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## PP-R PRE-INSULATED PIPE SYSTEMS

for district heating and cooling

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More information on REHAU district heating and all documentation is available for download at

[www.rehau.uk/districtheating](http://www.rehau.uk/districtheating)

# PP-R PRE-INSULATED PIPE SYSTEMS

## For district heating

One of the most energy-efficient methods of transporting water for heating or cooling applications covering long distances underground.

To achieve the necessary insulating characteristics for these types of applications, pipe systems are insulated with PUR rigid foam and coated with a casing pipe made of PEHD. Medium pipe is plastic-fibre composite.

### Medium pipes

#### REHAU PP-R pipe

faser composite pipe system

SDR 11 in dimensions to 355mm

Pipe system for heating, cooling and waste water

#### Fields of application

System recommended due to its technical advantages ■

	Blue PP-R pipe SDR 11
Potable water application	
Climate technology	■
Chilled water technology	■
Swimming pool technology	■
Rainwater application	■
Irrigation	■
District heating	■
District cooling	■
Application in the field of ship building	■
Industrial liquids <i>considering the material resistance</i>	■

*Please note: For applications not shown here (higher temperature or pressure), please get back to us for assistance as we might be able to offer solutions for specific applications.*

#### Material

The medium pipes, integrated in the PP-R pipe system, are made of fusiolen® PP-R.

Special heat and extraction stability are only two of the features of this material. Its physical and chemical properties are well-suited to the transfer of cold and hot water. Above all, the good welding properties and fusion, resulting in a permanent connection, have made the PP-R-pipe systems and the raw material fusiolen® PP-R well known worldwide.

#### Environment

The environmentally friendly material polypropylene fusiolen® PP-R is recyclable and can be ground, melted and reutilised for various applications e.g. motor-protections, wheel linings, laundry baskets and other kinds of transport boxes. There are no polluting substances with PP-R either in its processing or in its disposal.

**Fusiolen® PP-R – for the benefit of our environment!**

#### Use of metal deactivators

By adding suitable additives the risk of material damage caused by metal under extreme conditions of application is substantially reduced.

#### Higher long-term heat stabilisation

The long-term heat stabilisation has been increased to resist to the potential effects of peak temperatures within higher safety parameters.

#### System advantages

System recommended due to its technical advantages ■

	Blue PP-R pipe SDR 11
Low expansion	■
Odourless	
Corrosion resistant	■
Very good welding properties	■
Less pipe friction	■
High impact resistance	■
Heat stability	■
Metal deactivation	■
Recyclable	■
Sound- and heat insulation	■
Low weight	■
Self compensating	■

# 1 SYSTEM FEATURES

## 1.1 Medium pipes

### PP-R blue faser composite pipe system SDR 11

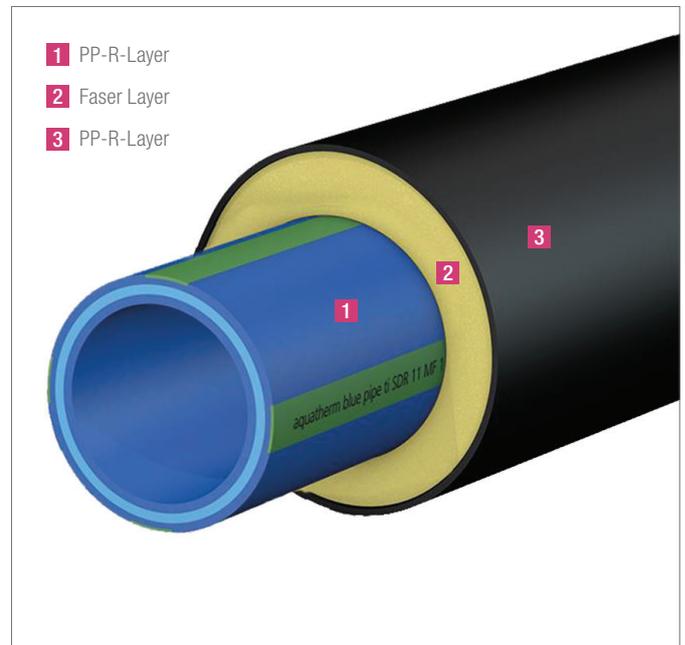
The PP-R blue pipe system has been developed especially for applications outside the potable water installation.

Medium pipe	PP-R blue faser composite pipe SDR 11	Casing pipe
External diameter	Dimension	External diameter
200 mm	DN 150	315 mm
250 mm	DN 200	400 mm
315 mm	DN 250	450 mm
355 mm	DN 300	500 mm

Larger dimensions on request

### Permissible working pressure

For general pressure applications outside the fields of application on the adjoining diagram.



Temperature	Years of service	Blue PP-R pipe SDR 11 Permissible working pressure in bar and (psi)	
		bar	psi
-20°C up to 5°C	1	23.8	(345)
	5	22.3	(323)
	10	21.7	(315)
	15	21.0	(305)
	50	20.4	(296)
	100	19.9	(289)
10°C	1	27.8	(403)
	5	26.2	(380)
	10	25.6	(371)
	25	24.7	(358)
	50	24.1	(350)
	100	23.5	(341)
15°C	1	25.7	(373)
	5	24.2	(351)
	10	23.6	(342)
	25	22.8	(331)
	50	22.2	(322)
	100	21.6	(313)
20°C	1	23.8	(345)
	5	22.3	(323)
	10	21.7	(315)
	25	21.0	(305)
	50	20.4	(296)
	100	19.9	(289)
30°C	1	20.2	(293)
	5	18.9	(274)
	10	18.4	(267)
	25	17.8	(258)
	50	17.3	(251)
	100	16.8	(244)

Permissible working pressure - Continued

Temperature	Years of service	Blue PP-R pipe SDR 11	
		Permissible working pressure in bar and (psi)	
		bar	psi
40°C	1	17.1	(248)
	5	16.0	(232)
	10	15.6	(226)
	25	15.0	(218)
	50	14.6	(212)
	100	14.1	(205)
50°C	1	14.5	(210)
	5	13.5	(196)
	10	13.1	(190)
	25	12.6	(183)
	50	12.2	(177)
	100	11.9	(173)
60°C	1	12.2	(177)
	5	11.4	(165)
	10	11.0	(160)
	25	10.6	(154)
	50	10.3	(149)
70°C	1	10.3	(149)
	5	9.6	(139)
	10	9.2	(133)
	25	8.0	(116)
	50	6.8	(99)
75°C	1	9.4	(136)
	5	8.7	(126)
	10	8.0	(116)
	25	6.4	(93)
	50	5.4	(78)
80°C	1	8.6	(125)
	5	7.7	(112)
	10	6.5	(94)
	25	5.2	(75)
90°C	1	7.2	(104)
	5	5.1	(74)
	10	4.3	(62)

For fittings of butt-welded pipe segments a reduction factor of 0.75 (reduction of the table values by 25 %) is effective.

### Material parameters

Technical data	PP80
Melt-flow index 230°C/2.16 kg	0.3 g/10 minutes
Elastic modulus	800 N/mm <sup>2</sup>
Yield stress	25 N/mm <sup>2</sup>
Tensile strength	25 MPa
Thermal expansion coefficient	0.15 W/mK (measured at the pipe)
Reynolds-No.	0.007
Inflammability, DIN 4102	B2
oxygen tight (ot pipe)	by oxygen barrier layer, for PE only from -39°C
Medium thermal expansion coeff., K-1, DIN 53752	0.7 · 10 <sup>-4</sup>

## Support intervals

### Blue PP-R pipe SDR 11

Table to determine support intervals in conjunction with temperature and outside diameter.

Difference in temperature $\Delta T$ [K]	Pipe diameter d (mm)														
	20	25	32	40	50	63	75	90	110	125	160	200	250	315	355
	Support intervals in cm														
0	120	140	160	170	195	220	235	250	275	280	285	290	300	310	315
20	90	105	120	125	145	165	175	185	200	205	210	220	225	230	235
30	90	105	120	125	145	165	175	185	190	195	200	210	215	220	225
40	85	95	110	115	135	155	165	175	180	185	190	200	210	210	215
50	85	95	110	115	135	155	160	170	170	175	180	190	200	205	205
60	80	90	105	110	125	145	150	160	160	165	170	180	185	190	195
70	70	80	95	70	120	135	140	145	150	155	160	170	175	70	190

Spaces of pipe clamp of vertical pipes can be increased by 20 % to the values in the table, that means to multiply the table values by 1.2.

## 1.2 Insulation

### Material

The Blue PP-R pipe systems are insulated with PUR-rigid foam. This polyurethane foam is made of Polyol and Isocyanate and meets the functional requirements of the EN 253. The foam is homogeneous with an average cell size of max. 0.5 mm.

For the professional insulation of the pipe and fitting connections, insulation jackets made of PUR-rigid foam are available for the system, coated with shrink shrouds resulting in a permanent connection with the casing pipes.

### Material parameters

Technical data	PUR
Cell gas Cyclopentane	> 8 %
Core density	> 60 kg/m <sup>3</sup>
Closed cell	> 88 %
Water absorption	< 10 % (Vol)
Compression strength 10 % deformation	> 0.3 N/mm <sup>2</sup>
Shearing resistance	> 0.12 N/mm <sup>2</sup>
Tangent shearing resistance	> 0.20 N/mm <sup>2</sup>
Thermal conductivity at 50°C	< 0.03 W/mK

## 1.3 Loss of heat and cooling energy

Blue PP-R pipe SDR 11			
Type of pipe	Heat loss at average temperature 40°C in W/m	Heat loss at average temperature 50°C in W/m	Heat loss at average temperature 65°C in W/m
200 mm	14.6	15.25	23.73
250 mm	14.15	17.69	23.00
315 mm	18.30	22.88	29.74
355 mm	19.34	24.18	31.43

Blue PP-R pipe SDR 11			
Type of pipe	Cooling energy loss at F: -12°C R: -6°C AT: 26°C in W/m	Cooling energy loss at F: 6°C R: 12°C AT: 26°C in W/m	Cooling energy loss at F: 15°C R: 18°C AT: 26°C in W/m
200 mm	12.81	6.22	3.48
250 mm	12.40	6.02	3.37
315 mm	16.23	7.88	4.41
355 mm	16.92	8.22	4.59

F = flow, R = return, AT = ambient temperature

## 1.4 Casing pipes

### Material

The casing pipes of the PP-R pipe system are made of the material PE according to DIN EN 8075.

Like insulated steel pipes correspond to the EN 253, REHAU applies casing pipes, which correspond to the technical requirements of this standard. The material is characterized by the following mechanical and thermal features:

### Material parameters

Technical data	PUR
Density, g/cm <sup>3</sup> , ISO 1183	0.95
Yield stress, MPa, DIN EN ISO 527	22
Elongation at yield stress, %, DIN EN ISO 527	9
Elongation at break, %, DIN EN ISO 527	300
Tension-E-module, MPa, DIN EN ISO 527	800
Impact strength, kJ/m <sup>2</sup> , DIN EN ISO 179	without break
mpact strength, kJ/m <sup>2</sup> , DIN EN ISO 179	12
Ball impression hardness, MPa, DIN EN ISO 2039-1	40
Shore hardness, D, ISO 868	63
Medium thermal expansion coeff., K-1, DIN 53752	$1.8 \cdot 10^{-4}$
Thermal conductivity, W/m · K, DIN 52612	0.38
Electric strength, kV/mm, VDE 0303-21	47
Surface resistance, Ohm, DIN IEC 167	1014
Inflammability, DIN 4102	B2
Physiological harmlessness acc. to BgVV	yes
Chemical resistance acc. to DIN 8075 supplement	complied with
Thermal operating conditions	°C -40 to +80

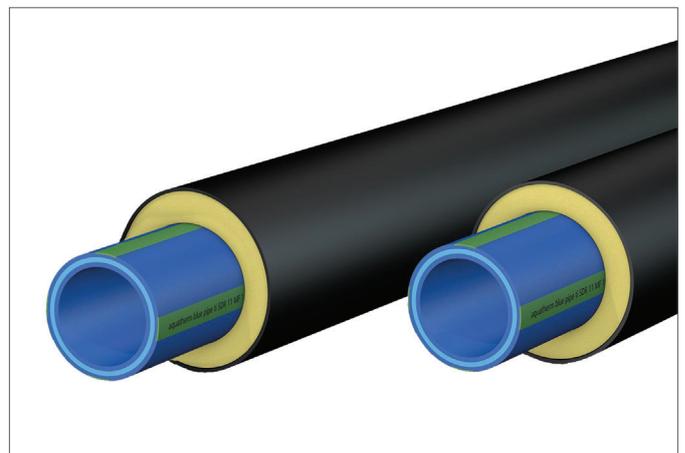
## 1.5 Blue PP-R pipe data sheet

### Key dimensions

Medium pipe	Casing pipe	PUR-rigid foam
External diameter	External diameter	Thickness
200 mm	315 mm	52.60 mm
250 mm	400 mm	68.70 mm
315 mm	450 mm	60.50 mm
355 mm	500 mm	64.70 mm

### Pipe data

Pipe dimension		Blue PP-R pipe SDR 11	
Medium pipe	Casing pipe	Weight	Water content
200 mm	315 mm	18.3 kg/m	21.010 l/m
250 mm	400 mm	29.0 kg/m	32.861 l/m
315 mm	450 mm	40.6 kg/m	52.172 l/m
355 mm	500 mm	50.8 kg/m	66.290 l/m



# 2 PROCESSING

## 2.1 Assembly of welding tools

The professional processing of PP-R medium pipes is made by the following tools for the connection of insulated pipes by butt-welding.

### IMPORTANT



Only use the original welding devices and welding tools, except devices and tools which are especially approved by REHAU.

Butt-welding machines for medium pipes of dimension 160–630 mm



Butt-welding machine type Light and accessories

## 2.2 Instructions for the assembly of welding tools

- The heating plate of the welding device must be in good order and condition.
- External damages like scratches or grooves and impurities must be removed.
- If required, both parts of the tools must be cleaned with a nonfibrous, coarse tissue and optionally with spirit.
- Damaged tools generally must not be used. They must be exchanged.
- Fit the chamfering and the cold welding tools manually.

## 2.3 Heating-up phase/handling

### Part A: Heating-up phase

1. Plug the welding device and control if the yellow pilot lamp glows.
2. Dependent on the size of the welding tools and the ambient temperature, the heating up of the tools takes between 10 and 30 minutes.
3. Never use pliers or any other unsuitable tools, as this will damage the coating of the welding tools.
4. A temperature of 260°C is required for welding the Blue PP-R medium pipes. According to DVS-Welding Guidelines, the welding temperature must be checked at the tools before welding. The temperature control is made by a fast indicating surface thermometer.

### ATTENTION:



First welding: 5 minutes after achieving the welding temperature!

### Part A: Handling

5. A tool change at a heated device requires another check of the welding temperature at the new tool after its heating up.
6. If the device has been unplugged, e.g. during longer breaks, the heating up process must be restarted (from item 1).
7. After finishing the welding works, unplug the welding device and let it cool down.  
Never use water or other liquids to cool the welding device as this destroys the heating resistances! Never open the welding devices or repair them by yourself. Return the defective devices for repair to REHAU.
8. Welding devices and welding tools must be protected from moisture and impurities. Burnt particles may cause an incorrect fusion. The application of damaged and dirty tools is not allowed.
9. Before and after the welding do not lay the welding device on the welding tools, as the Teflon coating of the tools may be damaged. Always put the device in the included stand.

## 2.4 Technical regulations and data

### Part A: Technical regulations

For the correct handling of welding machines the General Regulations for Protection of Labour and Prevention of Accidents must be observed. Particularly the Regulations of the Employers' Liability Insurance Association of the Chemical Industry regarding Machines for the Processing of Plastics (Chapter: Welding Machines and Welding Equipment) are effective.

For the appropriate and professional handling with the tools and accessories, the manufacturer's instructions must be observed.

#### **Advice regarding butt-welding of medium pipes of dimensions 200–355 mm.**

The standard data concerning butt-welding depend on the pipe dimensions and devices. They are available in the processing description enclosed to the machines or they can be required directly at REHAU.

**Dimensions 200-355mm are joined by butt-welding.**

## 2.5 Notes for preparation



Measurement of temperature at the butt-welding machine

### **Control of welding temperature**

The welding temperature must be checked at all welding devices and machines with a fast indicating thermometer. The measurement is made directly at the tools.

The temperature measurement is always made in the beginning of each welding. If the required welding temperature is not achieved, the welding connection may be incorrect.

### **Welding temperatures for Blue PP-R pipes**

Heating element butt-welding:

210°C for medium pipes of dimension 200–355 mm

## 2.6 Cutting and skinning of pipes



1 Measure the pipe length and mark on the casing pipe.



5 Cut the casing pipe with the pipe cutter up to the PUR-insulation layer around the whole pipe.



2 Mark the cutting line with an adhesive tape around the pipe.



6 Slit the casing up to the PUR-insulation layer with a customary handsaw for plastic.



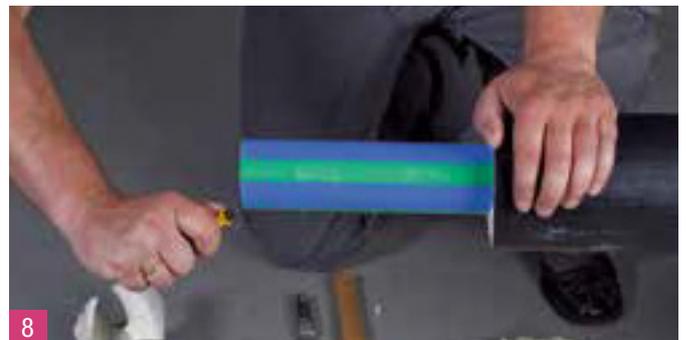
3 Cut the pipe with a customary handsaw with a saw blade for plastic along the cutting line.



7 Detach the end of the casing pipe and then remove the PUR-insulation layer mechanically on the full skinning length.



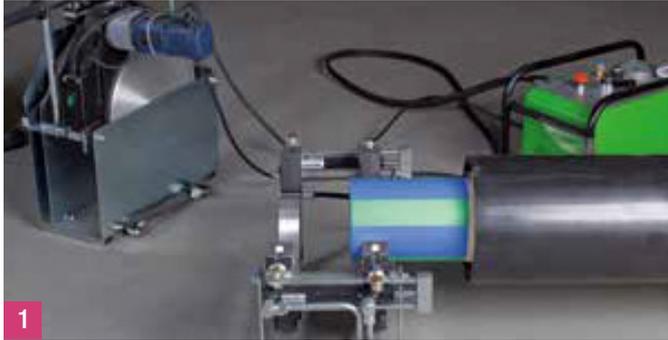
4 Mark the skinning length of 22.5 cm from the pipe end on the casing pipe.



8 Clean the skinned medium pipe and deburr the pipe ends inside and outside.

## 2.7 Heating-element butt-welding with the butt welding machine type: Two-ring-machine widos

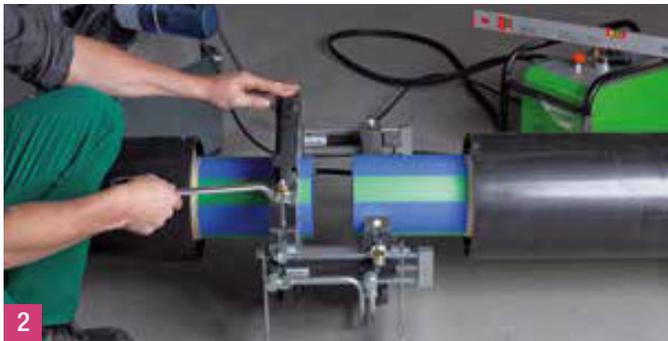
### Preparation of pipe ends and fusion



1 Arrange and align the welding machine, plug in the hose of the hydraulics and energise the welding device and milling cutter.



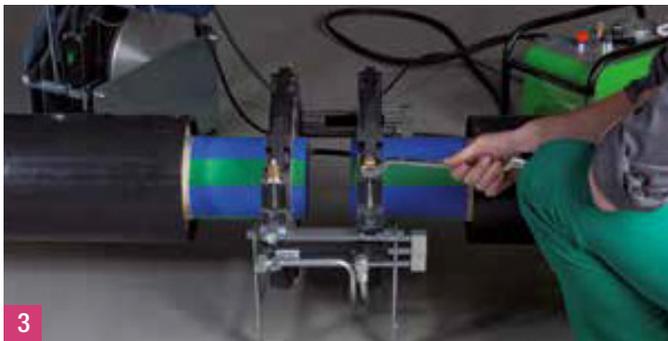
5 Switch on the milling cutter and drive up the pipe ends slowly in the machine slide to the milling cutter by operating the hydraulic system.



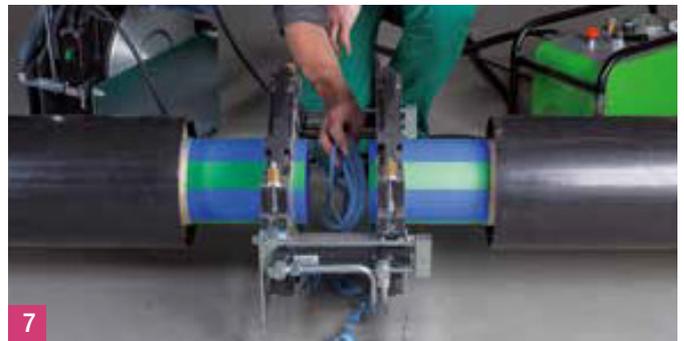
2 Place the first pipe end in the in the mounting clamps. Align it with the upper mounting clamp and fix it.



6 By using the hydraulic system the pipe ends are milled plane at the face side with light pressure to the milling cutter.



3 Place the other pipe end in the same way in the mounting clamps, align and fix it with the mounting clamp.



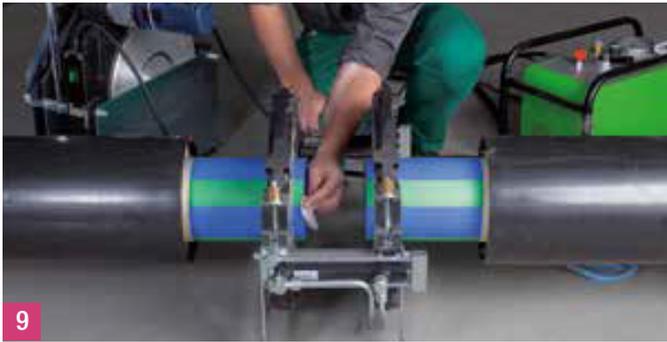
7 If the milling flake is circumferential, drive apart the machine slide, take the milling cutter away and remove the debris.



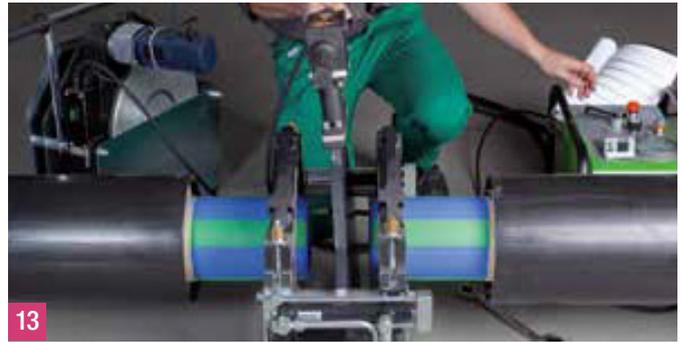
4 Insert the milling cutter between the pipe ends and fix it with the locking at the frame of the machine slide. The power-on of the tool only works with correct locking.



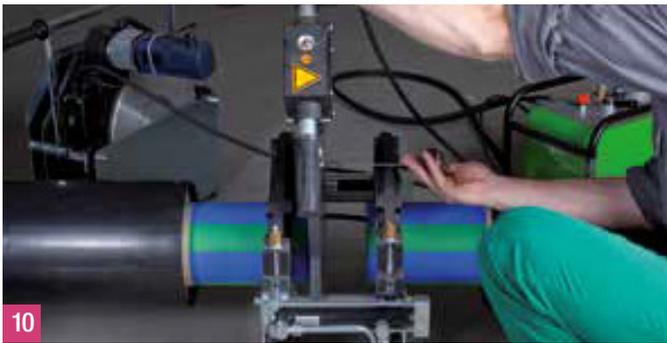
8 Drive the machine slide slowly together again. The pipe ends must fit planar. Control clearance and then adjust the pressure at the hydraulic system in accordance with the data sheet.



9 Clean the pipe ends at the face sides.



13 After the end of the heating period drive apart the machine slide speedily by using the hydraulic system. Then remove the welding plate.



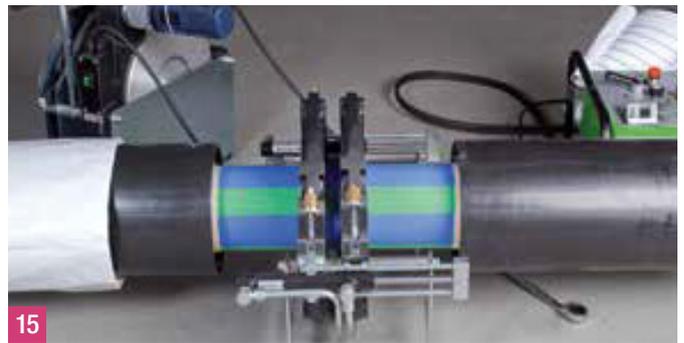
10 Insert the welding device between the pipe ends. Check, if the welding plate is clean and measure the welding temperature.



14 By using the hydraulic system the pipe ends are joined slowly until the required welding pressure is achieved.



11 Drive the machine slide, by operating the hydraulic system, slowly against the welding plate. Then press the pipe ends until the predetermined adjustment pressure is achieved against the welding plate.



15 The adjusted welding pressure remains on the machine slide up to the end of the cooling period.



12 After the bead has achieved the preset height, the pressure is reduced at the hydraulic system. Then the heating up phase starts. Now the face sides in which the face sides of the pipe ends are heated up to the required welding temperature.



16 After the end of the cooling period the pressure is released at the hydraulic system. Then the mounting clamps are disconnected and the clamping device is removed.

# 3 ASSEMBLY - PP-R SYSTEM SHROUDS

## 3.1 Product specification

The PP-R pipe shroud is a cross-linked heat shrinkable casing system for half-shell joint protection of pre-insulated pipes. This socket is full length shrinkable and is mainly applied in combination with PUR-half-shell technology.

The CSC-X shroud consists of the following articles which are supplied in a set as one packing unit:

- 1 pc shrink sleeve CSC-X
- 1 pc casing shrink film
- 1 pc casing shrink film
- 2 pcs PUR-rigid foam insulation element type 1
- 2 pcs PUR-rigid foam insulation element type 2
- 2 pcs tension tape

(only for casing pipes of the dimension 300 mm and more).



CSC-X shroud

## 3.2 Storage and safety

Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental conditions.

Avoid storage at temperatures above 80°C or below -20°C. Product installation should be made in accordance with local health and safety regulations.

## 3.3 Equipment list for processing

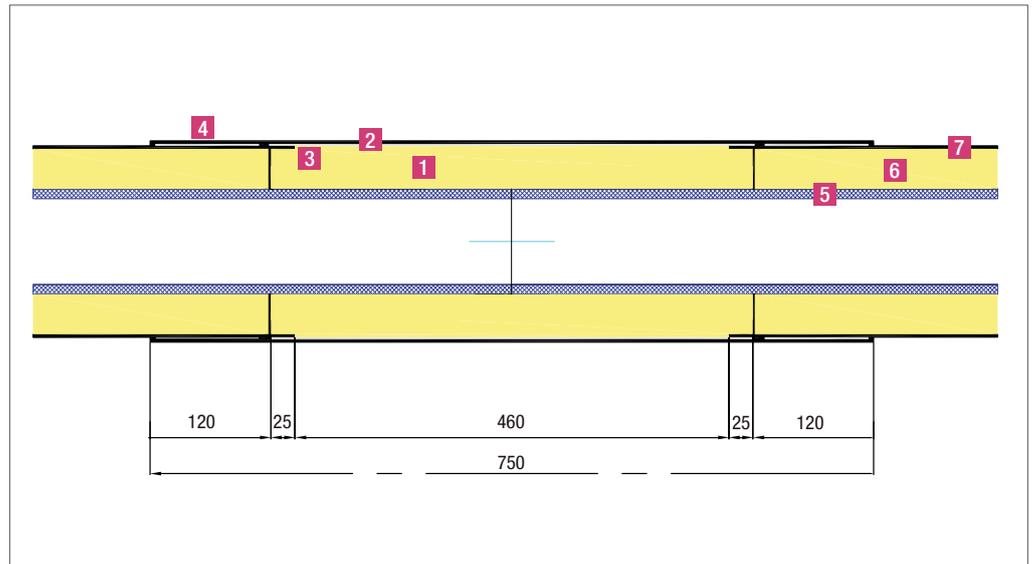
Tools, required for the further processing of the shroud:

- Propane tank with hose, torch and regulator
- Grease and lint-free rag
- Marking pen free from grease
- Ethanol / Spirit (min. 99,9 %)
- Sandpaper (40–60 grade)
- Measuring tape, knife, cutter, press roll, hard hat, triangular scraper, concave rasp
- Temperature measuring device with contact sensor
- Wooden wedges
- Assembly carrier truck.

### 3.4 Shrink sleeve system

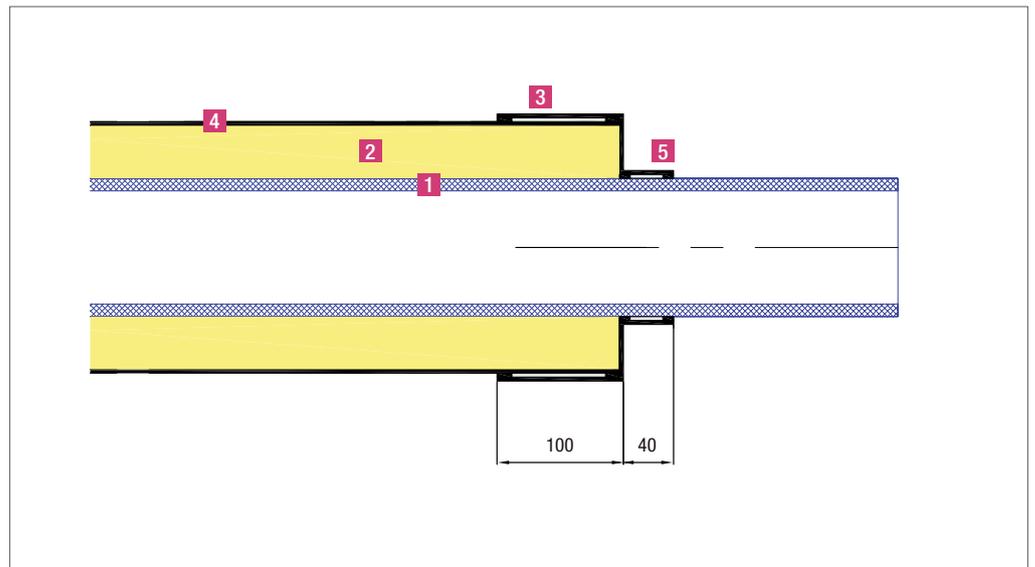
#### Shroud

- 1 Insulation half shell
- 2 Shrink sleeve
- 3 Casing shrink film
- 4 Melting adhesive strip
- 5 Medium pipe
- 6 PUR-Insulation
- 7 Casing pipe



#### End cap

- 1 Medium pipe
- 2 PUR-insulation
- 3 Melting adhesive strip
- 4 Casing pipe
- 5 End cap



### 3.5 PP-R System shrouds

#### Backfilling trench

Correct conditions of the trench must be checked before starting the installation of the district pipeline. The digging of the excavation works must be placed in a way that the installation is not obstructed.

For a professional installation of the shroud in the trench, ensure that there is adequate work space area around the pipe in the backfilling trench. The trench bottom must be free from water and sludge.

The pipe laying must meet the requirements.

#### Flame intensity

Adjust the flame according to the outside conditions.

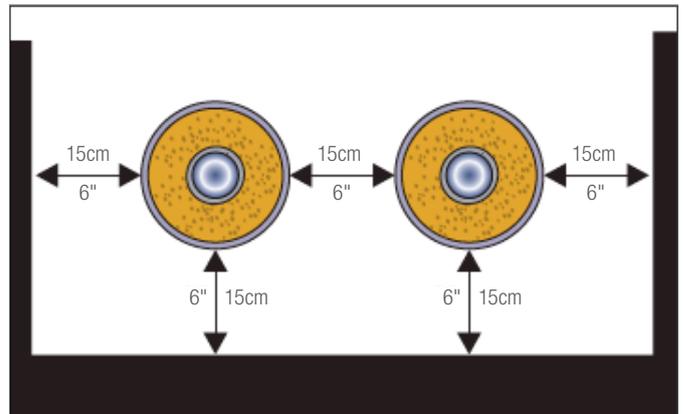
- Use weak yellow flame for thin-walled casing pipe and shrink products, at still air, high outside temperatures and less space in the trench (A)
- Use moderate blue flame for thick-walled casing pipes and shrink products for high wind and low temperatures (B)

Always aim the torch perpendicular to the casing shrink film and shrink sleeve. Move in circumferential direction quickly around the jacket pipe.

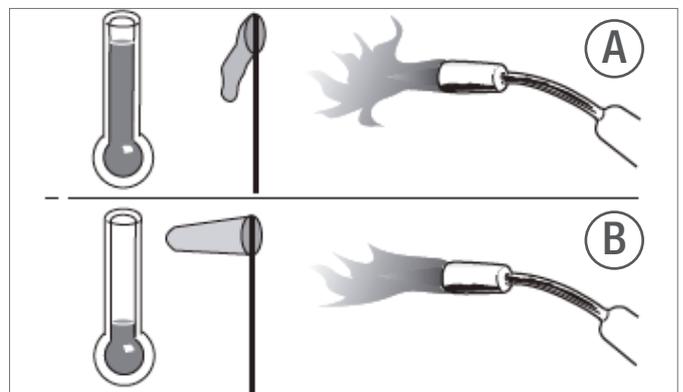
Do not overheat the casing pipe because there is a risk of burning the PE-casing pipe.

### 3.6 Casing preparation

1. Before connecting the medium pipe by butt-welding, the shrink sleeve must be pulled over one of the pipe ends. The white protective foil must not be removed yet! During the welding of the medium pipe the shrink sleeve must be protected from burning.
2. Dry and clean the whole connection area and all sealing areas from loose impurities with a propane torch and a dry grease and lint-free rag.
3. Remove any wet PUR foam from the end of the pre-insulated pipe. The cut should be made with a suitable saw – planar-vertical as possible – to ease the later adjustment of the insulation half shells.
4. Remove any burrs and dirt from **all** sealing areas with a triangular scraper or a concave rasp.



Place requirement



Advice for handling with propane gas torch

### 3.7 Insulation half-shell installation

The insulation half-shell parts must be adjusted to fit without gaps or extra force applied.



Both half-shells marked 1 and 2 are fit into the cavity at the same time on top of the pipe. Then they are joined parallel in direction of the medium pipe and turned to the bottom side of the pipe.



Now the other two insulation half-shells marked with number 1 and 2 are inserted as described under step 1. The key and slot joint of all elements allows a gap-free and custom-fit joining of all shell elements.



An additional fixing of the insulation half-shells is made by a custom adhesive tape in the middle.

Clean the surface of all sealing areas with a rag to remove dirt and degrease the areas with ethanol (min. 99.9 %) by using a grease and lint-free rag.

### 3.8 Marking of shrink sleeve position



To mark the same overlap on both sides of the casing pipes, the shrink sleeve must be pushed to one end of the casing pipe. Then the end of the shrink sleeve is marked on the other side of the casing pipe.



Pass the dimension of centre distance on the casing pipe on the opposite side and mark it also.



Push back the shrink sleeve so far in direction of the starting position that the marking of step 1 becomes visible. Meter the distance between marking and leading edge of the casing pipe and mark centre distance.

### 3.9 Preparation of the seal areas



1  
Roughen the surface of the casing pipe end complete circumferentially up to the marking by using sandpaper (40 to 60 grade). Repeat the process at the other end of the casing pipe.



2  
Use a dry, grease and lint-free rag with ethanol/spirit (min. 99.9 %) or Tangit cleaning wipes to clean the roughened surface of the casing pipe ends.

### 3.10 Assembly of melting adhesive strips



1  
Heat the cleaned pipe end with a low flame on each side of the pipe up to approximately 80°C.



4  
Remove the thick release liner on the top side of the melting adhesive strip only in the overlapping area at the beginning of the melting adhesive strip. Gently heat the end of the melting adhesive strip at the bottom side. Then tightly wrap the heated film around the pipe and press it close in the overlapping area.



2  
Remove the thinner release liner at the underlap of the melting adhesive strip



5  
Repeat the described work process of step 1 to 4 at the other end of the casing pipe.



3  
Attach the melting adhesive strip at the end of the casing pipe in a distance of approx. 30 mm to the marking of the centre distance in a 90° angle to the pipe axis and wrap around closely.



6  
Wrap outwards the upper release liner on both sides in a 45° angle that the beginning of the film of both melting adhesive strips protrudes over the marking of the centre distance.

### 3.11 Assembly of casing shrink film

#### Before installation check the following:

- Film is in full contact with the PUR-insulation sleeves and the casing pipe ends
- Casing shrink film conforms to the PUR insulation sleeves
- No cracks or holes in film backing

In general, the casing shrink film will shrink during the shrink sleeve application, however, the film can be heated gently in advance to remove any wrinkling or to improve profile conformance.



Remove the release liner at the bottom of the casing shrink film. Centre the film over the PUR-insulation sleeve in a 90° angle to the pipe axis and wrap closely around the PUR-insulation sleeves. A sufficient overlap of the shrink film of at least 10 cm is important. On both ends the shrink film must overlap the casing pipes with at least 2.5 cm.



Gently heat the end of the shrink film at the bottom side – like the melting adhesive strips. Then wrap the heated part around the pipe and press it tight in the overlap area.

### 3.12 Positioning of the shrink sleeve



Push the shrink sleeve as far to the marking of the centre distance on the other side of the casing pipe until the marking is visible on both sides of the centre distance.



Cut the release liner with a knife from the outside in a way that the release liner in the inside of the shrink sleeve can also be pulled out from one side.



Pull out the release liner from one side and remove it completely. Position the shrink sleeve in a way that the quality-control number is in the area between "10 and 2 o'clock position".



Pull off the release liner of the melting adhesive strip and remove it.



Pull off the release liner of the melting adhesive strip on the other side and remove it. Check the position of the shrink sleeve according to the markings of the centre distance on both sides of the casing pipes.

### 3.13 Shrinking sequence

Check the position of the shrink sleeve and the cleanliness in the whole processing area again.

For the processing of the ISO-socket of dimension 315 mm and higher it is advisable for economic and mounting reasons to work with two assemblers and two propane gas torches.

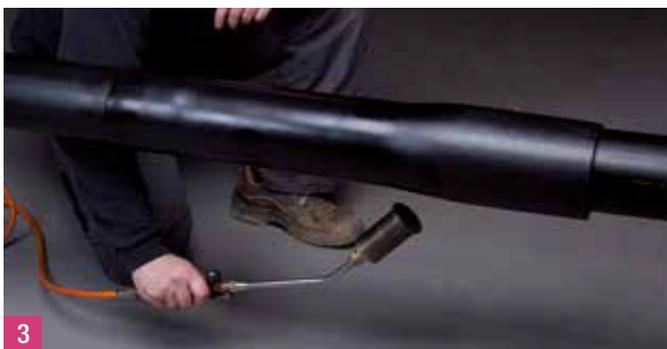
The shrinking process starts at one side of the shrink sleeve. Consider that the shrink sleeve is heated up with a weak propane gas flame (see page 16). The burner head must be swayed slowly around the pipe. **Especially regard the area between “5 and 7 o'clock position”.**

The shrinking process must be continued by controlled, spiral forward motions of the burner head around the pipe – form a funnel to avoid air bubbles – and is completed at the other end of the shrink sleeve.

### Quality control – “finger test”

During the shrinking process check the “weakness” of the shrink sleeve base and the liquefaction of the hot-melt adhesive in the sealing area by a “finger test”. Still existing cold zones can be reheated without any difficulty.

When the shrink sleeve lays evenly tight and without gaps completely around the PUR-insulation jacket respectively around the casing pipes, the shrinking process can be finished.



### 3.14 Processing of the tension tape

The ends of the shrink sleeves for casing pipes with a diameter of 300 mm and more must be fixed with the tension tape (in the installation kit) directly after finishing the shrinking process.

### 3.15 Quality control by “finger tip test”

Upon completion of the shrinking process a simple “finger tip test” can ensure that the ends of the shrink sleeve are not bent up at any point of the sealing area. If so this area can be reheated.

### 3.16 Final control

Upon completion of the above specified work processes the following must be assured:

- The shrink sleeve lays evenly tight and completely around the PUR-insulation jackets and the PE-casing pipes on the whole length.
- The hot-melt adhesive is visible at the outline.
- No cold areas or damages at the shrink sleeve base.

#### Recommendations

The time between the end of the shroud processing and the start of the sand back-filling of the pre-insulated PP-R system elements should be at least 0.5–1.0 hour.

The shrinkable base material and the hot-melt adhesive must be cooled down sufficiently and hardened so that the required protection and the peel strength are achieved and a permanent tightness is guaranteed.

### Elements/System review

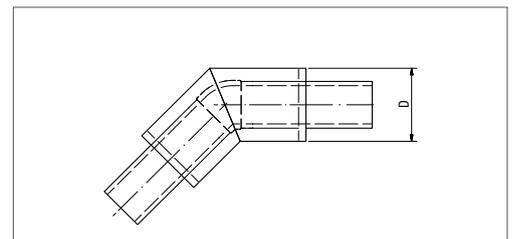
**For all PP-R pipe sizes the following system elements are available:**

- Pipes (5.8 m and 11.6 m length)
- Elbows 15°
- Elbows 30°
- Elbows 45°
- Elbows 90°
- Branches
- Reducing branches
- Cross-over branches
- Reduced cross-over branches
  
- ISO shrink sleeve
- ISO reduced shrink sleeve
- ISO closing collar
  
- Special fittings on request
  
- Compact seals

# 4 PRODUCTS

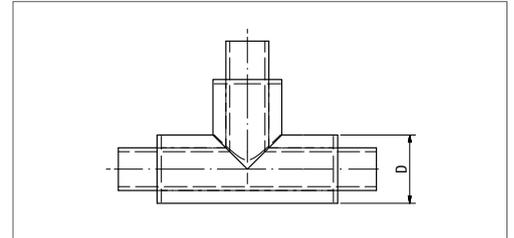
PP-R Faser composite pipes - PUR rigid foam and coated with a casing pipe made of PEHD				
Article No.	Medium Pipe Outside Dia. (mm)	Casing Pipe Outside Dia. (mm)	Type	Length (m)
323932 001	200	315	SDR 11	5.8
323933 001	250	400	SDR 11	5.8
323934 001	315	450	SDR 11	5.8
325726 001	355	500	SDR 11	5.8
324167 001	200	315	SDR 11	11.6
324168 001	250	400	SDR 11	11.6
324169 001	315	450	SDR 11	11.6
325727 001	355	500	SDR 11	11.6

PP-R Elbow - with PUR rigid foam and coated with a casing pipe made of PEHD				
	Article No.	Description	Pipe Outside Dia. (mm)	Type
P-R 15° Elbow	323877 001	Elbow- SL500	200	SDR 11 pipe 15°
	323878 001	Elbow- SL500	250	SDR 11 pipe 15°
	323879 001	Elbow- SL500	315	SDR 11 pipe 15°
	325728 001	Elbow- SL500	355	SDR 11 pipe 15°
PP-R 30° Elbow	323880 001	Elbow- SL500	200	SDR 11 pipe 30°
	323881 001	Elbow- SL500	250	SDR 11 pipe 30°
	323882 001	Elbow- SL500	315	SDR 11 pipe 30°
	325729 001	Elbow- SL500	355	SDR 11 pipe 30°
PP-R 45° Elbow	323883 001	Elbow- SL500	200	SDR 11 pipe 45°
	323884 001	Elbow- SL500	250	SDR 11 pipe 45°
	323885 001	Elbow- SL500	315	SDR 11 pipe 45°
	325730 001	Elbow- SL500	355	SDR 11 pipe 45°
PP-R 90° Elbow	323886 001	Elbow- SL1000	200	SDR 11 pipe 90°
	323887 001	Elbow- SL1000	250	SDR 11 pipe 90°
	323888 001	Elbow- SL1000	315	SDR 11 pipe 90°
	325732 001	Elbow- SL1000	355	SDR 11 pipe 90°



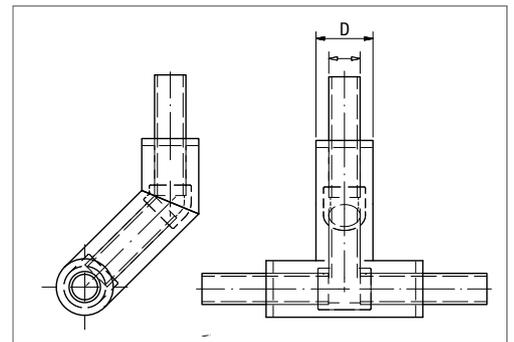
**PP-R Equal tee - with PUR rigid foam and coated with a casing pipe made of PEHD**

Article No.	Description	Pipe Outside Dia. (mm)	Type
323889 001	Equal tee- SL750	200	SDR 11
323890 001	Equal tee- SL750	250	SDR 11
323891 001	Equal tee- SL750	315	SDR 11
325733 001	Equal tee- SL750	355	SDR 11



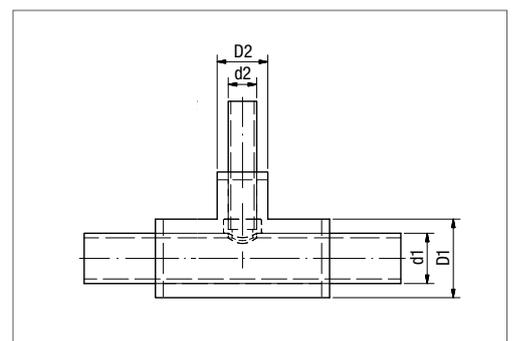
**PP-R Equal cross-over tee - with PUR rigid foam and coated with a casing pipe made of PEHD**

Article No.	Description	Pipe Outside Dia. (mm)	Type
323892 001	Cross-over equal tee - SL1500	200	SDR 11
323893 001	Cross-over equal tee - SL1500	250	SDR 11
324170 001	Cross-over equal tee - SL1500	315	SDR 11
325734 001	Cross-over equal tee - SL1500	355	SDR 11



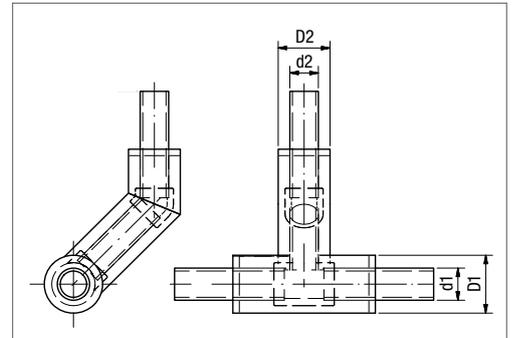
**PP-R Reducing tee - with PUR rigid foam and coated with a casing pipe made of PEHD**

Article No.	Description	Pipe Outside Dia. (mm)	Type
324175 001	Reducing tee - SL750	250/200/250	SDR 11
324176 001	Reducing tee - SL750	315/200/315	SDR 11
324177 001	Reducing tee - SL750	315/250/315	SDR 11
325736 001	Reducing tee - SL750	355/200/355	SDR 11
325737 001	Reducing tee - SL750	355/250/355	SDR 11
325738 001	Reducing tee - SL750	355/315/355	SDR 11



**PP-R Reducing cross-over tee - with PUR rigid foam and coated with a casing pipe made of PEHD**

Article No.	Description	Pipe Outside Dia. (mm)	Type
324178 001	Cross-over reducing tee - SL1000	250/200/250	SDR 11
324179 001	Cross-over reducing tee - SL1000	315/200/315	SDR 11
324180 001	Cross-over reducing tee - SL1000	315/250/315	SDR 11
325739 001	Cross-over reducing tee - SL1000	355/200/355	SDR 11
325742 001	Cross-over reducing tee - SL1000	355/250/355	SDR 11
325743 001	Cross-over reducing tee - SL1000	355/315/355	SDR 11

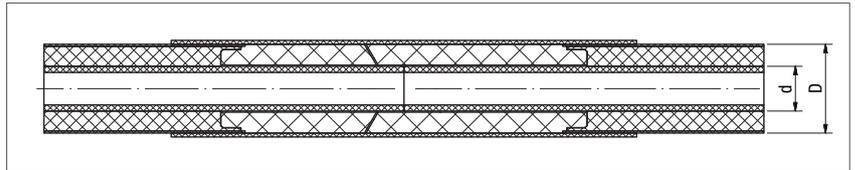


**PP-R Reducing tee with PN16 flange (for PE-Xa connection) - with PUR rigid foam and coated with a casing pipe made of PEHD**

Article No.	Description	Pipe Outside Dia. (mm)	Type
324181 001	Reducing tee with PN16 flange - SL750	200/32/200	SDR 11
324182 001	Reducing tee with PN16 flange - SL750	200/40/200	SDR 11
324183 001	Reducing tee with PN16 flange - SL750	200/50/200	SDR 11
324184 001	Reducing tee with PN16 flange - SL750	200/63/200	SDR 11
324185 001	Reducing tee with PN16 flange - SL750	200/75/200	SDR 11
324186 001	Reducing tee with PN16 flange - SL750	200/90/200	SDR 11
324188 001	Reducing tee with PN16 flange - SL750	200/110/200	SDR 11
324427 001	Reducing tee with PN16 flange - SL750	200/125/200	SDR 11
324189 001	Reducing tee with PN16 flange - SL750	200/160/200	SDR 11
324190 001	Reducing tee with PN16 flange - SL750	250/32/250	SDR 11
324191 001	Reducing tee with PN16 flange - SL750	250/40/250	SDR 11
324192 001	Reducing tee with PN16 flange - SL750	250/50/250	SDR 11
324193 001	Reducing tee with PN16 flange - SL750	250/63/250	SDR 11
324194 001	Reducing tee with PN16 flange - SL750	250/75/250	SDR 11
324195 001	Reducing tee with PN16 flange - SL750	250/90/250	SDR 11
324196 001	Reducing tee with PN16 flange - SL750	250/110/250	SDR 11
324197 001	Reducing tee with PN16 flange - SL750	250/125/250	SDR 11
324198 001	Reducing tee with PN16 flange - SL750	250/160/250	SDR 11
324199 001	Reducing tee with PN16 flange - SL750	315/32/315	SDR 11
324200 001	Reducing tee with PN16 flange - SL750	315/40/315	SDR 11
324201 001	Reducing tee with PN16 flange - SL750	315/50/315	SDR 11
324202 001	Reducing tee with PN16 flange - SL750	315/63/315	SDR 11
324203 001	Reducing tee with PN16 flange - SL750	315/75/315	SDR 11
324204 001	Reducing tee with PN16 flange - SL750	315/90/315	SDR 11
324235 001	Reducing tee with PN16 flange - SL750	315/110/315	SDR 11
324237 001	Reducing tee with PN16 flange - SL750	315/125/315	SDR 11
324239 001	Reducing tee with PN16 flange - SL750	315/160/315	SDR 11
325744 001	Reducing tee with PN16 flange - SL750	355/160/355	SDR 11

**PP-R Cross-over reducing tee with PN16 flange (for PE-Xa connection) - with PUR rigid foam and coated with a casing pipe made of PEHD**

<b>Article No.</b>	<b>Description</b>	<b>Pipe Outside Dia. (mm)</b>	<b>Type</b>
324241 001	Cross-over reducing tee with PN16 flange - SL1000	200/32/200	SDR 11
324242 001	Cross-over reducing tee with PN16 flange - SL1000	200/40/200	SDR 11
324243 001	Cross-over reducing tee with PN16 flange - SL1000	200/50/200	SDR 11
324244 001	Cross-over reducing tee with PN16 flange - SL1000	200/63/200	SDR 11
324245 001	Cross-over reducing tee with PN16 flange - SL1000	200/75/200	SDR 11
324246 001	Cross-over reducing tee with PN16 flange - SL1000	200/90/200	SDR 11
324247 001	Cross-over reducing tee with PN16 flange - SL1000	200/110/200	SDR 11
324248 001	Cross-over reducing tee with PN16 flange - SL1000	200/125/200	SDR 11
324249 001	Cross-over reducing tee with PN16 flange - SL1000	200/160/200	SDR 11
324250 001	Cross-over reducing tee with PN16 flange - SL1000	250/32/250	SDR 11
324251 001	Cross-over reducing tee with PN16 flange - SL1000	250/40/250	SDR 11
324252 001	Cross-over reducing tee with PN16 flange - SL1000	250/50/250	SDR 11
324253 001	Cross-over reducing tee with PN16 flange - SL1000	250/63/250	SDR 11
324254 001	Cross-over reducing tee with PN16 flange - SL1000	250/75/250	SDR 11
324255 001	Cross-over reducing tee with PN16 flange - SL1000	250/90/250	SDR 11
324256 001	Cross-over reducing tee with PN16 flange - SL1000	250/110/250	SDR 11
324257 001	Cross-over reducing tee with PN16 flange - SL1000	250/125/250	SDR 11
324258 001	Cross-over reducing tee with PN16 flange - SL1000	250/160/250	SDR 11
324259 001	Cross-over reducing tee with PN16 flange - SL1000	315/32/315	SDR 11
324260 001	Cross-over reducing tee with PN16 flange - SL1000	315/40/315	SDR 11
324261 001	Cross-over reducing tee with PN16 flange - SL1000	315/50/315	SDR 11
324262 001	Cross-over reducing tee with PN16 flange - SL1000	315/63/315	SDR 11
324263 001	Cross-over reducing tee with PN16 flange - SL1000	315/75/315	SDR 11
324264 001	Cross-over reducing tee with PN16 flange - SL1000	315/90/315	SDR 11
324265 001	Cross-over reducing tee with PN16 flange - SL1000	315/110/315	SDR 11
324340 001	Cross-over reducing tee with PN16 flange - SL1000	315/125/315	SDR 11
324341 001	Cross-over reducing tee with PN16 flange - SL1000	315/160/315	SDR 11
325745 001	Cross-over reducing tee with PN16 flange - SL1000	355/160/355	SDR 11



#### PP-R CSC-X Socket

Art No.	Pipe Outside Dia. (mm)	Description
324342 001	200	CSC-X Socket
324343 001	250	CSC-X Socket
324344 001	315	CSC-X Socket
325735 001	355	CSC-X Socket

#### PP-R Reducing socket

Article No.	Pipe Outside Dia. (mm)	Description
324345 001	250/200	Reducing socket
324346 001	315/200	Reducing socket
324347 001	315/250	Reducing socket
325746 001	355/250	Reducing socket
325747 001	355/315	Reducing socket

#### Fittings:

##### PN16 flange adapter

Article No.	Description	Pipe Outside Dia. (mm)
324348 001	PN16 flange adapter	200
324349 001	PN16 flange adapter	250
324350 001	PN16 flange adapter	315
325748 001	PN16 flange adapter	355

##### PN16 flange ring

Article No.	Description	Pipe Outside Dia. (mm)
324351 001	PN16 flange ring	200
324352 001	PN16 flange ring	250
324353 001	PN16 flange ring	315
325749 001	PN16 flange ring	355

##### Pre-insulated isolation valve

Article No.	Description	Pipe Outside Dia. (mm)
324354 001	Pre-insulated isolation valve	200
324355 001	Pre-insulated isolation valve	250
324356 001	Pre-insulated isolation valve	315
325750 001	Pre-insulated isolation valve	355

##### Fixing bracket for building entries

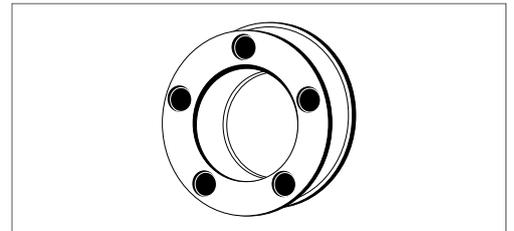
Article No.	Description	Pipe Outside Dia. (mm)
324357 001	Fixing bracket	200
324358 001	Fixing bracket	250
324359 001	Fixing bracket	315
325751 001	Fixing bracket	355

**Heat shrink end cap**

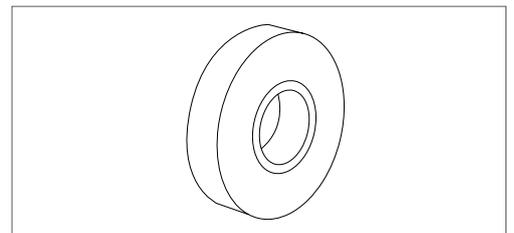
Article No.	Description	Pipe Outside Dia. (mm)
324364 001	Heat shrink end cap	200
324365 001	Heat shrink end cap	250
324366 001	Heat shrink end cap	315
325752 001	Heat shrink end cap	355

**Compact wall seal**

Article No.	Description	Pipe Outside Dia. (mm)
324361 001	Compact wall seal	200
324362 001	Compact wall seal	250
324363 001	Compact wall seal	315
325753 001	Compact wall seal	355

**District Heating WARNING TAPE**

Article No.	Description
311150-001	Warning tape



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