD) mm	s mm	z mm	r mm	L mm	Weight
90	25.399.0090.11	90	8,2	380	135	150	135
110	25.399.0110.11	110	10	440	165	150	165
125	25.399.0125.11	125	11,4	470	188	150	188
140	25.399.0140.11	140	12,7	520	210	150	210
160	25.399.0160.11	160	14,6	550	240	150	240
180	25.399.0180.11	180	16,4	590	270	150	270
200	25.399.0200.11	200	18,2	650	300	150	300
225	25.399.0225.11	225	20,5	675	338	150	338
250	25.399.0250.11	250	22,7	780	375	250	375
280	25.399.0280.11	280	25,4	750	420	250	420
315	25.399.0315.11	315	28,6	900	496	300	496



- EF-coupler
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



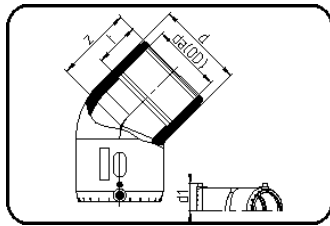
Dim.	Code	da (OD) mm	L mm	d mm	d1 mm	t mm	Weight
63	25.173.0063.11	63	127	83	59	63	0.249
75	25.173.0075.11	75	141	97	65.5	70	0.35
90	25.173.0090.11	90	141	112	72	69	0.46
110	25.173.0110.11	110	152	136	83	75	0.73
125	25.173.0125.11	125	172	155	91	84.5	1.03
140	25.173.0140.11	140	181	180	99	89.5	1.58
160	25.173.0160.11	160	181	197	109	89.5	1.71
180	25.173.0180.11	180	201	221	119	99	2.46
200	25.173.0200.11	200	217	245	127	107	3.20
225	25.173.0225.11	225	231	275	142	114	4.30
250	25.173.0250.11	250	240	310	155	118	4.82
280	25.173.0280.11	280	251	346	180	123	7.70
315	25.173.0315.11	315	262	386	181	129	8.00
355	25.173.0355.11	355	282	445	225	138	14.75
400	25.173.0400.11	400	302	499	254	148	19.80
450	25.173.0450.11	450	340	552	260	168	20.60
500	25.173.0500.11	500	360	604	289	180	26.00



- EF-Tee
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



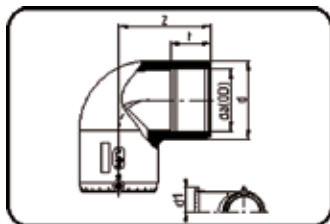
Dim.	Code	da (OD) mm	z mm	L mm	L3 mm	d mm	d1 mm	t mm	Weight
63	25.176.0063.11	63	117	189	65	88	60	63	0.56
75	25.176.0075.11	75	128	212	72	97	64	70	0.64
90	25.176.0090.11	90	172	294	91	124	72.5	77	1.72
110	25.176.0110.11	110	190	328	101	149	85	72	2.67
125	25.176.0125.11	125	215	349	111	170	93.1	87	3.70
160	25.176.0160.11	160	245	372	122	212	111	86	6.12
180	25.176.0180.11	180	275	421	130	232	124	100	9.00
225	25.176.0225.11	225	325	482	147	287	150	111	13.40



- EF-Elbow 45°
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



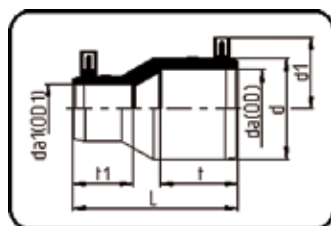
Dim.	Code	da (OD) mm	z mm	d mm	d1 mm	t mm	Weight
63	25.170.0063.11	63	82	82,5	58,5	62,7	0,327
75	25.170.0075.11	75	94	97	66	70	0.33
90	25.170.0090.11	90	113	115	74	71	0.50
110	25.170.0110.11	110	124	140	82.5	72	0.89
125	25.170.0125.11	125	124	161	92	86	1.43
160	25.170.0160.11	160	164	200	112	89	1.83
180	25.170.0180.11	180	172	224	119	99	3.56
200	25.170.0200.11	200	178	249	131	107	4.89
225	25.170.0225.11	225	190	279	146	114	6.00



- EF-Elbow 90°
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



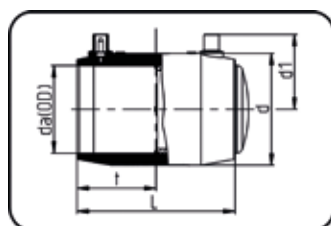
Dim.	Code	da (OD) mm	z mm	d mm	d1 mm	t mm	Weight
63	25.171.0063.11	63	100	83	60	63	0.39
75	25.171.0075.11	75	115	97	66	70	0.60
90	25.171.0090.11	90	147	114	73	70.5	1.09
110	25.171.0110.11	110	164	140	82.5	71.5	1.80
125	25.171.0125.11	125	164	161	91	84	2.40
160	25.171.0160.11	160	222	200	109	87	4.70
180	25.171.0180.11	180	230	224	118	98.5	6.25
200	25.171.0200.11	200	250	248	130	107	8.00
225	25.171.0225.11	225	274	279	144	113	10.80



- EF-Reducer
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	da1 (OD) mm	L mm	d mm	d1 mm	t mm	t1 mm	Weight
75/63	25.177.7563.11	75	63	157	97	63	70	63	0.38
90/63	25.177.9063.11	90	63	173	117	73.5	72	64	0.56
110/63	25.177.1163.11	110	63	202	141	84	73	64	0.86
110/90	25.177.1190.11	110	90	182	141	84	73	72	0.94
125/90	25.177.1290.11	125	90	185	156	90	84	69	0.99
125/110	25.177.1211.11	125	110	175	156	90	83	70	1.05
160/90	25.177.1690.11	160	90	242	200	109	91	71	1.89
160/110	25.177.1611.11	160	110	226	200	109	91	72	2.00
225/160	25.177.2216.11	225	160	284	280	147	114	89	5.12



- EF-Endcap
- Injection moulded
- PE 100(-RC) black
- SDR 11, ISO S-5

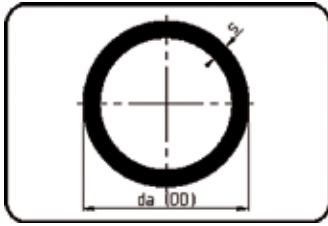


Dim.	Code	da (OD) mm	L mm	d mm	d1 mm	t mm	Weight
63	25.174.0063.11	63	127	83	59	63	0.35
75	25.174.0075.11	75	141	97	65.5	70	0.50
90	25.174.0090.11	90	141	112	72	69	0.73
110	25.174.0110.11	110	152	136	83	75	1.23
125	25.174.0125.11	125	172	155	91	84.5	1.70
140	25.174.0140.11	140	181	180	99	89.5	2.40
160	25.174.0160.11	160	181	197	108	89.5	2.92
180	25.174.0180.11	180	201	221	119	99	4.18
200	25.174.0200.11	200	217	245	127	107	5.32
225	25.174.0225.11	225	231	275	142	114	7.20
250	25.174.0250.11	250	240	310	155	118	8.84
280	25.174.0280.11	280	251	346	180	123	12.66
315	25.174.0315.11	315	262	386	187	129	14.70



15 Product range

# 200 psi



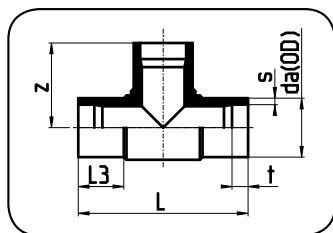
- Pipe
- Extruded
- PE 100(-RC) black



Dim.	Code	da (OD) mm	s mm	Weight
63	70.722.0063.09	63	7.1	1.30
75	70.722.0075.09	75	8.4	1.80
90	70.722.0090.09	90	10.1	2.60
110	70.722.0110.09	110	12.3	3.80
125	70.722.0125.09	125	14	4.90
140	70.722.0140.09	140	15.7	6.20
160	70.722.0160.09	160	17.9	8.05
180	70.722.0180.09	180	20.1	10.20
200	70.722.0200.09	200	22.4	12.60
225	70.722.0225.09	225	25.2	15.90
250	70.722.0250.09	250	27.9	19.56
280	70.722.0280.09	280	31.3	24.60
315	70.722.0315.09	315	35.2	31.10
355	70.722.0355.09	355	39.7	39.50
400	70.722.0400.09	400	44.7	50.10
450	70.722.0450.09	450	50.3	63.4
500	70.722.0500.09	500	55.8	78.1

Product range 200 psi

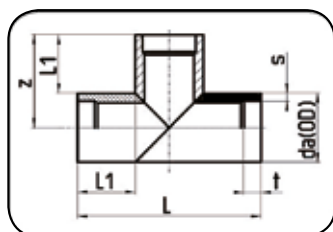




- Tee
- Injection molded
- PE 100(-RC) black
- SDR 7.4, ends machined to SDR 9
- Long Spigot



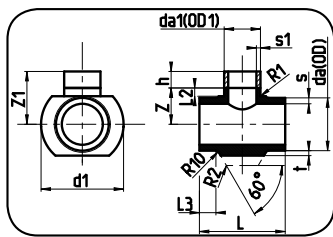
Dim.	Code	Da (OD)	s mm	Z mm	L mm	L3 mm	t mm
63	25.066.0063.09	63	7.1	110	217	63	20
90	25.066.0090.09	90	10.1	145.0	275	79	20
110	25.066.0110.09	110	15.1	160.0	315	82	20
125	25.066.0125.09	125	17.1	175.0	346	87	20
160	25.066.0160.09	160	21.9	208.0	408	98	20
200	25.066.0200.09	200	27.4	248	495	112	20
225	25.066.0225.09	225	30.8	270	540	120	20



- Tee segmented
- SDR 7.4 – ends machined to SDR 9
- PE 100(-RC) black
- Long Spigot



Dim.	Code	Da (OD)	s mm	Z mm	L mm	L1 mm	t mm
250	25.326.0250.09	250	27.9	265	530	140	20
280	25.326.0280.09	280	31.3	290	580	150	20
315	25.326.0315.09	315	35.2	327.5	655	170	20
355	25.326.0355.09	355	39.7	357.5	715	180	20
400	25.326.0400.09	400	44.7	400	800	200	20
450	25.326.0450.09	450	50.3	450	900	225	20
500	25.326.0500.09	500	55.8	485	970	235	20



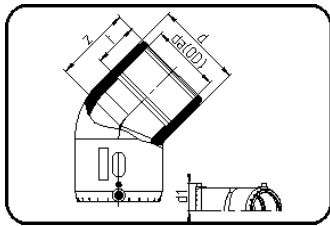
- Reducing tee
- Short spigot
- Machined
- PE 100(-RC) black
- SDR 9 ISO S-4



Dim.	Code	da (OD) mm	da1 (OD1) mm	s [mm]	s1 mm	d1 mm	h mm	L mm	L2 mm	L3 mm	z mm	z1 mm
90/63	25.307.9063.09	90	63	10,1	7,1	154	100	213	20	50	70	170
90/75	25.307.9075.09	90	75	10,1	8,4	159	100	225	20	50	70	170
110/63	25.307.1163.09	110	63	12,3	7,1	172	100	213	20	50	80	180
110/90	25.307.1190.09	110	90	12,3	10,1	184	100	240	20	50	80	180
125/63	25.307.1263.09	125	63	14,0	7,1	186	100	213	20	50	87,5	187,5
125/90	25.307.1290.09	125	90	14,0	10,1	197	100	240	20	50	87,5	187,5
140/63	25.307.1463.09	140	63	15,7	7,1	201	100	213	20	50	95	195
140/90	25.307.1490.09	140	90	15,7	10,1	211	100	240	20	50	95	195
140/110	25.307.1411.09	140	110	15,7	12,3	220	100	260	20	50	95	195
140/125	25.307.1412.09	140	125	15,7	14	228	100	275	20	50	95	195
160/63	25.307.1663.09	160	63	17,9	7,1	220	100	213	20	50	105	205
160/90	25.307.1690.09	160	90	17,9	10,1	229	100	240	20	50	105	205
160/110	25.307.1611.09	160	110	17,9	12,3	238	100	260	20	50	105	205
160/125	25.307.1612.09	160	125	17,9	14	245	100	275	20	50	105	205
180/63	25.307.1863.09	180	63	20,1	7,1	239	100	213	20	50	115	215
180/90	25.307.1890.09	180	90	20,1	10,1	247	100	240	20	50	115	215
180/110	25.307.1811.09	180	110	20,1	12,3	255	100	260	20	50	115	215
180/125	25.307.1812.09	180	125	20,1	14	262	100	275	20	50	115	215
200/63	25.307.2063.09	200	63	22,4	7,1	258	100	213	20	50	125	225
200/90	25.307.2090.09	200	90	22,4	10,1	266	100	240	20	50	125	225
200/110	25.307.2010.09	200	110	22,4	12,3	274	100	260	20	50	125	225
200/125	25.307.2012.09	200	125	22,4	14	280	100	275	20	50	125	225
200/140	25.307.2014.09	200	140	22,4	15,7	287	100	290	20	50	125	225
200/160	25.307.2016.09	200	160	22,4	17,9	297	100	310	20	50	125	225
225/63	25.307.2263.09	225	63	25,2	7,1	283	100	213	20	50	137,5	237,5
225/90	25.307.2290.09	225	90	25,2	10,1	290	100	240	20	50	137,5	237,5
225/110	25.307.2211.09	225	110	25,2	12,3	297	100	260	20	50	137,5	237,5
225/125	25.307.2212.09	225	125	25,2	14	303	100	275	20	50	137,5	237,5
250/63	25.307.2563.09	250	63	27,9	7,1	307	100	213	20	50	150	250
250/90	25.307.2590.09	250	90	27,9	10,1	314	100	240	20	50	150	250
250/110	25.307.2511.09	250	110	27,9	12,3	320	100	260	20	50	150	250
280/63	25.307.2863.09	280	63	31,3	7,1	336	100	213	20	50	165	265
280/90	25.307.2890.09	280	90	31,3	10,1	343	100	240	20	50	165	265

Product range 200 psi

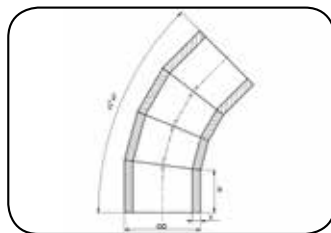
Dim.	Code	da (OD) mm	da1 (OD1) mm	s [mm]	s1 mm	d1 mm	h mm	L mm	L2 mm	L3 mm	z mm	z1 mm
280/110	25.307.2811.09	280	110	31,3	12,3	348	100	260	20	50	165	265
280/125	25.307.2812.09	280	125	31,3	14	353	100	275	20	50	165	265
315/63	25.307.3163.09	315	63	35,2	7,1	371	100	213	20	50	182,5	282,5
315/90	25.307.3190.09	315	90	35,2	10,1	376	100	240	20	50	182,5	282,5
315/110	25.307.3111.09	315	110	35,2	12,3	382	100	260	20	50	182,5	282,5
315/160	25.307.3116.09	315	160	35,2	17,9	399	100	310	20	50	182,5	282,5
315/180	25.307.3118.09	315	180	35,2	20,1	407	150	330	20	50	182,5	332,5
355/63	25.307.3563.09	355	63	39,7	7,1	410	100	263	20	75	202,5	302,5
355/90	25.307.3590.09	355	90	39,7	10,1	415	100	290	20	75	202,5	302,5
355/110	25.307.3511.09	355	110	39,7	12,3	420	100	310	20	75	202,5	302,5
355/160	25.307.3516.09	355	160	39,7	17,9	436	100	360	20	75	202,5	302,5
355/180	25.307.3518.09	355	180	39,7	20,1	444	150	380	20	75	202,5	352,5
400/63	25.307.4063.09	400	63	44,7	7,1	455	100	263	20	75	225	325
400/90	25.307.4090.09	400	90	44,7	10,1	459	100	290	20	75	225	325
400/110	25.307.4011.09	400	110	44,7	12,3	464	100	310	20	75	225	325
400/125	25.307.4012.09	400	125	44,7	14	468	100	325	20	75	225	325
400/140	25.307.4014.09	400	140	44,7	15,7	472	100	340	20	75	225	325
400/160	25.307.4016.09	400	160	44,7	17,9	478	100	360	20	75	225	325
400/180	25.307.4018.09	400	180	44,7	20,1	485	150	380	20	75	225	375
450/63	25.307.4563.09	450	63	50,3	7,1	504	100	263	20	75	250	350
450/110	25.307.4511.09	450	110	50,3	12,3	512	100	310	20	75	250	350
450/160	25.307.4516.09	450	160	50,3	17,9	525	100	360	20	75	250	350
450/180	25.307.4518.09	450	180	50,3	20,1	532	150	380	20	75	250	400
450/225	25.307.4522.09	450	225	50,3	25,2	549	150	425	20	75	250	400
500/63	25.307.5063.09	500	63	55,8	7,1	554	100	263	20	75	275	375
500/110	25.307.5011.09	500	110	55,8	12,3	561	100	310	20	75	275	375
500/160	25.307.5016.09	500	160	55,8	17,9	573	100	360	20	75	275	375
500/180	25.307.5018.09	500	180	55,8	20,1	579	150	380	20	75	275	425
500/225	25.307.5022.09	500	225	55,8	25,2	595	150	425	20	75	275	425



- EF-Elbow 45°
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



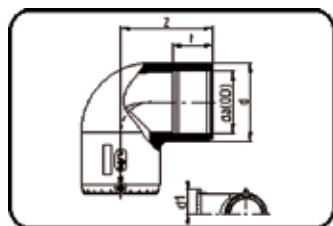
Dim.	Code	da (OD) mm	z mm	d mm	d1 mm	t mm	Weight
63	25.170.0063.11	63	82	82.5	58.5	62.7	0.327
75	25.170.0075.11	75	94	97	66	70	0.33
90	25.170.0090.11	90	113	115	74	71	0.50
110	25.170.0110.11	110	124	140	82.5	72	0.89
125	25.170.0125.11	125	124	161	92	86	1.43
160	25.170.0160.11	160	164	200	112	89	1.83
180	25.170.0180.11	180	172	224	119	99	3.56
200	25.170.0200.11	200	178	249	131	107	4.89
225	25.170.0225.11	225	190	279	146	114	6.00



- Bend 45°
- Segmented
- Long spigot
- PE 100(-RC) black
- SDR 9 ISO S-4



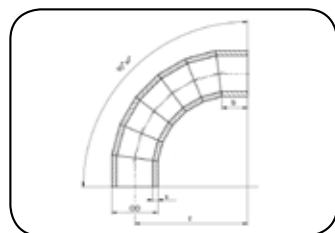
Dim.	Code	da (OD) mm	s mm	b mm	z
250	25.327.0250.09	250	27.9	175	356
280	25.327.0280.09	280	31.3	175	362
315	25.327.0315.09	315	35.2	175	369
355	25.327.0355.09	355	39.7	300	642
400	25.327.0400.09	400	44.7	300	651
450	25.327.0450.09	450	50.3	300	661
500	25.327.0500.09	500	55.8	300	672



- EF-Elbow 90°
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



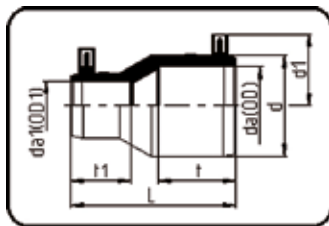
Dim.	Code	da (OD) mm	z mm	d mm	d1 mm	t mm	Weight
63	25.171.0063.11	63	100	83	60	63	0.39
75	25.171.0075.11	75	115	97	66	70	0.60
90	25.171.0090.11	90	147	114	73	70.5	1.09
110	25.171.0110.11	110	164	140	82.5	71.5	1.80
125	25.171.0125.11	125	164	161	91	84	2.40
160	25.171.0160.11	160	222	200	109	87	4.70
180	25.171.0180.11	180	230	224	118	98.5	6.25
200	25.171.0200.11	200	250	248	130	107	8.00
225	25.171.0225.11	225	274	279	144	113	10.80



- Bend 90°
- Segmented
- Long spigot
- PE 100(-RC) black
- SDR 9 ISO S-4



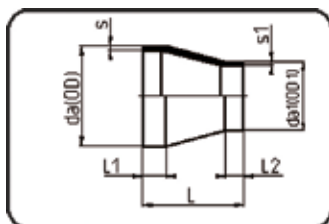
Dim.	Code	da (OD) mm	s mm	b mm	z
250	25.328.0250.09	250	27.9	175	696
280	25.328.0280.09	280	31.3	175	711
315	25.328.0315.09	315	35.2	175	728
355	25.328.0355.09	355	39.7	300	1302
400	25.328.0400.09	400	44.7	300	1324
450	25.328.0450.09	450	50.3	300	1349
500	25.328.0500.09	500	55.8	300	1374



- EF-Reducer
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	da1 (OD1) mm	L mm	d mm	d1 mm	t mm	t1	Weight
90/63	25.177.9063.11	90	63	173	117	73.5	72	64	0.56
110/63	25.177.1163.11	110	63	202	141	84	73	64	0.86
110/90	25.177.1190.11	110	90	182	141	84	73	72	0.94
125/90	25.177.1290.11	125	90	185	156	90	84	69	0.99
125/110	25.177.1211.11	125	110	175	156	90	83	70	1.05
160/90	25.177.1690.11	160	90	242	200	109	91	71	1.89
160/110	25.177.1611.11	160	110	226	200	109	91	72	2.00
225/160	25.177.2216.11	225	160	284	280	147	114	89	5.12

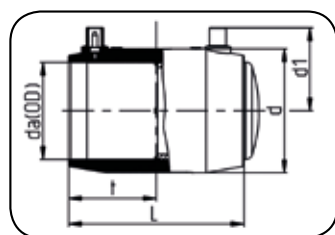


- Reducer
- Machined
- Short spigot
- PE 100(-RC) black
- SDR 9 ISO S-4



Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	s1 mm	L mm	L1 mm	L2
250/160	25.317.2516.09	250	160	27.9	17.9	200	60	40
250/200	25.317.2520.09	250	200	27.9	22.4	200	60	40
250/225	25.317.2522.09	250	225	27.9	25.5	200	60	40
280/160	25.317.2816.09	280	160	31.3	17.9	200	60	40
280/200	25.317.2820.09	280	200	31.3	22.4	200	60	40
280/225	25.317.2822.09	280	225	31.3	25.5	200	60	40
280/250	25.317.2825.09	280	250	31.3	27.9	200	60	40
315/160	25.317.3116.09	315	160	35.2	17.9	200	60	40
315/180	25.317.3118.09	315	180	35.2	20.1	200	60	40
315/225	25.317.3122.09	315	225	35.2	25.5	200	60	40
315/250	25.317.3125.09	315	250	35.2	27.9	200	60	40
315/280	25.317.3128.09	315	280	35.2	31.3	200	60	40
355/180	25.317.3518.09	355	180	39.7	20.1	250	65	45
355/225	25.317.3522.09	355	225	39.7	25.5	250	65	45
355/250	25.317.3525.09	355	250	39.7	27.9	250	65	45
355/280	25.317.3528.09	355	280	39.7	31.3	250	65	45
355/315	25.317.3531.09	355	315	39.7	35.2	250	65	45

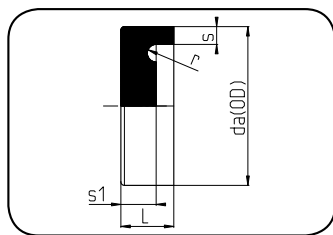
Dim.	Code	da (OD) mm	da1 (OD1) mm	s mm	s1 mm	L mm	L1 mm	L2
400/180	25.317.4018.09	400	180	44.7	20.1	250	65	45
400/225	25.317.4022.09	400	225	44.7	25.5	250	65	45
400/250	25.317.4025.09	400	250	44.7	27.9	250	65	45
400/315	25.317.4031.09	400	315	44.7	35.2	250	65	45
400/355	25.317.4035.09	400	355	44.7	39.7	250	65	75
450/225	25.317.4522.09	400	225	50.3	25.5	250	65	45
450/280	25.317.4528.09	450	280	50.3	31.3	250	65	45
450/315	25.317.4531.09	450	315	50.3	35.2	250	65	45
450/355	25.317.4535.09	450	355	50.3	39.7	250	65	75
450/400	25.317.4540.09	450	400	50.3	44.7	250	65	75
500/315	25.317.5031.09	500	315	55.8	35.2	250	65	75
500/355	25.317.5035.09	500	355	55.8	39.7	250	65	75
500/400	25.317.5040.09	500	400	55.8	44.7	250	65	75



- E-End cap
- Injection molded
- PE 100(-RC) black
- SDR 11, ISO S-5



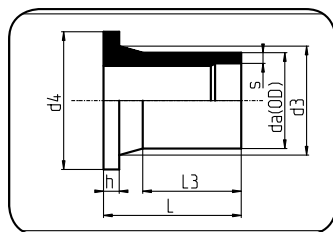
Dim.	Code	da (OD) mm	L mm	d mm	d1 mm	t mm	Weight
63	25.174.0063.11	63	127	83	59	63	0.35
75	25.174.0075.11	75	141	97	65.5	70	0.50
90	25.174.0090.11	90	141	112	72	69	0.73
110	25.174.0110.11	110	152	136	83	75	1.23
125	25.174.0125.11	125	172	155	91	84.5	1.70
140	25.174.0140.11	140	181	180	99	89.5	2.40
160	25.174.0160.11	160	181	197	108	89.5	2.92
180	25.174.0180.11	180	201	221	119	99	4.18
200	25.174.0200.11	200	217	245	127	107	5.32
225	25.174.0225.11	225	231	275	142	114	7.20
250	25.174.0250.11	250	240	310	155	118	8.84
280	25.174.0280.11	280	251	346	180	123	12.66
315	25.174.0315.11	315	262	386	187	129	14.70



- Endcap
- Machined
- Short spigot
- PE 100(-RC) black
- SDR 9 ISO S-4



Dim.	Code	da (OD) mm	s mm	L mm	s1 mm	R mm
355	25.302.0355.09	355	39.7	90	65	12.5
400	25.302.0400.09	400	44.7	95	70	12.5
450	25.302.0450.09	450	50.3	110	85	12.5
500	25.302.0500.09	500	55.8	120	95	12.5

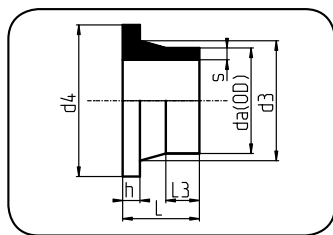


- Stub flange DIN
- Injection molded
- Long spigot
- PE 100(-RC) black
- SDR 7,4, Ends machined to SDR 9



Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h mm	t
63	25.062.0063.09	63	7.1	118	78	75	102	14	20
75	25.062.0075.09	75	8.4	128	89	89	122	16	20
90	25.062.0090.09	90	10.1	140	95	105	138	17	20
110	25.062.0110.09	110	12.3	140	97	125	158	18	20
125	25.062.0125.09	125	14	183.5	121.5	132	158	25	20
160	25.062.0160.09	160	17.9	181.5	119.5	175	212	25	20
200	25.062.0200.09	200	22.4	180.5	121.5	232	268	32	20
225	25.062.0225.09	225	25.2	212	145	235	268	32	20

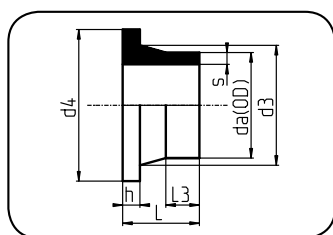




- Stub flange DIN
- Machined
- Short spigot
- PE 100(-RC) black
- SDR 9 ISO S-4



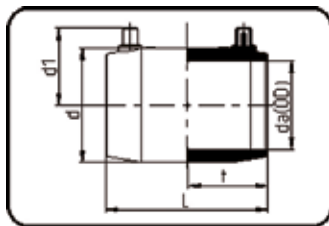
Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h mm
250	25.312.0250.09	250	27.9	130	58	285	320	41
280	25.312.0280.09	280	31.3	130	58	291	320	45
315	25.312.0315.09	315	35.2	136	65	335	370	47
355	25.312.0355.09	355	39.7	150	70	373	430	52
400	25.312.0400.09	400	44.7	155	70	427	482	58
450	25.312.0450.09	450	50.3	166	70	514	585	69
500	25.312.0500.09	500	55.8	175	70	530	585	71



- Stub flange ANSI
- Machined
- Short spigot
- PE 100 black
- SDR 9 ISO S-4



Dim.	Code	da (OD) mm	s mm	L mm	L3 mm	d3 mm	d4 mm	h mm
63	25.314.0063.09	2	7.1	118	78	75	100.4	14
75	25.314.0075.09	2 1/2	8.4	128	89	89	117	16
90	25.314.0090.09	3	10.1	140	95	105	132.4	17
110	25.314.0110.09	4	12.3	140	97	125	170.5	18
160	25.314.0160.09	6	17.9	181.5	119.5	175	219.6	25
200	25.314.0200.09	8	22.4	180.5	121.5	232	276.5	32
225	25.314.0225.09	9	25.2	212	145	235	276.5	32
250	25.314.0250.09	10	27.9	130	58	285	337	41
315	25.314.0315.09	12	35.2	136	65	335	406	47
355	25.314.0355.09	14	39.7	150	70	373	445	52
400	25.314.0400.09	16	44.7	155	70	427	510	58
450	25.314.0450.09	18	50.3	166	70	514	545	69
500	25.314.0500.09	20	55.8	175	70	530	600	71



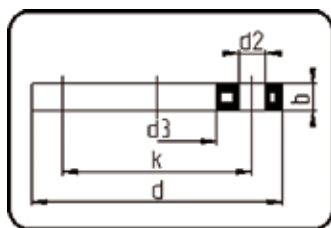
- EF-coupler
- Injection molded
- PE 100 black
- SDR 11, ISO S-5



Dim.	Code	da (OD) mm	L mm	d mm	d1 mm	t mm	Weight
63	25.173.0063.11	63	127	83	59	63	0.249
75	25.173.0075.11	75	141	97	65.5	70	0.35
90	25.173.0090.11	90	141	112	72	69	0.46
110	25.173.0110.11	110	152	136	83	75	0.73
125	25.173.0125.11	125	172	155	91	84.5	1.03
140	25.173.0140.11	140	181	180	99	89.5	1.58
160	25.173.0160.11	160	181	197	109	89.5	1.71
180	25.173.0180.11	180	201	221	119	99	2.46
200	25.173.0200.11	200	217	245	127	107	3.20
225	25.173.0225.11	225	231	275	142	114	4.30
250	25.173.0250.11	250	240	310	155	118	4.82
280	25.173.0280.11	280	251	346	180	123	7.70
315	25.173.0315.11	315	262	386	181	129	8.00
355	25.173.0355.11	355	282	445	225	138	14.75
400	25.173.0400.11	400	302	499	254	148	19.80
450	25.173.0450.11	450	340	552	260	168	20.60
500	25.173.0500.11	500	360	604	289	180	26.00

16 Backing rings  
and blind flanges

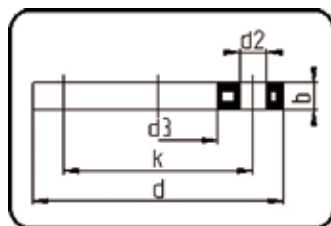
175 psi  
200 psi



- Backing ring
- Injection molded
- PE 100 black with steel insert



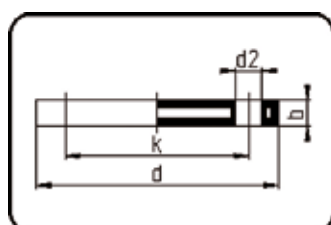
Dim.	Code	da (OD) DIN mm ANSI inch	d mm	d2 mm	d3 mm	b mm	k mm	K mm	nm [NM]	numb Stk	Weight
<b>(Acc. to EN 1092-1 PN 10)</b>											
63	14.014.0063.11	63	165	18	78	18	125	M16	35	4	0.79
75	14.014.0075.11	75	186	18	92	18	145	M16	40	4	1.12
90	14.014.0090.11	90	202	18	108	20	160	M16	40	8	1.18
110	14.014.0110.11	110	220	18	128	20	180	M16	40	8	1.30
125	14.014.0125.11	125	220	18	135	20	180	M16	45	8	1.18
140	14.014.0140.11	140	250	18	158	24	210	M16	50	8	2.03
160	14.014.0160.11	160	285	22	178	23	240	M20	60	8	2.61
180	14.014.0180.11	180	285	22	190	23	240	M20	60	8	2.25
200	14.014.0200.11	200	340	22	235	25	295	M20	70	8	2.79
225	14.014.0225.11	225	340	22	238	25	295	M20	70	8	2.75
250	14.014.0250.11	250	409	22	288	30	350	M20	100	12	6.27
280	14.014.0280.11	280	409	22	294	30	350	M20	100	12	6.16
315	14.014.0315.11	315	463	23	338	34	400	M20	110	12	9.76
355	14.014.0355.11	355	515	23	376	42	460	M20	160	16	14.80
400	14.014.0400.11	400	574	26	430	46	515	M24	170	16	17.74
450	14.014.0450.11	450	678	26	517	45	620	M24	190	20	24.96
500	14.014.0500.11	500	678	26	533	45	620	M24	190	20	24.38
<b>ANSI (Acc to. ASME B 16.5 class 150)</b>											
63	11.013.0063.11	2	162	20	78	18	120.7		35	4	0.81
75	11.013.0075.11	2 1/2	184	20	92	18	139.7		40	4	1.07
90	11.013.0090.11	3	194	20	111	18	152.4		40	4	1.03
110/125	11.013.0110.11	4	229	20	133	18	190.5		40	8	1.54
160	11.013.0160.11	6	283	22	178	24	241.3		60	8	2.40
200/225	11.013.0200.11	8	345	22	236	24	298.5		70	8	3.39
250/280	11.013.0250.11	10	412	25	288	26	362		100	12	6.20
315	11.013.0315.11	12	487	25	338	32	431.8		110	12	13.04



- Backing ring ANSI (Acc. to ASME B 16,5 class 150)
- Steel
- Hot dipped galvanized



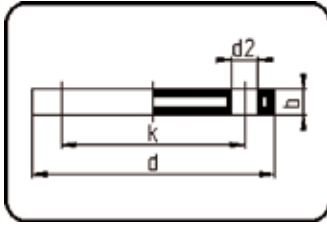
Dim.	Code	da (OD) inch	d mm	d2 mm	b mm	k mm	DN mm	K mm	nm [NM]	numb Stk	Weight
355	90.013.0355.17H	14	535	29	33.4	476.3	350	M30	160	12	
400	90.013.0400.17H	16	595	29	35.0	539.8	400	M32	170	16	
450	90.013.0450.17H	18	635	32	38.1	577.9	400	M32	190	16	
500	90.013.0500.17H	20	700	32	41.3	635	500	M32	190	20	



- Blind flange
- Injection molded
- PP-FRP black



Dim.	Code	da (OD) DIN mm ANSI inch	d mm	d2 mm	b mm	k mm	DN mm	K mm	nm [NM]	numb	Weight
<b>(Acc. to EN 1092-1 PN 10)</b>											
63	14.045.0063.11	63	165	18	17	125	50	M16	35	4	1.15
75	14.045.0075.11	75	186	18	19	145	65	M16	40	4	1.64
90	14.045.0090.11	90	202	18	20	160	80	M16	40	8	1.96
110/125	14.045.0110.11	110	220	18	20	180	100	M16	40	8	2.28
140	14.045.0140.11	140	250	18	25	210	125	M16	50	8	3.92
160/180	14.045.0160.11	160	285	22	23	240	150	M20	60	8	5.06
200/225	14.045.0200.11	200	340	22	25	295	200	M20	70	8	7.80
250/280	14.045.0250.11	250	409	22	30	350	250	M20	100	12	15.40
315	14.045.0315.11	315	463	22	34	400	300	M20	110	12	26.00
355	14.045.0355.11	355	515	22	42	460	350	M20	160	16	39.66
400	14.045.0400.11	400	574	27	46	515	400	M24	170	16	50.44
<b>ANSI (Acc. to ASME B 16.5 class 150)</b>											
63	11.043.0063.11	2	162	20	18	120.7	50		35	4	1.22
75	11.043.0075.11	2 1/2	184	20	18	139.7	65		40	4	1.54
90	11.043.0090.11	3	194	20	18	152.4	80		40	4	1.84
110/125	11.043.0110.11	4	229	20	18	190.5	100		40	8	2.95
160	11.043.0160.11	6	283	22	24	241.3	150		60	8	5.10
200/225	11.043.0200.11	8	345	22	24	298.5	200		70	8	7.92
250/280	11.043.0250.11	10	412	25	27	362	250		100	12	15.15
315	11.043.0315.11	12	487	25	33	431.8	300		110	12	28.8



- Blind flange DIN
- Steel
- Hot-dipped galvanized



Dim.	Code	da (OD) DIN mm ANSI inch	d mm	d2 mm	b mm	k mm	K mm	nm [NM]	numb Stk	Weight
<b>DIN (Acc. to EN 1092-1 PN 10)</b>										
450/500	90.045.0450.17H	450	670	26	44	620	M24	190	20	
<b>ANSI (Acc. to ASME B 16.5 class 150)</b>										
355	90.043.0355.17H	14	535	32	33.4	476.3		160	12	
400	90.043.0400.17H	16	595	35	35.0	539.8		170	16	
450	90.043.0450.17H	18	635	35	38.1	577.9		190	16	
500	90.043.0500.17H	20	700	35	41.3	635		190	20	





Y10502020116F

Your distributor:



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