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# PP-R Pre-Insulated Pipe System

Technical Information



# Contents

<b>01</b>	<b>System Features</b>	<b>5</b>
01.01	Description	5
01.02	Medium Pipe	5
01.03	Insulation	6
01.04	Outer Jacket	7
01.05	Fittings	7
<b>02</b>	<b>Installation</b>	<b>8</b>
02.01	Requirements to PP-R butt-fusion tools	8
02.02	Instructions for the assembly of welding tools	8
02.03	Heating-up phase/handling	8
02.04	Butt welding jointing technique	9
02.05	Electrofusion jointing technique	11
02.06	Underground Installation	13
02.07	Other installations	14
02.08	Shrouds Installation Instructions	15
02.09	Guide Installation Times	17
02.10	Pressure Testing	17
<b>03</b>	<b>Parts List</b>	<b>18</b>
	<b>Notes</b>	<b>25</b>
	<b>Sales Offices</b>	<b>27</b>

# PP-R Pre-Insulated Pipe System

## For district heating and cooling

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

REHAU pre-insulated PP-R pipe system for district heating and cooling includes a complete range of pre-insulated fittings and pipes insulated with rigid PUR (polyurethane) foam protected by an outer jacket made from PE-HD.

### REHAU PP-R pipe

The internal carrier pipes and fittings which form the REHAU PP-R pre-insulated system, are made using advanced materials PP-R 80 Super and PP-RCT WOR (White Oxidation Resistance) with a blend of additives to ensure greater resistance to oxidants and metal ions.












The material ensures high stability at high temperatures; the middle layer of the pipes is made of fibre-reinforced polypropylene (PP\_RF), which reduces linear thermal expansion up to 70% compared to single-layer PP-R pipes. The high quality PUR heat insulation connects the carrier pipes with the outer PE-HD jacket to create a fully bonded, compact pipe system.

These characteristics make REHAU PP-R pre-insulated system ideal to distribute energy between the heat sources, chillers, heat pumps, geothermal systems, etc. and the utilities involving networks of pre-insulated underground pipes, ensuring maximum safety and design reliability.

### Environment








The environmentally friendly material polypropylene PP-R is recyclable and can be ground, melted and re-used 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.

### Fields of application

	PP-R Pipe SDR 11
Climate technology	
Chilled water systems	
Swimming pools	
Rainwater management*	
Irrigation	
District heating	
District cooling	
Ship building	
Industrial liquids* (depending on the material resistance)	
Civil geothermal plants	
Industrial geothermal plants	

\* Please note: For applications not shown here (higher temperature or pressure) please check with REHAU Technical Department

### System advantages

	PP-R Pipe SDR 11
Low expansion	
Corrosion resistant	
Very good welding properties	
Low pipe friction	
High impact resistance	
Metal deactivation	
Recyclable	

## Installation advantages



- Easy and quick installation and reliable joints made by butt or electro fusion.
- Reduced weight compared to steel pipe work, which makes it easier to handle the materials on site. No cranes are needed to handle the items during the welding.
- Fully insulated joint shrouds with on-site foaming with PUR (two-component foam).
- Pre-fabrication and custom articles.
- Pipe section can be joined outside the trench and lowered into position at a later time. This can be useful for optimising civil works and installing in adverse weather conditions when trench is unusable.
- When installed underground, no expansion loops for long runs or directional changes are required due to system's excellent self-compensation features.
- Possible installation in "pre-tension" conditions with open trench, which consists of preheating the pipes to temperatures that reach at least 50% of the max. design temperature, before being buried to close the excavation.
- This is possible also thanks to the reduced mechanical stresses that the pipe develops due to thermal expansion.
- These are proportional to modulus, which for fibre-reinforced PP is about 1,5 GPa, 100 times lower than steel.
- The stresses produced by residual thermal expansions will be absorbed and compensated (self-compensation) in a natural manner by the material, and the viscoelasticity characteristics of the material provide a new configuration of the pipeline.

	<b>Modulus of elasticity</b>	<b>Coefficient of linear thermal expansion</b>
PP-RF	1450/mm <sup>2</sup>	0.035 mm/m°C
Steel	210.000N/mm <sup>2</sup>	0.017 mm/m°C

## Energy saving

REHAU pre-insulated PP-R system ensures several energy saving advantages:

- Minimum heat loss thanks to the low thermal transmittance  $U$  (W/m<sup>2</sup>°K) values, also in the presence of high temperature differences ( $\Delta T$ ).
- This factor is mainly characterised by the very low thermal conductivity of the service pipe (0.19 W/mK, against 52 W/mK for steel).
- Together with an excellent and uniform insulation by means of rigid polyurethane foam (PUR) injected into the space between the service pipe and the external casing pipe (made with PE-HD), it makes the pipes highly efficient from the energy saving point of view.
- Energy saving thanks to its low thermal conductivity value.
- Reduced pressure drops: the inner surface of the service pipes, with a roughness value of 0.007 mm (against 0.020 mm of steel pipes) generates low friction inside the pipes, promoting fluid flow and significantly reducing distributed pressure drops.
- This factor is reflected, for example, in considerable energy savings when using pumps: due to their design capacity, they can operate more slowly, decreasing the flow rate of the conveyed fluid and therefore consuming less energy, while still ensuring the required flow rate.
- In addition, this feature significantly reduces the noise of the system.
- Increased system cleanliness: the polymer material used for the production of the service pipes of REHAU pre-insulated PP-R range prevents the formation of sludge and the presence of rust, as well as drastically reducing limescale deposits.
- This prevents poor equipment performance, possible clogging problems in heat exchangers, filters, shut-off valves and other devices that are part of the system, resulting in reduced operation and maintenance.
- Excellent chemical resistance: REHAU pre-insulated PP-R system does not require anti-corrosion film-forming treatments, it is compatible with antifreeze products and is resistant to many chemicals.
- No corrosive phenomena such as: galvanic corrosion due to metal couplings between different metal alloys.
- Stray currents: it is not necessary to provide any cathodic-anodic protection since the fibre-reinforced PP-R pipe features high electrical volume resistance of approximately 10<sup>14</sup>Ω•m; electrochemical or chemical corrosion due to the effect of water or chemicals dissolved in it.

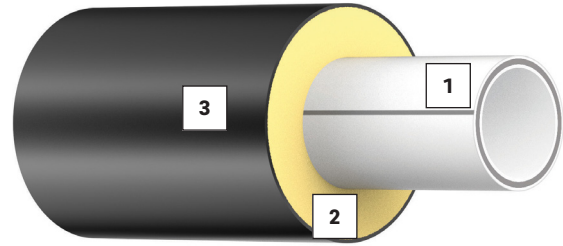
# 01 System Features

## 01.01 Description

### PP-R composite pipe system SDR 11

Pre-insulated pipe made of PUR (rigid polyurethane foam) protected by an outer jacket, and a fibre reinforced carrier pipe (SDR 11) in PP-RCT WOR with high resistance against high temperature and oxidation process, especially suitable for mechanical installations: heating, air conditioning and compressed air systems, transport of technological fluids.

The high performance of the raw materials used makes it possible to install systems with pipes of lower thickness compared to conventional ones, thus increasing the total water flow.



- 1 PP-R carrier pipe
- 2 PU insulation layer
- 3 PE-HD outer jacket

## 01.02 Medium pipe

### Material parameters

Raw material: PP-RCT WOR/PP-RF/PP-R

Thermal conductivity at 20°C: 0.190 W/mK

Coefficient of linear thermal expansion (CLTE):  
a 0.035 mm/mK

Internal roughness: 0.007 mm

Colour: inner layer white, external layer white with grey stripes, black outer casing

Size: from Ø 160 to 315 mm

Medium pipe			External pipe			Pipe weight				
External	Internal	Thickness	External	Thickness	Insulation thickness	DN	Straight length	Water content	Uninsulated	Pre-insulated*
mm	mm	mm	mm	mm	mm		m	l/m	kg/m	kg/m
160	130.8	14.6	250	3.6	41.4	125	5.8 / 11.6	13.437	6.733	10.95
200	163.6	18.2	315	4.1	53.4	150	5.8 / 11.6	21.021	10.695	17.047
250	204.6	22.7	400	4.8	70.2	200	5.8 / 11.6	32.878	16.607	26.501
315	257.8	28.6	450	5.2	62.3	250	5.8 / 11.6	52.198	26.33	37.658

\* Pre-insulated pipe weight refers to 1 metre pipe totally insulated and coated. The indicated weights are ones of the manufactured samples, therefore the weight can vary depending on the dimensional tolerances of the product.

Note: Straight length of a finished product has uninsulated pipe length of 190mm at each end.

Temperature	Years of operation	REHAU PP-R SDR11	
		SF 1.25	SF 1.5
		bar	bar
10°C	10	24	19.9
	25	23.1	19.3
	50	22.5	18.8
	100	21.2	17.7
20°C	10	21.7	18.1
	25	20.9	17.4
	50	20.3	17
	100	19.2	16.1
30°C	10	19.3	16.1
	25	18.4	15.5
	50	18.2	15.2
	100	17.3	14.4
40°C	10	17	14.2
	25	16.4	13.7
	50	16	13.4
	100	15.3	12.8
50°C	10	14.6	12.2
	25	14.2	11.8
	50	13.8	11.5
	100	13.3	11.1
60°C	10	12.3	10.3*
	25	11.9	9.8*
	50	11.7	9.7*
	100	11.3	
70°C	10	9.9	8.3*
	25	9.6	8*
	50	9.5	7.9*
80°C	10	8.4	7*
	25	8	6.6*
90°C	10	6.4	5.4*
	25	6.1	5*

\*Please check your project working conditions with REHAU Technical Department

## 01.03 Insulation

The pipe, fittings and custom parts insulation process is carried out in reference to UNI EN 253. This process is performed using digital equipment that monitors the stoichiometric dosing, mixing of the two base components (polyol and isocyanate) and injection of the mixture in real time.

The polyaddition reaction between these two reagents leads to the formation of a polyurethane product (PUR) obtained by reaction between isocyanate and polyol, with the addition of catalysts and water like expanding agent, which increases the reaction rate and promotes the formation of rigid expanded foam, with high thermal insulation capacity.

The coaxiality of the items is guaranteed by spacers made of polymer material, placed at appropriate distances.

The use of these spacers also limits the tension generated during the expansion of the PUR foam and also ensures the even support of the outer jacket

Core density -29-32kg/m<sup>3</sup>

Closed-cell content >92%

Compression strength with 10% deformation >1.75N/mm<sup>2</sup>

Thermal conductivity at 50°C 0.023W/mK

Absorption in water to EN 1609 0.20kg/m<sup>2</sup> ( 23°C/ 24 hours)

### Heat loss at average temperatures including flow and return pipe, W/m trench

Pipe size	30°C	40°C	50°C	60°C	70°C
160/250mm	11.31	16.96	22.61	28.27	33.92
200/315mm	11.13	16.69	22.26	27.82	33.39
250/400mm	10.82	16.22	21.63	27.04	32.45
315/450mm	13.74	20.62	27.49	34.36	41.23

### Heat loss at average temperatures including flow pipe only, W/m

Pipe size	30°C	40°C	50°C	60°C	70°C
160/250mm	5.65	8.48	11.31	14.13	16.96
200/315mm	5.56	8.35	11.13	13.91	16.69
250/400mm	5.41	8.11	10.82	13.52	16.22
315/450mm	6.87	10.31	13.74	17.18	20.62

### Heat loss conditions:

Ground temperature 10°C

Soil conductivity 1.0 W/mk

Depth from surface 0.8m

#### 01.04 Outer jacket

##### Material

The outer jacket, made of PE-HD and compliant with product Standards UNI EN 253, is designed to protect the polyurethane foam, especially in underground installations.

The physical characteristics of polyethylene (PE), considered one of the best materials in terms of chemical and electrochemical resistance, make REHAU PP-R system particularly resistant to:

- Weathering, and in particular UV exposure, through the use of antioxidant additives in the polymer material of the casing pipe;
- Electrolytes and stray currents in the soil.

To facilitate adhesion between the inner surface of the casing and the polyurethane foam, the inner surface of the casing is first of all subject to a treatment which modifies the surface tension optimising the adhesion of the polyurethane foam and ensuring high stability of the entire system.

##### Material parameters

Physical and technical features	Results
Density	0.950 g/cm <sup>3</sup>
Thermal conductivity	0.40W/mK
Thermal expansion coefficient	0.18
Modulus of elasticity	800MPa

#### 01.05 Fittings

Pre-insulated PP-R pipe fittings are made by welding segments of pipes. The made products are then pre-insulated with PUR (rigid polyurethane foam) and protected by outer jacket. Each end is protected by caps, then each fitting is individually packaged. In order to meet market requests and requirements custom parts can be manufactured on specific project requests.



## 02 Installation

### 02.01 Requirements to PP-R butt-fusion tools

PP-R jointing is typically made by butt-fusion.

**Tools sourced should cover the range of pipework installed on site. This might mean you have to cover the range with more than one tool.**

Butt fusion joint to be performed with the following tool parameters.

Please contact REHAU for tooling recommendations.

- Welding to DVS 2207-11 Specification
- Pipe material PP
- Overall product outer diameter (casing outer diameter) and carrier pipe outer diameter dimensions. Typically one tool covers a range of sizes.
- Pipe SDR
- Temperature range as per DVS 2207-11 at 210°C

### 02.02 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 must not be used.
- Fit the chamfering and the cold welding tools manually.

### 02.03 Heating-up phase/handling

#### Part A: Heating-up phase

1. Plug in the welding tool and check if the 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 210°C is required for welding the 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.

#### Part B: Handling

5. After any tool changes on a warmed up tool, confirm the correct weld temperature on the tool prior to commencing any welds.
6. If the device has been unplugged, e.g. during longer breaks, the heating up process must be repeated (start at point 1).
7. After finishing the welding works, unplug the welding tool and let it cool down. Never use water or other liquids to cool the welding plate as this destroys the heating resistances! Never open the welding tools or repair them by yourself. Return the defective devices for repair to the hire company.
8. Welding plates and welding tools must be protected from moisture and contamination. Burnt particles may cause an incorrect fusion. The use of damaged and dirty tools is not allowed.
9. Before and after the welding do not lay the welding plate on the welding tools, as the Teflon coating of the tools may be damaged. Always put the plate in the included stand.



## 02.04 Butt welding jointing technique

The weld parameters vary with pipe size and from weld device to weld device and specific tool instructions should always be provided with the tool.

**Dimensions 160 - 315 mm are joined by butt-welding.**

### Notes for making a connection:

1. Connect the equipment and assemble the pipe within bracketing using inserts as required.
2. Follow the instructions given on the screen of the welding machine. To start, check the two pipes are perfectly aligned by bringing them together.
3. Clean the pipe ends.
4. Fit the cutter on the tool and grind the ends of the pipe until the cut is square (indicated by a continuous swarf).
5. Follow the instructions of the tool to start the heating process, this includes assembling the heating plate. Automatic tools will follow the data uploaded to the tool (DVS 2207-11 and material information) to set heating times, pressure and cooling times.

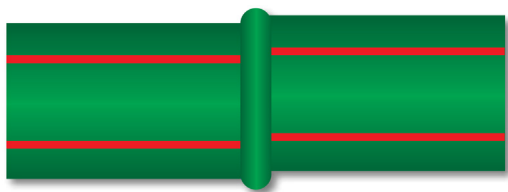


On manual welding tools the operator must also set and then check the following welding parameters on the machine:

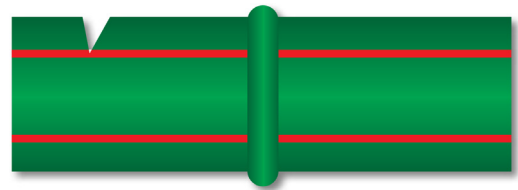
- Heating plate temperature
- Pressures
- Bead dimensions
- Stage duration times

### Errors in butt welding

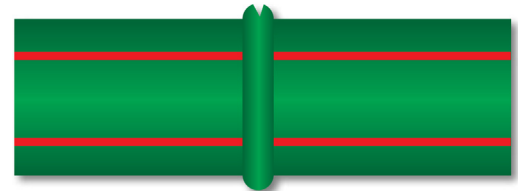
**Important:** Do not use cold water or compressed air to accelerate the cooling. Use a welding tent to protect the joint from water or other weather conditions and to maintain a constant environment for welding



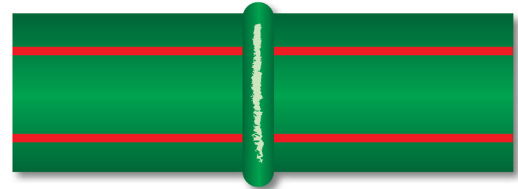
**Misalignment**



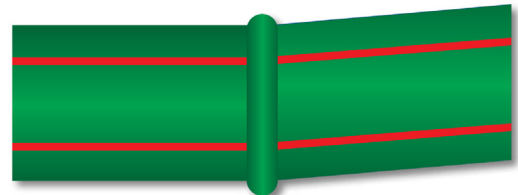
**Scratches**



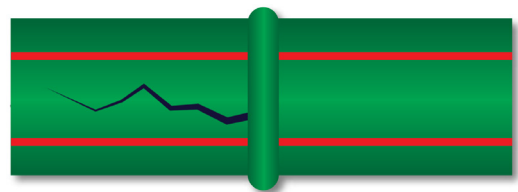
**Cuts in the bead**



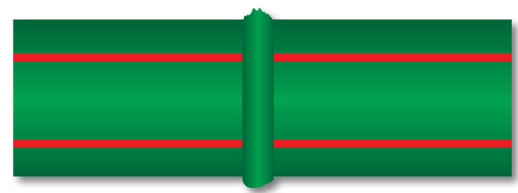
**Presence of impurities**



**Angled weld**

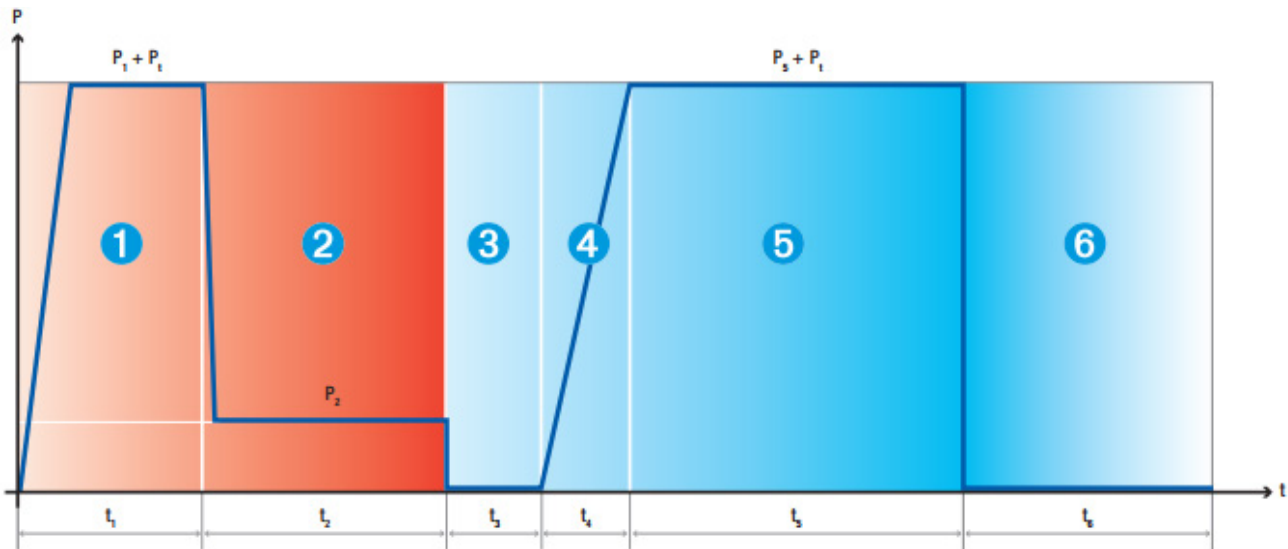


**Cracks**



**Uneven bead**

### Simple Pressure Welding Cycle



$P_1$  = Build up and pre-heating pressure,  
 $P_2$  = Maximum heating pressure,  
 $P_5$  = Welding pressure,  
 $P_t$  = (Dragging pressure): pressure necessary to overcome tool friction. If using a manual tool the operator must measure it on the oleodynamic control unit pressure gauge.  
 $t_1, t_2, \dots, t_6$  = stage duration 1,2, ..., 6.

#### 1. Approach and Pre-Heating

Bring the ends to weld to the heating element at the pressure ( $P_1 + P_t$ ) and wait for the bead to reach the size required by the standard used.

#### 2. Heating

Reduce the pressure to the maximum  $P_2$  value sufficient to maintain the ends in contact with the heating plate for the time  $t_2$ .

NB: the operator, reducing the pressure, must pay attention not to detach the ends from the heating plate. If this happens, welding must be repeated.

#### 3. Removing the heated plate

Remove the heated plate in maximum time  $t_3$ , without damaging the ends of the two pipes.

#### 4. Reaching welding pressure

Bring the two pipe ends together, progressively increasing the pressure up to the ( $P_5 + P_t$ ) value, in the time  $t_4$ .

Avoid sudden overfills of melted material.

#### 5. Welding

Keep the ends in contact at the pressure ( $P_5 + P_t$ ) for the time  $t_5$ .










#### 6. Cooling

When welding is complete (stage 5), the welded joint can be removed from the welding machine without being subjected to stress. It must not be stressed until it has completely cooled.

Do not use cold water or compressed air to accelerate cooling. If necessary, protect the joint from rain, wind or excessive solar exposure.

NB: always follow the instructions in the operating manual supplied with the machine used and follow the DVS 2207 directive, part 11. REHAU also recommends using the App for smart devices (mobiles, tablets, etc.) made available by the manufacturer of the equipment which, in addition to guiding the operator in the processing step by step, is regularly updated according to the legislative/or technical changes of the equipment in use.

## 02.05 Electrofusion jointing technique

	Remove the fitting from the packaging and keep the label as it provides useful information on the welding settings.
	Measure the length of the fitting and divide it by two.
	Add 10mm and mark the distance from the pipe end.
	Scrape the pipe ends by at least 0.2mm on diameters of 160-400mm
	Clean the pipe ends from all swarf. For this purpose, use a scraper.
	Clean the pipe ends with the PP cleaning fluid.
	Push the pipe ends into the fitting all the way to the end stop.
	Connect the fitting to the welding machine with the pins.
	Program the welding machine with the correct values of temperature and voltage: either by scanning the barcode on the fitting label or by inserting welding parameters manually. Proceed to the welding cycle according to the technical manuals. WARNING: Keep a safe distance during the electric welding.

**Electric welding estimated time**

<b>Ext. Pipe Ø</b>	<b>Voltage</b>	<b>Welding time</b>	<b>Cooling time</b>
<b>mm</b>	<b>V</b>	<b>sec</b>	<b>min</b>
20	17	76	10
25	20	86	10
32	18	86	10
40	20	122	10
50	40	87	10
63	40	165	15
75	40	150	15
90	40	125	20
110	38	190	20
125	40	160	40
160	30	650	40
200	30	16 min	40
250	30	27 min	40
315	35	20 min	40
355	35	20 min	45
400	35	23 min	45

## 02.06 Underground Installation

Correct conditions of the trench must be checked before starting the installation of the pipes. Excavation works must ensure an unobstructed installation of the pipes. For an installation of the shroud in the trench, ensure that there is adequate work space area around the pipe in the trench. The trench base must be free from water and sludge. The pipe laying must meet the requirements. The pipes are generally laid at a certain depth below ground level or, more frequently, below the road surface.

In the case of aqueduct pipelines, adequate protection for the conveyed fluid is required, both for preserving the product characteristics and for protecting against frost, as well as to prevent contamination. The installation depth depends on the type of the pipeline and the site conditions: especially in city centres, the proximity of other services requires close coordination of available space, by positioning each of them at a different level.

Minimum cover of pipework must be 0.8m from the top of the pipe to the ground level.

If the minimum required depth cannot be observed, the pipe must be protected with concrete or conduits. The type of trench to be carried out must be evaluated, in the initial design stage, according to the composition of the soil and installation depth.

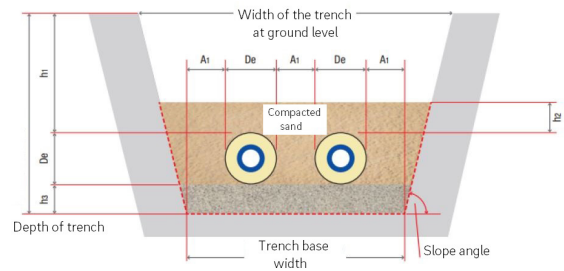
Pipe sections can also be assembled outside the trench, therefore the installation process can also take place for successive sections with the aid of mechanical means.

In order to exclude any possibility of contamination, it is mandatory to place any sewer system at a lower level than the distribution network, with depths dictated by the need to provide adequate gradients for each section.

The pipes are installed after a topographical survey along the planned route. The pipes are installed in continuous trenches with vertical walls (rock excavations) or sub-vertical trenches, depending on the type of soil: compact soil only requires a gradient of 10-15%, while loose soil requires much higher values or support of the excavation with adequate "shoring" (reinforced excavation).

The pipes must be covered with compacted sand of grade 0/4, up to a height of 200mm, minimum 100mm, above the upper level of the pipeline. The while the remaining depth is filled with excavation material and, if necessary, the road surface is reinstated.

### Typical trench details



#### Legend

h1

minimum height of pipe cover created by using selected excavation material. The 0.8m cover is the minimum value to prevent frost, mechanical compacting with a vibrator with max. pressure 100 Kpa

h2

minimum height of sand layer above the pipes with mixed medium 0-4mm grain size, manually compacted. This is minimum 100mm.

h3

minimum height of sand layer on trench base with mixed medium 0-4 mm grain size. This is minimum 150mm, and also applies to distance between pipes, as well as between pipes and trench walls

De

outside diameter of the pipes

In the case of excavations in the presence of water it is advisable to provide mechanical drainage, especially when using electrical equipment and/or devices. It is recommended to manually level and compact the sand bed around the pipes (h2/h3), while the backfilling (h1) between the sand bed and the ground level can take place with the aid of mechanical vibrators for compaction.

During backfilling operations, suitable signalling tape must be placed around the area. For the excavation areas subject to heavy traffic (>35 q) reinforced concrete slabs must be provided.

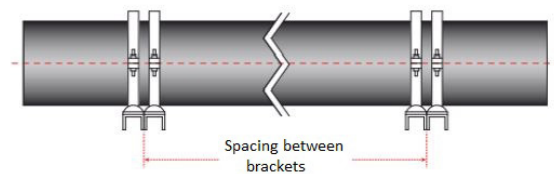
## 02.07 Other installations

Please contact REHAU Technical Department for advice on aboveground and other types of installations different from 02.06 Underground installation.

For horizontal aboveground installations use the table below indicating fix point spacing for PP-R pipes. For pipes installed vertically, increase the distance by 20%. All fixing brackets should be of fixed-point type; for each fixed point, use 2 brackets. The bracket must be suitable for the external diameters of the pipe. The bracket must be at least 40mm wide and 3mm thick and does not need a rubber lining.

Multilayer PP-R pipe fixing distances (mm)

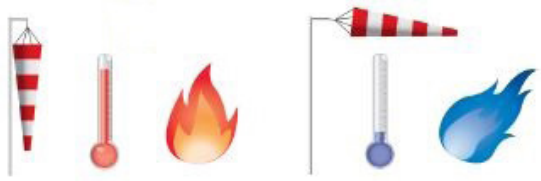
$\Delta T$	$\varnothing 32$	$\varnothing 40$	$\varnothing 50$	$\varnothing 63$	$\varnothing 75$	$\varnothing 90$	$\varnothing 110$	$\varnothing 125$	$\varnothing 160$	$\varnothing 200$	$\varnothing 250$	$\varnothing 315$
<b>0°C</b>	1550	1750	2000	2250	2400	2550	2750	2850	2900	3000	3100	3150
<b>20°C</b>	1150	1350	1550	1700	1800	1900	2050	2100	2150	2250	2350	2400
<b>30°C</b>	1150	1300	1500	1650	1750	1850	1950	2000	2050	2150	2250	2300
<b>40°C</b>	1050	1200	1450	1600	1700	1800	1850	1950	1950	2050	2200	2250
<b>50°C</b>	1000	1150	1400	1550	1650	1750	1750	1800	1850	1950	2150	2200
<b>60°C</b>	950	1000	1250	1450	1550	1600	1600	1650	1750	1850	1900	1950
<b>70°C</b>	850	1000	1200	1350	1450	1500	1550	1600	1650	1750	1800	1900



## 02.08 Shrouds Installation Instructions

Components of single pipe shroud kit

- 1 pre-holed heat-shrinking casing pipe with preapplied sealant bands inside
- 2 curing plugs
- 2 weld plugs
- 1 2-component foam (1 bottle polyol + 1 bottle isocyanate)
- Instructions and warnings



additionally required material;

- polyfusion welding tool
- matrix for polyfusion welding tool
- emery cloth, grain 50÷70
- cleaning liquid
- cleaning cloths
- rasp
- hammer (0.5 Kg)
- cutter
- whiteout or marker
- plastic funnel (only for vertical foaming)
- LPG cylinder with reduction, pressure relief valve with overpressure
- LPG torch with pilot and regulator with bell burner 50 mm
- 2 m long hose, short handle and/or industrial heat gun.



1 - Perform the welding operation by following the instructions that are described in the technical manual. Before welding the, slide on the heat-shrink shroud still covered with the supplied film onto the pipe.

2 - Measure the length of the shroud and subtract the length of the non-insulated pipe. Divide the result by two: and mark with a white marker so that the position of heat-shrink shroud ends will be clear.



3 - By using emery cloth (sandpaper), abrade the pre-insulated pipe by about 0.1 ÷ 0.25mm: start from the drawn line towards the inside to remove impurities and the oxidized layer. Repeat the operation on both sides.



4 - Clean the ends, which were previously ground with the cleaning liquid, and then preheat using a torch up to about 40° in the area to be coated.



5 - Remove the packaging of the heat-shrink shroud using a cutter. Do not damage the pipe casing.



6 - The sealant bands are already pre-applied inside the heat-shrink shroud. Remove the protective paper inside. Place the heat-shrink shroud by making sure its ends overlap on the sealant bands.



7 - Heat the heat-shrinkable band evenly; the band will start acting as glue. At the end of the operation there will be a slight leakage of sealing material at the sides of the heat-shrinkable band. Repeat the operation for both heat-shrinkable bands.



8 - Mix the two chemicals by pouring the polyol content into the isocyanate container: after that, shake quickly for a few seconds, and then pour the content into one of the two holes. **WARNING!** This operation must be carried out because the chemical reaction of the mixture is immediate.



9 - Place the two supplied curing caps by making sure the vent opening is not pushed inside the hole. After that, wait for about 5-10 minutes, depending on the outside temperature, so that the poured in mixture becomes foam.



10 - With a hammer lightly pop the drilled curing caps. Slightly scrape the material to remove foam residues; after that, wipe with a cloth soaked in the cleaning liquid to finish the cleaning.



11 - Weld in the supplied end caps observing the melting and cooling times.



12 - Now, the installation of the single-seal shroud is complete.

To correctly perform the welding operation, it is important that the flame is adjusted to the weather conditions of the building site. When installing outside at high air temperatures and no wind using thin walled pipes and with limited space in the trench use a **YELLOW FLAME**

When installing outside at low air temperatures and strong winds using thick walled pipes use a **STRONG BLUE FLAME** Furthermore, remember to apply the flame in a continuous circular manner evenly across the heat shrink area.



## 02.09 Guide Installation Times

The installation times were established from completed projects carried out according to our technical instructions. With regard to welding times, they refer to the time required for completing the joint between the parts (pipe/pipe or pipe/fitting).

The "in machine" cooling times of the thermo-welded pieces, which are generally considered dead time, are not to be considered as installation costs, since they do not require the use of personnel.

Dimension Ø (mm)		Welding time for service and casing pipe (sec)				
External casing pipe	Internal service pipe	Butt-welding	Electric-welding	Cutting to size (cut-back)	End cap	Heat-shrink shroud
250	160	780	950	420	507	863
315	200	900	1150	510	614	1044
400	250	1080	1380	625	755	1275
450	315	1300	1650	695	840	1420

## 02.10 Pressure Testing

Every system installed must be tested by the installing company in compliance with the laws or standards in force. The testing process involves a series of tests to be carried out during installation or when the system is completed, prior to masonry work or backfilling: the acceptability of the system is subject to the tests being passed successfully.

Below illustrates the acceptance test method in compliance with UNI EN 806-4 procedure C, modified according to REHAU's suggestions. It is in any case the responsibility of the design engineer to define these conditions. The test can be carried out with water. Where permitted by national regulations, use of low pressure air without oil or inert gases is allowed. The pressure gauges must be accurate to 0.2 bar and must be mounted at the lowest point of the system. Standard UNI EN 806-4 covers different procedures. REHAU suggests that the system is tested with water by Standard UNI EN 806-4 (procedure C) but applying x 1.1 max operating pressure or 15 bar for PP-R only runs, and x 1.1 max operating pressure or a max of 10 bar for hybrid PEX-PP-R runs.

The purpose of this indication is to ensure a high level of safety during the testing process, without compromising the functionality of the PPR system and to consider the viscoelastic behaviour, typical of polymeric materials.

### System testing procedure according to UNI EN 806-4

It is advisable to carry out the test by following the procedures:

#### A- PRE-TEST

test duration 60 minutes (1 hour)

- Fill the system, making sure all the air pockets are removed, then close all vents and the bleed valves.
- Connect the variable pressure pump to the most suitable terminal, filling the network up to a maximum pressure of 15 bar for PP-R only systems.

PLEASE NOTE: this pressure must be reduced if there are radiators, taps and valves in the system.

**IMPORTANT:** If the system installed is a combination of PEX and PP-R pipework, maximum pressure to be used is 10bar.

- After 30 minutes, record the measured pressure and perform a visual inspection to locate any obvious leaks within the system.
- After a further 30 minutes, record the measured pressure.

If the pressure drop is less than 0.6 bar, the system can be considered as having no obvious leaks and the pre-test may be considered successful.

#### B- FINAL TEST

test duration 120 minutes (2 hours)

- If the pre-test is successful, leave the pressure constant for the next 120 minutes (2 hours).

In this period of time, perform a further visual inspection to locate any leaks within the system.

If after 120 minutes (2 hours) the pressure drop is less than 0.2 bar, the final test can be considered completed successfully.

- Complete the test report in all its parts.

## 03 Parts list

### PP-R - Pipes

Multilayer pipe fiber-reinforced in the middle layer, inner layer white, outer layer white with grey stripes, preinsulated with PUR rigid foam, protected by a black PE-HD outer jacket

Art. No	Var.	PP-R pipe
335600	001	160/250mm SDR 11 PP-R pipe 5.8m length
323932	001	200/315mm SDR 11 PP-R pipe 5.8m length
323933	001	250/400mm SDR 11 PP-R pipe 5.8m length
323934	001	315/450mm SDR 11 PP-R pipe 5.8m length
Custom		355/500mm SDR 11 PP-R pipe 5.8m length (non-standard)
Custom		400/550mm SDR 11 PP-R pipe 5.8m length (non-standard)
335601	001	160/250mm SDR 11 PP-R pipe 11.6m length
324167	001	200/315mm SDR 11 PP-R pipe 11.6m length
324168	001	250/400mm SDR 11 PP-R pipe 11.6m length
324169	001	315/450mm SDR 11 PP-R pipe 11.6m length
Custom		355/500mm SDR 11 PP-R pipe 11.6m length (non-standard)
Custom		400/550mm SDR 11 PP-R pipe 11.6m length (non-standard)



## PP-R Fittings & Accessories

### Elbows

Range of elbows made of PP-R multilayer pipe and fittings, inner layer white, outer layer white with grey stripes, preinsulated with PUR rigid foam, protected by a black PE-HD outer jacket.

Art. No	Var.	15° elbow - Preinsulated (non-standard)
335602	001	160-160mm SDR 11 PP-R pipe 15° elbow
323877	001	200-200mm SDR 11 PP-R pipe 15° elbow
323878	001	250-250mm SDR 11 PP-R pipe 15° elbow
325728	001	315-315mm SDR 11 PP-R pipe 15° elbow
Art. No	Var.	30° elbow - Preinsulated (non-standard)
335619	001	160-160mm SDR 11 PP-R pipe 30° elbow
323880	001	200-200mm SDR 11 PP-R pipe 30° elbow
323881	001	250-250mm SDR 11 PP-R pipe 30° elbow
323882	001	315-315mm SDR 11 PP-R pipe 30° elbow
Art. No	Var.	45° elbow, Preinsulated
335620	001	160-160mm SDR 11 PP-R pipe 45° elbow
323883	001	200-200mm SDR 11 PP-R pipe 45° elbow
323884	001	250-250mm SDR 11 PP-R pipe 45° elbow
323885	001	315-315mm SDR 11 PP-R pipe 45° elbow
Art. No	Var.	90° elbow, Preinsulated
335621	001	160-160mm SDR 11 PP-R pipe 90° elbow
323886	001	200-200mm SDR 11 PP-R pipe 90° elbow
323887	001	250-250mm SDR 11 PP-R pipe 90° elbow
323888	001	315-315mm SDR 11 PP-R pipe 90° elbow

Note: Custom angle elbows are available on request



## Tees

Range of tees made of PP-R multilayer pipe and fittings, inner layer white, outer layer white with grey stripes, preinsulated with PUR rigid foam, protected by a black PE-HD outer jacket.

Art. No	Var.	Equal-Tee, Preinsulated
335625	001	160-160-160mm SDR 11 PP-R equal tee
323889	001	200-200-200mm SDR 11 PP-R equal tee
323890	001	250-250-250mm SDR 11 PP-R equal tee
323891	001	315-315-315mm SDR 11 PP-R equal tee
Art. No	Var.	Equal cross-over Tee, Preinsulated
335628	001	160-160-160mm SDR 11 PP-R cross-over equal tee
323892	001	200-200-200mm SDR 11 PP-R cross-over equal tee
323893	001	250-250-250mm SDR 11 PP-R cross-over equal tee
324170	001	315-315-315mm SDR 11 PP-R cross-over equal tee



**Tees**

<b>Art. No</b>	<b>Var.</b>	<b>Reducing Tee, Preinsulated</b>
324181	001	200-32-200mm SDR 11 PP-R reducing tee
324182	001	200-40-200mm SDR 11 PP-R reducing tee
324183	001	200-50-200mm SDR 11 PP-R reducing tee
324184	001	200-63-200mm SDR 11 PP-R reducing tee
324185	001	200-75-200mm SDR 11 PP-R reducing tee
324186	001	200-90-200mm SDR 11 PP-R reducing tee
324188	001	200-110-200mm SDR 11 PP-R reducing tee
324427	001	200-125-200mm SDR 11 PP-R reducing tee
324189	001	200-160-200mm SDR 11 PP-R reducing tee
324190	001	250-32-250mm SDR 11 PP-R reducing tee
324191	001	250-40-250mm SDR 11 PP-R reducing tee
324192	001	250-50-250mm SDR 11 PP-R reducing tee
324193	001	250-63-250mm SDR 11 PP-R reducing tee
324194	001	250-75-250mm SDR 11 PP-R reducing tee
324195	001	250-90-250mm SDR 11 PP-R reducing tee
324196	001	250-110-250mm SDR 11 PP-R reducing tee
324197	001	250-125-250mm SDR 11 PP-R reducing tee
324198	001	250-160-250mm SDR 11 PP-R reducing tee
335630	001	250-200-250mm SDR 11 PP-R reducing tee
324199	001	315-32-315mm SDR 11 PP-R reducing tee
324200	001	315-40-315mm SDR 11 PP-R reducing tee
324201	001	315-50-315mm SDR 11 PP-R reducing tee
324202	001	315-63-315mm SDR 11 PP-R reducing tee
324203	001	315-75-315mm SDR 11 PP-R reducing tee
324204	001	315-90-315mm SDR 11 PP-R reducing tee
324235	001	315-110-315mm SDR 11 PP-R reducing tee
324237	001	315-125-315mm SDR 11 PP-R reducing tee
324239	001	315-160-315mm SDR 11 PP-R reducing tee
335631	001	315-200-315mm SDR 11 PP-R reducing tee
335632	001	315-250-315mm SDR 11 PP-R reducing tee



## Tees

Art. No	Var.	Cross-over reducing Tee, Preinsulated
324241	001	200-32-200mm SDR 11 PP-R cross-over reducing tee
324242	001	200-40-200mm SDR 11 PP-R cross-over reducing tee
324243	001	200-50-200mm SDR 11 PP-R cross-over reducing tee
324244	001	200-63-200mm SDR 11 PP-R cross-over reducing tee
324245	001	200-75-200mm SDR 11 PP-R cross-over reducing tee
324246	001	200-90-200mm SDR 11 PP-R cross-over reducing tee
324247	001	200-110-200mm SDR 11 PP-R cross-over reducing tee
324248	001	200-125-200mm SDR 11 PP-R cross-over reducing tee
324249	001	200-160-200mm SDR 11 PP-R cross-over reducing tee
324250	001	250-32-250mm SDR 11 PP-R cross-over reducing tee
324251	001	250-40-250mm SDR 11 PP-R cross-over reducing tee
324252	001	250-50-250mm SDR 11 PP-R cross-over reducing tee
324253	001	250-63-250mm SDR 11 PP-R cross-over reducing tee
324254	001	250-75-250mm SDR 11 PP-R cross-over reducing tee
324255	001	250-90-250mm SDR 11 PP-R cross-over reducing tee
324256	001	250-110-250mm SDR 11 PP-R cross-over reducing tee
324257	001	250-125-250mm SDR 11 PP-R cross-over reducing tee
324258	001	250-160-250mm SDR 11 PP-R cross-over reducing tee
335633	001	250-200-250mm SDR 11 PP-R cross-over reducing tee
326560	001	315-32-315mm SDR 11 PP-R cross-over reducing tee
326561	001	315-40-315mm SDR 11 PP-R cross-over reducing tee
326562	001	315-50-315mm SDR 11 PP-R cross-over reducing tee
326568	001	315-63-315mm SDR 11 PP-R cross-over reducing tee
326586	001	315-75-315mm SDR 11 PP-R cross-over reducing tee
326587	001	315-90-315mm SDR 11 PP-R cross-over reducing tee
326588	001	315-110-315mm SDR 11 PP-R cross-over reducing tee
326589	001	315-125-315mm SDR 11 PP-R cross-over reducing tee
325745	001	315-160-315mm SDR 11 PP-R cross-over reducing tee
335634	001	315-200-315mm SDR 11 PP-R cross-over reducing tee
335641	001	315-250-315mm SDR 11 PP-R cross-over reducing tee



### Accessories and other fittings

Art. No	Var.	PP-R to PEX adapter, Preinsulated
335642	001	32mm PP-R to PEX adapter
335644	001	40mm PP-R to PEX adapter
335646	001	50mm PP-R to PEX adapter
335647	001	63mm PP-R to PEX adapter
335653	001	75mm PP-R to PEX adapter
335654	001	90mm PP-R to PEX adapter
335655	001	110mm PP-R to PEX adapter
335656	001	125mm PP-R to PEX adapter
335657	001	160mm PP-R to PEX adapter

Art. No	Var.	Single joint kit
335658	001	160-160mm PP-R single shroud kit
324342	001	200-200mm PP-R single shroud kit
324343	001	250-250mm PP-R single shroud kit
324344	001	315-315mm PP-R single shroud kit

Art. No	Var.	Reducing coupler & shroud kit
335659	001	200-160mm PP-R reducing coupler & shroud kit
324345	001	250-200mm PP-R reducing coupler & shroud kit
324346	001	315-200mm PP-R reducing coupler & shroud kit
324347	001	315-250mm PP-R reducing coupler & shroud kit

Art. No	Var.	Flange adapter
335660	001	160mm SDR 11 PP-R flange adapter
324348	001	200mm SDR 11 PP-R flange adapter
324349	001	250mm SDR 11 PP-R flange adapter
324350	001	315mm SDR 11 PP-R flange adapter



**Accessories and other fittings**

<b>Art. No</b>	<b>Var.</b>	<b>Flange ring, PP coated steel</b>
335661	001	160mm PP-R PN10/16 flange ring
335662	001	200mm PP-R PN10 flange ring
335663	001	250mm PP-R PN10 flange ring
335664	001	315mm PP-R PN10 flange ring
324351	001	200mm PP-R PN16 flange ring
324352	001	250mm PP-R PN16 flange ring
324353	001	315mm PP-R PN16 flange ring



<b>Art. No</b>	<b>Var.</b>	<b>Wall seal</b>
324361	001	200mm PP-R wall seal
324362	001	250mm PP-R wall seal
324363	001	315mm PP-R wall seal
325753	001	355mm PP-R wall seal



<b>Art. No</b>	<b>Var.</b>	<b>Heat shrink end cap</b>
335665	001	160mm PP-R heat shrink end cap
324364	001	200mm PP-R heat shrink end cap
324365	001	250mm PP-R heat shrink end cap
324366	001	315mm PP-R heat shrink end cap



<b>Art. No</b>	<b>Var.</b>	<b>Electrofusion fittings SDR11</b>
343184	001	160mm Straight electrofusion coupler
343185	001	200mm Straight electrofusion coupler
343186	001	250mm Straight electrofusion coupler
347868	001	315mm Straight electrofusion coupler







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