

## Project Report 14



Transfer of combined wastewater using  
SIMONA® SPC protective-jacket pipes

## Project data

<b>Location</b>	Pressure sewer between the sewage treatment plants Niederdrees and Rheinbach, Rhineland Palatinate, Germany
<b>Planning</b>	Ing.-Büro M. Malkomes 53894 Mechernich Germany
<b>Client</b>	Erftverband 50126 Bergheim Germany
<b>Contractor</b>	Bauunternehmung Kösters GmbH & Co.KG 54673 Neuenburg Germany
<b>Technical administration</b>	SIMONA Product Management Relining Project Group Piping Systems SIMONA AG SIMONA AG 55606 Kirn Germany
<b>Construction period</b>	August 2001 – November 2001
<b>Pipe and fittings supplier</b>	SIMONA AG Plant III Gewerbestraße 77975 Ringsheim Germany
<b>Relining pipe</b> <b>Length</b> <b>Diameter</b> <b>DIN</b> <b>Quality assurance</b>	SIMONA® PE 100 SPC sewage pipes 2.800 m d 250 x 22.7 mm, SDR 11 based on DIN 8074/75 Test report 2.2
<b>Welding of PE pipes</b>	Heating element butt welding, electro fusion welding, acc. to DVS 2207, Part 1

# Project description

## Initial situation

The Ertverband, as owner and operator of the Niederdrees sewage treatment plant, was faced with the decision of either modernising the Niederdrees sewage treatment plant to conform to current technology, or to transfer the sewage requiring treatment to the Rheinbach sewage treatment plant, located 3 kilometres away.

A feasibility study led to the decision to pump the sewage with a volumetric flow of up to 30 l/s to the Rheinbach sewage treatment plant, which was operating below capacity. The feed to the new pumping station at the site of the former Niederdrees sewage treatment plant amounts to several hundred l/s and can be temporarily stored in an existing storm overflow. The challenge: to specify the route and the construction method (trenched or trenchless technology).

Owing to the fact that the approximately 2.8 km long pipe route crosses below three waterway crossings and below bituminous pavement access routes, trenchless technology was considered to be the best solution. Ultimately, the demands of the local water authority to lead the pipes below the waterways using trenchless technology, and the potential cost savings of not having to open and reseal the access route pavements were critical in the decision to execute the construction measures by means of the horizontal flush drilling methods.



# Horizontal flush drilling

## Description

Horizontal flush drilling is generally a controlled wet drilling method. Here, soil is loosened and flushed away (evacuated) in various stages by means of a drilling fluid (e.g. bentonite drilling mud).

In the initial stage, the pipe channel is created with a pilot bore. The pilot bore has the advantage that, besides the necessary preparation for pipe pulling, the route can be investigated geologically. In the subsequent stages the final pipe channel is created (enlarged) and the SPC pipe pulled in with pulling equipment, which is connected to an enlarging head via a rotary swivel.

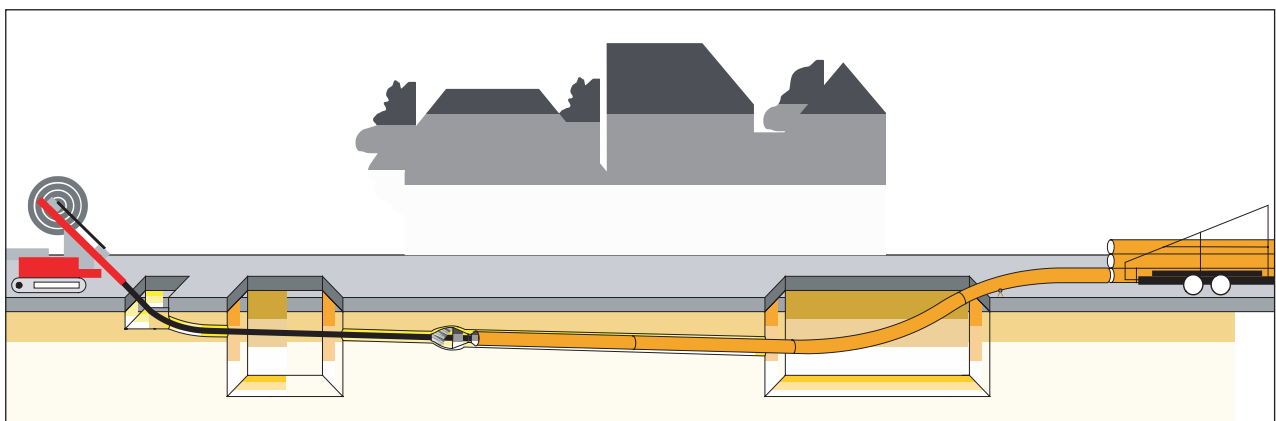
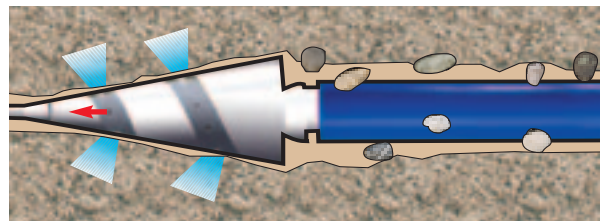
SPC pipes with a protective layer against external damage to the standardised inner pipe are just as suitable for this trenchless method as for pipe bursting methods. Additionally, the high strength and flexibility of the SPC pipes and the integral and longitudinally strong material bond of the welded connections provide high laying and operating safety.

## Trenchless pipelaying

Trenchless pipelaying encompasses a variety of methods. When it comes to slip lining, pipe bursting and directional drilling, the modified PP protective jacket provides an extremely high level of protection against all unforeseeable, potentially damaging, occurrences.

## Benefits of trenchless pipelaying

- Minimal adverse effect on developed and paved surfaces
- Construction work is performed whilst largely maintaining the flow of traffic
- Potential use of existing pipeline routes
- Construction time shortened due to the absence of protracted excavation and filling work
- Reduction in civil engineering and recultivation costs compared with open cut pipelaying



Horizontal flush drilling





*Pre-welded piping prepared for installation*



*Attaching the pulling head to the SIMONA® SPC protective-jacket pipe*

### **Increased pressure resistance**

Because the complete project was executed within a Class III water protection zone, exacting demands were placed both on environmentally friendly construction methods and on the pipes, which are subjected to extremely high pressures.

Polyethylene (PE) pipes are predestined for trenchless technology methods. To protect the pipes during pulling, the medium-carrying PE pipe is covered with a continuously extruded protective-jacket of modified polypropylene (PP). The 2.800 m long pipe route was executed using SIMONA® SPC protective-jacket pipes with  $d = 250 \times 22.7 \text{ mm}$  in 20 m sections, and homogeneously and axially material-bonded using heating element butt welding and electro fusion welding techniques.

Additionally, 19 concrete structures were erected along the complete route to serve as drainage, venting, and monitoring shafts, using pipes and fittings made of PE 100.



*Pulling the pipes for installation via the launch shaft*



*Flush head before pulling into the ground (left: pipe to be installed, right: old pipe)*

## Welding SPC protective-jacket pipes



*Peeling device for removing  
the protective jacket on  
SIMONA® SPC protective-jacket pipes*

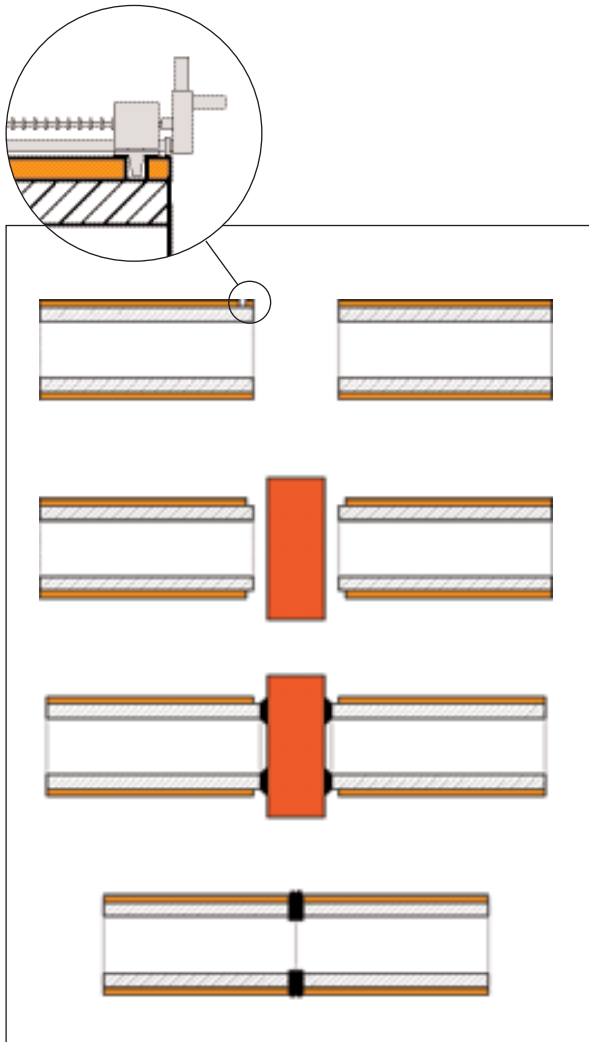


*Preparing the pipe ends for heating element butt welding.  
The protective jacket is only removed from the welding zone.*

The protective jacket of modified polypropylene must be removed from the welding zone of the standardised PE inner pipe for welding by heating element butt welding or electro fusion welding (according to DVS 2202, Part 1). This also applies to the areas where PE drilled fittings are to be subsequently attached.

The protective jacket is only removed in the welding zone; approximately 1.0 cm to 1.5 cm from the pipe ends for butt welding. The protective jacket must be removed to fit the socket insertion depth or the slip-on length for electrofusion sockets. When attaching drill fittings, the protective jacket must be removed according to the shape of the fitting.

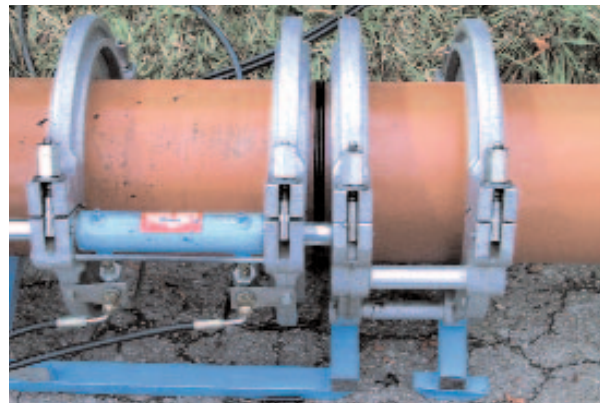
Appropriate handling tools are available for removing the protective jacket. Welding of the standardised inner pipes was carried out to DVS Regulation DVS 2207, Part 1.



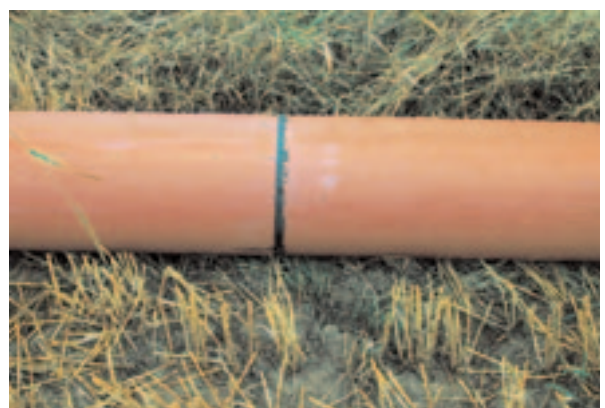
*Heating element butt welding: Schematic of SPC pipe with protective jacket removal before welding*



*Preparing the pipes for heating element butt welding by planing the end faces*



*Welding the pipes using the heating element butt welding method. Welding is carried out in accordance with DVS Regulation DVS 2207, Part 1.*



*Welded SIMONA® SPC protective-jacket pipes*

# SIMONA® SPC Protective-Jacket Pipes – the reliable choice for state-of-the-art pipelaying

## SIMONA® SPC pipes

SPC Protective-Jacket Pipes are a multi-layer solution manufactured by means of co-extrusion. They consist of a standardised inner pipe featuring a protective jacket made of modified polypropylene (SIMONA PP Protect).

### Inner pipe

The inner pipe can be made of the PE 100 or PE 80. These two bimodal materials fulfil all the requirements with regard to slow crack growth and crack resistance, as certified by notch tests (ISO DIS 13479) and FNCTs (Full Notch Creep Tests). The inner pipe is made of materials that fulfil the quality standards promulgated by the German Plastic Pipes Association (KRV). These materials also conform to the requirements of European product standards and to the relevant codes of DVGW, WRAS and DIN CERTCO.

### Protective jacket

The jacket is made of a specially modified polypropylene (SIMONA PP Protect), which is capable of protecting the surface of the inner pipe against potential notches and cracks generally associated with demanding installation methods such as pipe bursting or wash-boring. Even extremely deep scores in the protective jacket will not be transferred to the inner pipe when it is eventually exposed to service-related stresses.



*PE 80 SPC Waste-Water Pipe: light grey PE inner pipe, brown PP protective jacket; PE 100 SPC Drinking-Water Pipe: black PE inner pipe, blue PP protective jacket*

### Standardisation

The inner pipe is manufactured in accordance with all standards, approvals and guidelines currently applicable:

- DIN 8074/8075
- DIN 19537
- DIN 19533
- DVGW GW 335 T A2
- TÜV Süddeutschland certified
- DIN EN 12201
- DIN EN 13244

Processing and laying of the pipes is conducted in accordance with DVS guidelines DVS 2207 Part 1, DVS 2208 Part 1, DVS 2212 and the full range of associated standards such as DIN EN 1610.



<sup>1</sup> DVGW approval currently relates to the inner pipe. An application has been filed for system approval.



### Benefits at a glance

- The PP protective jacket provides the inner pipe with reliable protection against external damage
- High resistance to crack propagation
- High abrasion resistance
- No need for subsequent sealing of welded seam
- Light grey interior surface of the waste-water pipe is particularly conducive to internal camera inspection
- Permanent protection against extreme stresses during installation and in service
- No risk of cracking or fracturing
- Reliable quality due to the use of high-grade raw materials
- Guaranteed processing capability in accordance with all relevant pipeline construction guidelines, without any additional cost
- State-of-the-art solution for environment/infrastructure-friendly and cost-effective trenchless methods



#### *SIMONA PP Protect:*

*The PP protective jacket, specially adjusted with additives, provides the entire inner pipe with protection against notches, abrasion and wear.*

### Fields of application

SIMONA® SPC pipes are deployed within the area of drinking-water and gas supply as well as waste-water disposal. These fields of application are often associated with extreme demands on material.

- Laying in open trenches. Increased efficiency and potential savings with the possible use of excavated material and not the usual special bedding and sidefill materials.
- SIMONA® SPC pipes can be used in conjunction with virtually all trenchless installation technologies.
- Tailor-made for sewer repairs based on slip lining and pipe bursting methods.
- Tapping tees can be welded onto the inner pipe for service connections to buildings.

If extreme stresses are expected during the insertion procedure, for example on account of indefinable, unstable or rocky soils, we recommend involving our Applications Technology Department.

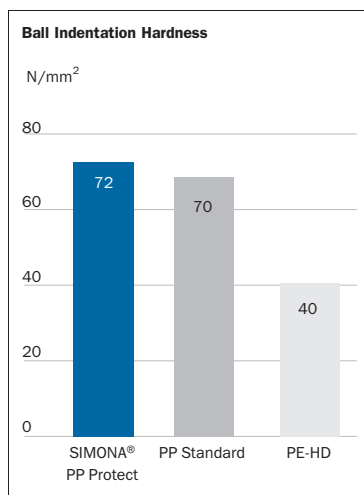
### Shear strength of SIMONA® SPC pipes

In trenchless pipelaying, the pipe is subjected to extremely high shear forces. As part of the technical production process, it is possible to achieve adhesion between the two layers of material without actually creating a chemical bond between the polyethylene and polypropylene materials.

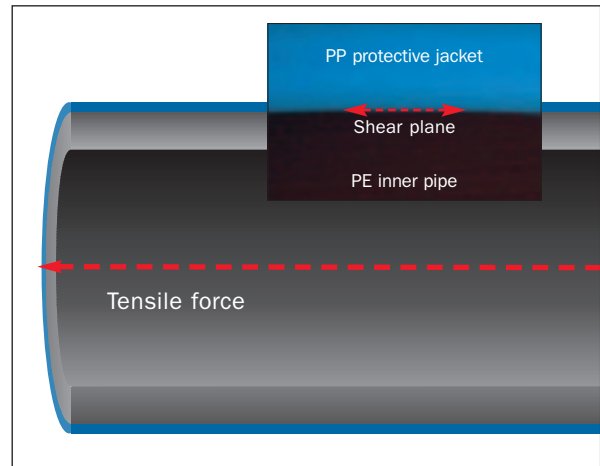
Bond and shear strength tests conducted in accordance with DIN 53769 Part 1 revealed a high level of axial strength (3.0 N/mm<sup>2</sup> to 5.0 N/mm<sup>2</sup>) between the inner pipe and the protective jacket. Thus, the protective jacket cannot “slide off” the inner pipe.

### Ball Indentation Hardness

The modified PP protective jacket of the SIMONA® SPC pipe features an increased material hardness. That considerably improves scratch resistance and resistance to penetrating objects. This property is defined by ball indentation hardness, which is measured as the resistance of a material surface to penetration by a defined body.



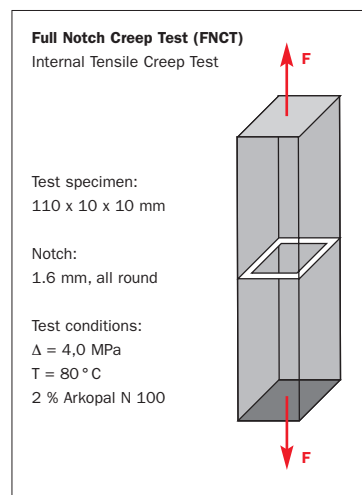
The protective jacket made of SIMONA PP Protect is almost twice as hard as PE-HD (high-density polyethylene).



Microtome section in the transitional zone between the protective jacket and the inner pipe

### Full Notch Creep Test (FNCT)

The FNCT examines creep by systematically inducing tension cracks in the test specimen by means of a wetting agent, mechanical stress and raised temperature.



The inner pipe of the SIMONA® SPC pipe achieved very high ratings (up to 3,000 h) in the FNCT.

# PE 80 SPC-Waste Water Pipes

## Material

Inner pipe PE 80  
and protective jacket  
made of modified PP  
Protect

## Dimensions

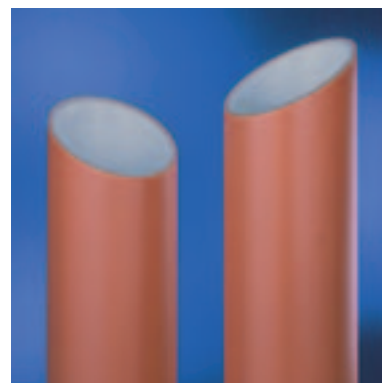
DIN 8074, DIN 19537  
Standard length 12 m;  
other lengths on  
request

## Colour

Inner pipe: light grey  
Jacket pipe: brown

## Product code

PE ARST-SPC R0



Inner pipe SDR 26			Inner pipe	Jacket thickness	Inner pipe + protective jacket			SPC pipe
d	x	e	weight	approx. dimensions	d <sub>2</sub>	x	e <sub>2</sub>	weight
mm			kg/m	mm	mm			≈ kg/m
160	x	6.2	3.04	2.0	164.0	x	8.2	4.06
180	x	6.9	3.79	2.0	184.0	x	8.9	4.92
200	x	7.7	4.69	2.0	204.0	x	9.7	5.96
225	x	8.6	5.89	2.3	229.6	x	10.9	7.53
250	x	9.6	7.30	2.3	254.6	x	11.9	9.12
280	x	10.7	9.10	2.3	284.6	x	13.0	11.10
315	x	12.1	11.60	2.7	320.4	x	14.8	14.30
355	x	13.6	14.60	2.7	360.4	x	16.3	17.70
400	x	15.3	18.60	2.7	405.4	x	18.0	21.90
450	x	17.2	23.50	3.0	456.0	x	20.2	27.70
500	x	19.1	28.90	3.0	506.0	x	22.1	33.60
560	x	21.4	36.20	3.0	566.0	x	24.4	41.50
630	x	24.1	45.90	3.0	636.0	x	27.1	51.80

Inner pipe SDR 17.6			Inner pipe	Jacket thickness	Inner pipe + protective jacket			SPC pipe
d	x	e	weight	approx. dimensions	d <sub>2</sub>	x	e <sub>2</sub>	weight
mm			kg/m	mm	mm			≈ kg/m
160	x	9.1	4.35	2.0	164.0	x	11.1	5.36
180	x	10.2	5.48	2.0	184.0	x	12.2	6.61
200	x	11.4	6.79	2.0	204.0	x	13.4	8.04
225	x	12.8	8.55	2.3	229.6	x	15.1	10.20
250	x	14.2	10.60	2.3	254.6	x	16.5	12.40
280	x	15.9	13.20	2.3	284.6	x	18.2	15.30
315	x	17.9	16.70	2.7	320.4	x	20.6	19.40
355	x	20.1	21.20	2.7	360.4	x	22.8	24.20
400	x	22.7	26.90	2.7	405.4	x	25.4	30.30
450	x	25.5	34.00	3.0	456.0	x	28.5	38.20
500	x	28.4	42.00	3.0	506.0	x	31.4	46.70
560	x	31.7	52.50	3.0	566.0	x	34.7	57.80
630	x	35.7	66.50	3.0	636.0	x	38.7	72.40

# PE 100 SPC-Waste Water Pressure Pipe

## Material

Inner pipe PE 100  
and protective jacket  
made of modified PP  
Protect

## Dimensions

DIN 8074, DIN 19537  
Standard length 12 m;  
other lengths on  
request

## Colour

Inner pipe: black  
Jacket pipe: brown

## Product code

PE 100 ARST-SPC RO



Inner pipe SDR 17			Inner pipe	Jacket thickness	Inner pipe + protective jacket			SPC pipe
d	e		weight	approx. dimensions	d <sub>2</sub>	e <sub>2</sub>		weight
mm			kg/m	mm	mm			≈ kg/m
90	x	5.4	1.47	1.5	93.0	x	6.9	1.90
110	x	6.6	2.18	1.5	113.0	x	8.1	2.72
125	x	7.4	2.78	1.5	128.0	x	8.9	3.37
140	x	8.3	3.49	1.5	143.0	x	9.8	4.15
160	x	9.5	4.56	2.0	164.0	x	11.5	5.57
180	x	10.7	5.76	2.0	184.0	x	12.7	6.90
200	x	11.9	7.11	2.0	204.0	x	13.9	8.38
225	x	13.4	9.01	2.3	229.6	x	15.7	10.70
250	x	14.8	11.00	2.3	254.6	x	17.1	12.90
280	x	16.6	13.90	2.3	284.6	x	18.9	15.90
315	x	18.7	17.60	2.7	320.4	x	21.4	20.30
355	x	21.1	22.30	2.7	360.4	x	23.8	25.40
400	x	23.7	28.20	2.7	405.4	x	26.4	31.70
450	x	26.7	34.70	3.0	456.0	x	29.7	40.00
500	x	29.7	44.20	3.0	506.0	x	32.7	48.90
560	x	33.2	55.30	3.0	566.0	x	36.2	60.60
630	x	37.4	70.00	3.0	636.0	x	40.4	76.00

Inner pipe SDR 11			Inner pipe	Jacket thickness	Inner pipe + protective jacket			SPC pipe
d	e		weight	approx. dimensions	d <sub>2</sub>	e <sub>2</sub>		weight
mm			kg/m	mm	mm			≈ kg/m
90	x	8.2	2.14	1.5	93.0	x	9.7	2.56
110	x	10.0	3.17	1.5	113.0	x	11.5	3.70
125	x	11.4	4.11	1.5	128.0	x	12.9	4.70
140	x	12.7	5.12	1.5	143.0	x	14.2	5.80
160	x	14.6	6.72	2.0	164.0	x	16.6	7.74
180	x	16.4	8.49	2.0	184.0	x	18.4	9.63
200	x	18.2	10.50	2.0	204.0	x	20.2	11.70
225	x	20.5	13.30	2.3	229.6	x	22.8	14.90
250	x	22.7	16.30	2.3	254.6	x	25.0	18.10
280	x	25.4	20.40	2.3	284.6	x	27.7	22.50
315	x	28.6	25.90	2.7	320.4	x	31.3	28.60
355	x	32.2	32.80	2.7	360.4	x	34.9	35.90
400	x	36.3	41.60	2.7	405.4	x	39.0	45.10
450	x	40.9	52.70	3.0	456.0	x	43.9	57.00
500	x	45.4	65.10	3.0	506.0	x	48.4	69.80
560	x	50.8	81.50	3.0	566.0	x	53.8	86.80
630	x	57.2	103.20	3.0	636.0	x	60.2	109.20



# Tender documents for SIMONA® SPC-Waste Water Pipes

## PE 100 SPC-Waste Water Pressure Pipes

### PE 80 SPC-Waste Water Pipes

PE 80/PE 100 SPC-Waste water pipes consisting of an inner pipe as per DIN 8074/8075, including an additional continuous protective jacket made of modified PP (SIMONA PP Protect), and perform laying of pipe as per DIN EN 1610 and in accordance with the supplier's specifications. Pipe manufacture with proof of quality assurance in accordance with DIN EN ISO 9001 and external certification by TÜV Süddeutschland.

The protective jacket shall be removed from the joint area on-site, if necessary, before the pipe ends are welded.

There is no need to seal SIMONA® SPC pipes after removal of the protective jacket in the welding area using SIMONA peeling devices. Please refer to the separate handling instructions for accessories.

### Product:

SIMONA® PE 80 SPC-Waste Water Pipe,  
article code: PE ARST-SPC RO

SIMONA® PE 100 SPC-Waste Water Pressure Pipe,  
article code: PE 100 ARST-SPC RO

### Supplier:

SIMONA AG  
Teichweg 16  
55606 Kirn  
Germany  
Phone +49 (0) 67 52 14-0  
Fax +49 (0) 67 52 14-211  
e-mail pmrelining@simona.de

### Description of supply:

- inner pipe dimension
- jacket pipe wall thickness
- SDR, PN
- colour of inner pipe
- colour of jacket pipe
- total quantity
- pipe length

## Example of a tender document for SIMONA® PE 80 SPC-Waste Water Pipes

Item No. 01	100m	..... €/quantity	..... Total price in €
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Product code: PE ARST-SPC RO

### PE 80 SPC-Waste water pipe

Supply of PE 80 waste water pipe consisting of a waste water light grey inner pipe as per GKR Guideline R 14.3.1 and DIN 8074/8075 and a continuous brown protective jacket and the laying of this pipe in accordance with DIN EN 1610 and per supplier specifications. Pipe manufacture with proof of quality assurance in accordance with DIN EN ISO 9001 and external certification TÜV Süddeutschland. The protective jacket in the joint area must be removed on-site prior to the welding of the pipe ends.

After the removal of the protective jacket in the welding area with SIMONA® stripping tools, the sealing of SIMONA® SPC pipes is not necessary. Please refer to the technical instructions for our peeling devices. .

## Quality, service, innovation

SIMONA AG is one of the leading manufacturers of semi-finished plastics. Our portfolio of products covers a wide range of applications:

- Sheets in thicknesses from 0.5 to 200 mm
- Pipes in diameters from 10 to 1.000 mm
- Fittings in diameters from 16 to 1.000 mm
- Solid rods in diameters from 6 to 800 mm
- Hollow rods in diameters from 125 to 450 mm
- Profiles and welding rods
- Electrofusion fittings
- Valves

The materials used are PE, PP, PVC-U, foam PVC-U, PETG, PVDF and E-CTFE as well as special materials, i.e. for applications in the orthopaedic sector.



*The quality and environmental management system at SIMONA AG is certified to DIN EN ISO 9001 : 2000 and DIN EN ISO 14001 : 1996.*

SIMONA AG with its head office in the Rhineland-Palatine Kirn (Germany) produces sheets, rods, profiles and welding rods in works I and II. Using technologically advanced equipment and machinery the pipes and fittings production is situated in works III in Ringsheim in Baden-Württemberg. To complement this, our worldwide distribution network with subsidiaries and sales partners guarantees a service close to the customer on all continents.

The quality of our products and services is one of our utmost priorities. We, therefore, critically audit and improve our quality management on a continual basis. To us this is a never ending process.

The high demands that we set are not limited to our own organisation but extend to the needs and requirements of our customers. The quality standard of our services is the decisive factor within our product range.

Our sense of quality combines the project development, the purchase of raw materials, the production, the dispatch, the advice given during projecting on the spot and the cooperation with our customers.

So, we are proud to state that we have achieved the DIN EN ISO 9001 certification as the first enterprise of our kind and that our quality management will be constantly optimized by external and internal audits.



## SIMONA worldwide

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