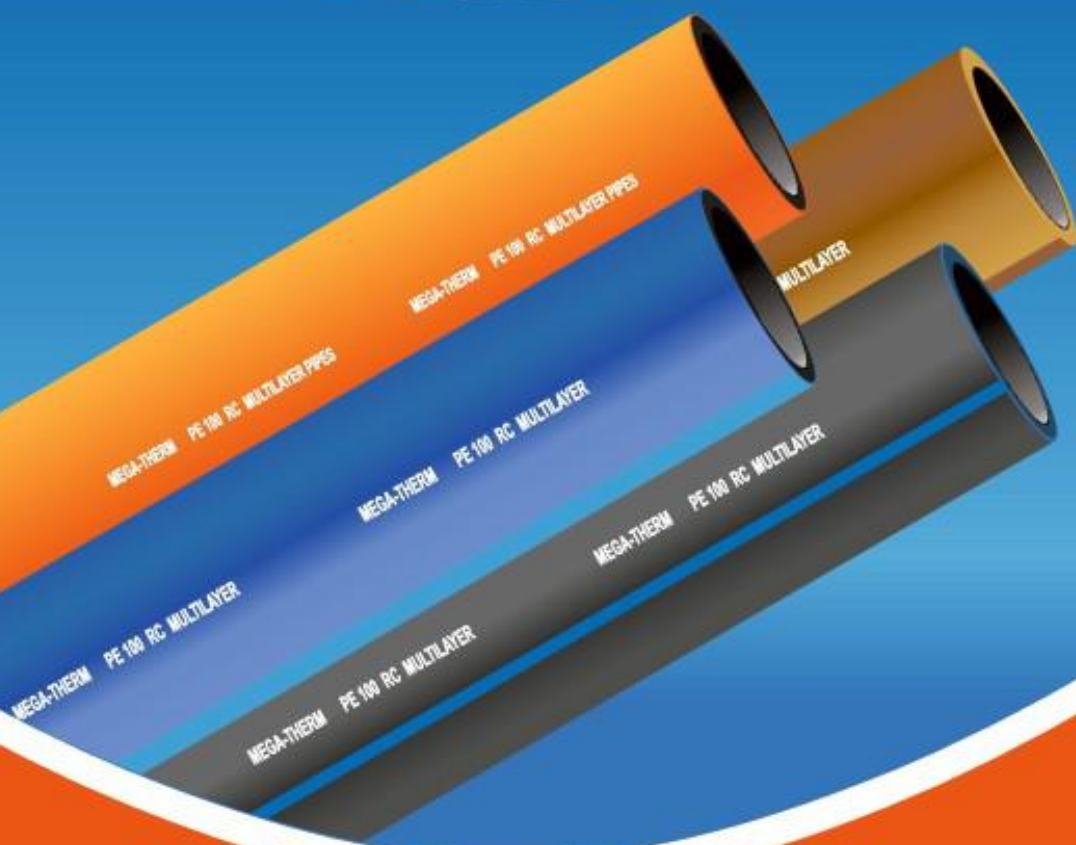




HDPE 100 RC MULTILAYER PIPE SYSTEMS



PE 100 RC (*Resistance to Crack*) pipes for pipe-laying without sand embedding and for the renovation of pipelines



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RESISTANCE TO CRACK PIPES FOR INFRASTRUCTURE SYSTEMS

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● 1.PRODUCT DESCRIPTION

High quality material for cost effective installation

1. Product Description

Cost and time pressure also force providers to rethink conventional methods and use modern materials. For example, the previously required embedding of PE pipes in sand or fine gravel is no longer necessary using pipes made of the latest PE 100-RC materials.

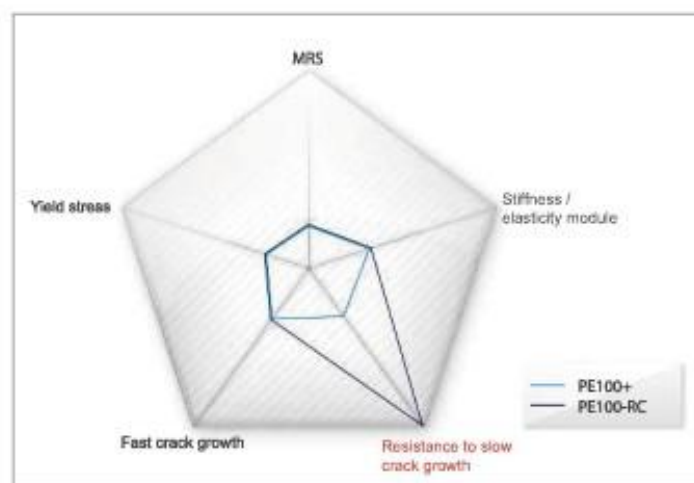
Conventional pipelines made of PE are exposed to higher stresses caused by stones, refuse glass and other compact materials present in the ground when no sand bedding is provided. In combination with the operating stresses (internal pressure, traffic and soil loads), the punctual or linear forces acting directly upon the pipe as a result will cause stress cracks (slow crack growth)

PE 100 RC multilayer pipes are co-extruded full-wall pipes with a dimensionally integrated coloured outer layer (Drinking Water = Blue, Gas = Orange-Yellow, Waste Water = Brown). PE 100 RC Multilayer is particularly resistant to the consequences following from scratches caused when no sand bedding is provided and to point loads occurring over a longer period of time.

The targeted utilisation of further developed product characteristics - resistance to slow crack growth - ensures the fulfilment of all requirements of modern and economic pipe laying. The manufacturing process ensures a service life of more than 100 years even with unconventional pipe laying (without sand bedding).

Comparison of PE 100 to PE 100-RC

All characteristics of the raw material PE 100 proven over many years are also fulfilled by PE 100-RC, e.g. MRS 10. The only but significant difference is the outstanding resistance of PE 100-RC to stress cracking. Processing, particularly the joining technique, is subject to the same conditions. Welding (e.g. heating element butt welding) is governed by guideline DVS 2207-1 for PE 100-RC as well and possible without any restrictions.



Comparison PE 100 and PE 100-RC

The growing demand for faster and more economic pipe installation with less environmental disturbance has led to new installation techniques. The last several years has seen investors in the infrastructure system construction industry searching for solutions for reducing investment costs with advanced technologies. The phenomenon encompasses both new pipelines and the renovation of current ones.



These include sandless bedding, pipe bursting and horizontal directional drilling. In order to apply such methods of pipe-laying and because of their aggressive impact on pipe, these new methods need new plastic pipe materials - a product that has its external surface durability several times higher than normal and a higher point load resistance.

PAS 1075

In terms of a common definition of the material PE 100-RC the PAS 1075 (Public Available Specification) titled *mPipes made of polyethylene for alternative installation technologies* was published by DIN. This public available specification is considered a supplement to existing standards and regulations.

The scope of PAS 1075 is the increased resistance to slow crack growth of PE 100-RC pipes which are used for alternative installation technologies, such as horizontal directional drilling, burst-lining or installation without sand embedding. The requirements, characteristics and test procedures as well as the respective quality assurance procedures are regulated and ensured via third party inspection. Polyethylene pipes, which are described in the regulation, do have a significantly higher resistance to slow crack growth compared to regular PE 80 and PE 100 pipes.

Material requirements according to ISO 13479

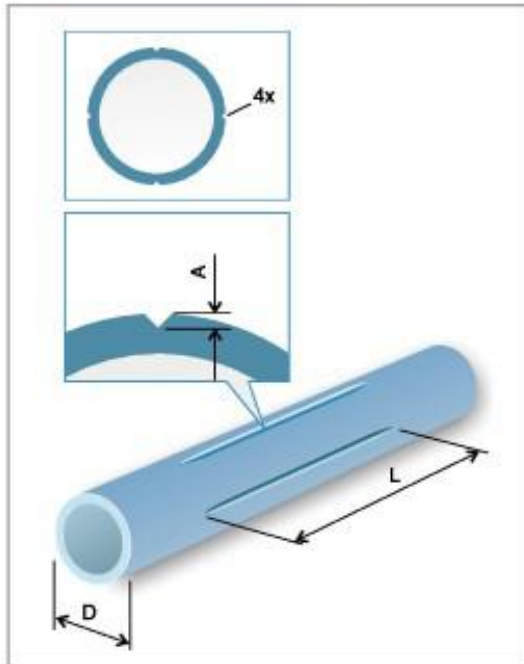
Nr.	Property	Requirements
1.	FNTC	>8760h at 80 °C, 4N/mm ² , 2% arkopal N-100 (raw material)
2.	Point load test at solid wall pipes	>8760h at 80 °C, 4N/mm ² , 2% arkopal N-100
3.	Notch test (EN 13479)	>8760h

Advantages of PE 100 RC MULTILAYER PIPES

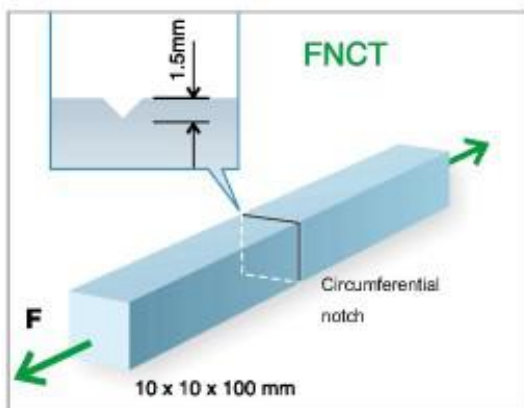
PE 100 RC class materials and the most advanced plastic processing ensure the highest reliability of the product.

- * Good abrasion resistance
- * High stress crack resistance
- * Good resistance to point loads (e. g. stones, fragments) (Dr. Hesselhs test)
- * High resistance to slow crack growth
- * Optimal choice for pipe-laying without sand embedding and backfill
- * Excavated soil to be used as backfill material
- * Can be used for trenchless pipe-laying
- * Can be butt-welded, ERW, poly fusion welded or connected mechanically
- * Compatible with classic PE pipes

What is that ensure protection against occurring points loads when no sand bedding is provided?



The notch test acc. to PN EN ISO 13479 is a pressure test conducted on a section of a pipe that has been notched on the surface, and then submerged in water at a given temperature and put under hydrostatic pressure. The notch test allows to determine the resistance of pipes to the fast propagation of cracks. The PE 100 RC pipe should withstand the hydrostatic pressure given for 5 000 hours. (PE 100 RC Multilayer 10 000 h).



Moulded plate in order to test its resistance to environmental conditions. The sample is notched and then stretched in an Arcopal solution at a specific temperature. The RC material sample should withstand these conditions for 3 300 hours without exhibiting damage (Acc. to ISO 16770) (PE 100 RC Multilayer Pipe Withstand >8 760 h).

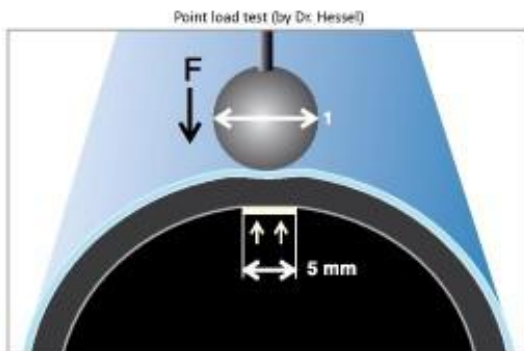


Fig. By HesselIngenieurechnik

Dr. Hessel's point load test is used to determine a material's resistance to slow propagation of cracks. A sample of pipe section is subjected to external point pressure in a given timeframe and at a specific temperature. The RC sample should withstand these conditions for 8 760 hours without exhibiting damage (PE 100 RC Multilayer = 10 000 h).

- * Point Load Test: Required result met, test interrupted after 10 000 hours.
- * FNCT: Required result met.
- * Notch Test: Required result met, test interrupted after 10 000 hours.



2.PRODUCT DATA SHEETS

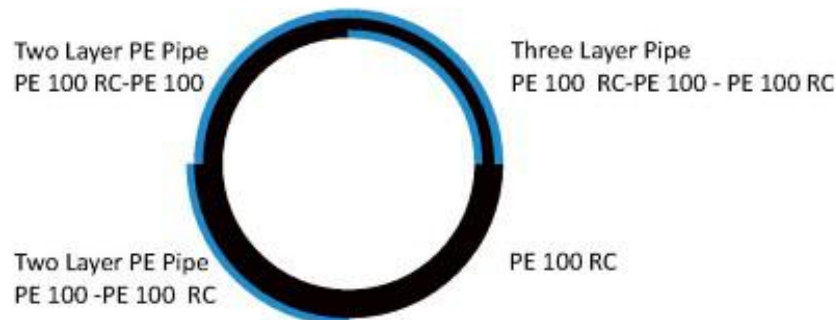
Pipe Clasification of PE 100-RC PIPE

There is several combination of material ,for pipe production , what allow PE 100-RC material, and this combination exceed the minimum requirements applicable for PE 100.

Type 1: Full wall pipes made of PE 100 cRC,

Single-wall full-wall pipes made of PE 100-RC as defined in ISO 4065.

This pipes can be made in full color, blue for water or orange for gas or brown for sewage, or black pipe and colour-strip according application which are also made of PE 100 RC materials.

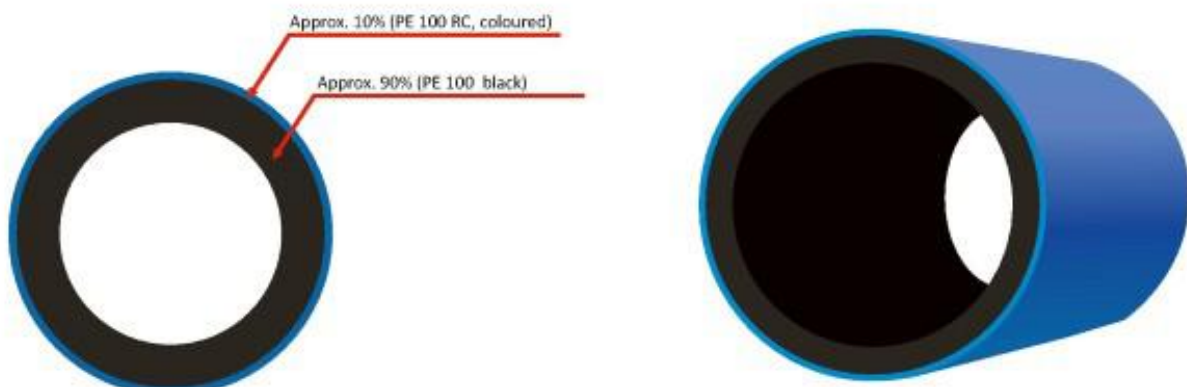


Type 2: Pipe with dimensionally integrated protective layer made of PE 100-RC

Double-layer pipes with dimensionally integrated protective layers consist of PE 100 or PE 100-RC and have an internal co-extruded protective layer made of PE 100-RC.

Tripple-layer pipes with dimensionally integrated protective layers consist of PE 100 or PE 100 -RC and have an internal and external co-extruded protective layer made of PE 100-RC.

The co-extruded layers have been inseparably bonded with each other in a special tool that fuses the layers together. Made of PE 100-RC, the internal layer is integrated as a functional layer in the wall structure. This production based on two and three layers pipe are with different external layer colour blue for water or orange for gas or brown for sewage.



Type 3: Pipes with dimensions according to ISO 4065 with dimensionally added outer protective layer made of PE 100 cRC

Pipes of dimensions as specified in ISO 4065 with outer protective jacket consist of a core pipe made of PE 100-RC and a protective jacket made of polypropylene. The minimum thickness of the protective jacket is 0.8 mm. The minimum thickness of the protective jacket is dependent on the pipe dimension; large-sized pipes have a thicker jacket because of the heavier loads the pipes are designed for. The bonding strength between protective jacket and core pipe must be such that the shearing forces occurring during pipe laying can be reliably transmitted. This type is like option, and on request, it is not present in regular production yet.



Certificates

PE 100 RCMULTILAYER PIPE water pipes have the same reference documents as classic PE 100 water pressure pipes. The pipes also have the National Institute of Hygiene certificate .

The PE 100 RCMULTILAYER PIPE gas pipes have the same reference documents as classic PE 100 gas pipes.

PE 100-RC Multilayer Pipe- Production Program

PE 100 RC Multilayer Water Pipe

PE 100 RC Multilayer Gas Pipe

Option -PE 100 RC Multilayer Sewage - Slurry Pipes

Option -PE 100 RC Multilayer Mining Pipe



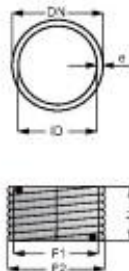
PE 100 RC MULTILAYER Water Pipe


MEGA-THERM PE 100 RC MULTILAYER

MEGA-THERM PE 100 RC MULTILAYER

Pipe Type 1 and 2

Pipe Design	Pipe in black with blue colored stripe, or medium pipe is black with dimensionally integrated blue outer layer
Application	Drinking water for buried installation, laying possible with and without sand bedding
Product Standard	EN 12201-2
Processing Standard	EN 805, DIN V ENV 1046
Material	PE 100 RC
Approvals	DVGW
Certification	ISO 9001/ISO 14001
Dimensions	SDR 7.4/9/11/17
Delivery Form	Straight length /coils

PE 100 RC MULTILAYER PIPE	DN/OD (mm)	SDR 11 C 5 *PN16		SDR 17 C 8 *PN10	
		s (mm)	Weight (kg/m)	s (mm)	Weight (kg/m)
	25	2.3	0.171	1.8	0.137
	35	2.9	0.272	1.9	0.187
	40	3.7	0.430	2.4	0.295
	50	4.6	0.666	3.0	0.453
	63	5.8	1.05	3.8	0.721
	75	6.8	1.47	4.5	1.02
	90	8.2	2.12	5.4	1.46
	110	10.0	3.14	6.6	2.17

PE 100 RC MULTILAYER PIPE	DN/OD (mm)	SDR 11 C 5 *PN16		SDR 17 C 8 *PN10	
		s (mm)	Weight (kg/m)	s (mm)	Weight (kg/m)
	125	11.4	4.08	7.4	2.76
	140	12.7	5.08	8.3	3.46
	160	14.6	6.67	9.5	4.52
	180	16.4	8.42	10.7	5.71
	200	18.2	10.4	11.9	7.05
	225	20.5	13.1	13.4	8.93
	250	22.7	16.2	14.8	11.0
	280	25.4	20.3	16.6	13.7
	315	28.6	25.6	18.7	17.4
	355	32.2	32.5	21.1	22.1
	400	36.3	41.3	23.7	28.0
	450	40.9	52.3	26.7	35.4
	500	45.4	64.5	29.7	43.8
	560	50.8	80.8	33.2	54.8
	630	57.2	102	37.4	69.4
	710	64.5	130	42.1	89
	800	-	-	47.4	113

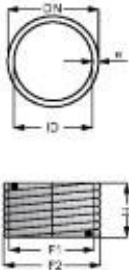
PE 100 RC MULTILAYER Gas Pipe

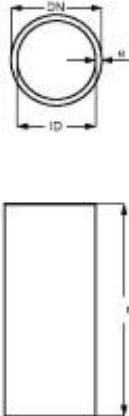
MEGA-THERM PE 100 RC MULTILAYER

MEGA-THERM PE 100 RC MULTILAYER

Pipe Type 1 and 2

Pipe Design	Pipe in black with orange-yellow colored stripe, or medium pipe is black with dimensionally integrated orange-yellow outer layer
Application	Gas Pipe for buried installation, laying possible with and without sand bedding
Product Standard	EN 1555-2
Processing Standard	EN 12007-2
Material	PE 100 RC
Approvals	DVGW
Certification	ISO 9001/ISO 14001
Dimensions	SDR 7.4/9/11/17
Delivery Form	Straight length /coils

PE 100 RC MULTILAYER PIPE	DN/OD (mm)	SDR 11 S 5 *PN 10		SDR 17.6 S 8.3 *PN 4	
		s (mm)	Weight (kg/m)	s (mm)	Weight (kg/m)
	25	2.3	0.150	2.3	0.150
	35	2.9	0.272	2.3	0.200
	40	3.7	0.430	2.3	0.285
	50	4.6	0.666	2.9	0.440
	63	5.8	1.05	3.6	0.688
	75	6.8	1.47	4.3	0.976
	90	8.2	2.12	5.1	1.39
	110	10.0	3.14	6.3	2.08

PE 100 RC MULTILAYER PIPE	DN/OD (mm)	SDR 11 S 5 *PN 10		SDR 17.6 S 8.3 *PN 4	
		s (mm)	Weight (kg/m)	s (mm)	Weight (kg/m)
	125	11.4	4.08	7.1	2.66
	140	12.7	5.08	8.0	3.34
	160	14.6	6.67	9.1	4.35
	180	16.4	8.42	10.2	5.48
	200	18.2	10.4	11.4	6.79
	225	20.5	13.1	12.8	8.55
	250	22.7	16.2	14.2	10.6
	280	25.4	20.3	15.9	13.2
	315	28.6	25.6	17.9	16.7
	355	32.2	32.5	20.1	21.2
	400	36.3	41.3	22.7	26.9
	450	40.9	52.3	25.5	34.0
	500	45.4	64.5	28.4	42.0
	560	50.8	80.8	31.7	52.5
	630	57.2	102	35.7	66.5



PE 100 RC MULTILAYER Sewage - Slurry Pipes



PE 100 RC Multilayer Sewage - Slurry Pipes - on request can be produced RC multilayer pipe for disposal pipelines (gravity pipelines) produced in light colored inner layer to allow and easier camera inspection, for mining application or disposal of other high abrasive media. Pipes can be supplied as 6 m and 12 m straight pipes or coil up to 125 mm in 100 m length. Further dimensions on request.

PE 100 RC MULTILAYER Mining Pipe



For the past few decades, plastic piping has been a widely accepted material for use in mining applications for pumping slurries and other materials. When it comes to selecting pipe materials for this industry, the two most important factors to consider are safety and reliability. Mega-Therm RC HDPE pressure pipe ranges are performance proven to meet the demanding conditions of numerous applications in the mining industry. These plastic piping systems are designed according to International Standard specifications to endure rugged terrains, extreme climates and transportation to the mining site. The low mass, flexibility, ease of installation and exceptional impact strength, as well the chemical and corrosion resistance properties make plastic piping the preferred choice among specifiers, engineers and contractors.

Ulkumen Ardila's dedication to heading up the industry with cutting edge solutions ensures maximum integrity for even the most ground-breaking projects. What Ulkumen Ardila provide, however, is not just the supply of quality plastic piping materials, but a complete service offering which includes professional advice and on-site technical support to ensure that the project is carried out successfully from start to finish, according to best practice installation methods.

3. LAYING INSTRUCTION

Pipe-laying and Assembly

PE 100 RC MULTILAYER pipes are laid and assembled just like typical PE100 pipes. Due to their high resistance to point loads and surface scratching effects, the pipes can be laid in soil without backfill and sand embedding which is usually used as a protective layer for the pipes. High resistance of

PE 100 RC MULTILAYER pipes to slow propagation of cracks allows pipe-laying in difficult native soils with backfill and packing of crushed rocks and stones up to 60 mm of grain. Remember that the soil fragments must evenly support the pipeline around its circumference. Soil transport is expensive - application of RC

PE 100 RC MULTILAYER can significantly reduce the costs of supplying the construction site with proper earthwork material and the removal of excess soil from the site.

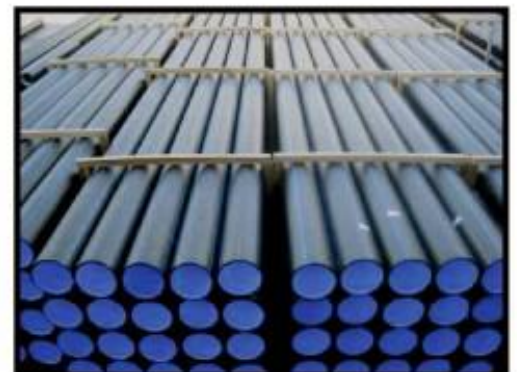
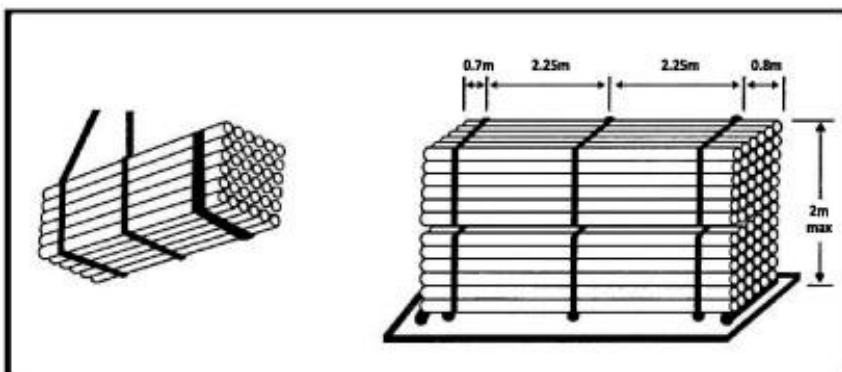
Handling and Storage

Before the installation of the pipes and components, check them for transport damage and other defects, and clean the joining faces and zones. Sort out damaged parts, and use a fine-toothed saw or plastic pipe cutter if the pipe needs to be cut. Cuts at right angles to the longitudinal pipe axis can be achieved when the saw is guided, for example by a mitre gauge. Once cut, prepare the pipe ends as is required for the type of joining.

Unwinding pipes from bundle can be performed in various ways. In the case of pipes with outer diameter up to 63 mm, the pipe is usually unwound with the bundle held in vertical position and the pipe start fixed. An unwind device is recommended to be used for greater dimensions.

The pipes must be unwound straight and must not be kinked; also pulling them off in a spiral form is not allowed.

Note: When shortening and laying the pipeline, remember to take the temperature - dependent length change into account. A PE pipe 1 m long will elongate when the temperature rises and become shorter when the temperature decreases, by 0.2 mm per K.



Pipelaying in an open trench

Applicable standards are EN 805 (water pipe), EN 1610 (waste water and sewer pipe) and EN 12207-2 Gas pipe.



Bedding and backfilling

Based on the proof of resistance to slow crack growth (tested by an independent, Multilayer PE 100-RC pipes made of PE 100-RC are suitable for laying without a sand bedding. Thus, additional work in order to replace the excavated material with a sand bed in accordance with EN 805 (transport, disposal) is not necessary. The pipe properties are such that no restriction of the grain size of the bedding and backfilling materials is necessary.

Trenchless laying of pipes

Multilayer PE 100 RC pipes suitable for alternative - trenchless laying.

- * Ploughing
- * Milling



Alternative installation methods are chosen because they are time and cost-saving. In the last few years various installation technologies become the state-of-the-art due to their economic advantages:

- * Minimal adverse effect on developed and paved surfaces.
- * Use of existing pipeline routes.
- * Minor inconvenience for residents.
- * Shorter construction time.
- * Lower civil engineering and recultivation costs.
- * Installation possible under rivers, lakes or traffic routes.
- * Reduction in CO2 emissions, as no vehicles are needed for transport of road surface materials, excavation work, etc.
- * Avoidance of traffic rerouting and congestion.

Ploughing

Ploughing (fig. 1)

Ploughing is the fast and possibly most cost-effective method of laying new plastic pipes. The technique used has a minimal impact on the subsoil and is therefore considered to be environmentally friendly. A winch is used to pull a plough blade and pipe-laying unit through the ground. Once the pipe has been installed, the furrow (trench) is automatically closed as the plough blade advances. This method is also suitable for the parallel installation of several pipelines. As the soil initially displaced by the plough is re-used without any further processing, the pipes deployed have to be highly resistant to point, i.e. concentrated, loads. Owing to their high stress crack resistance, PE 100 RC pipes are particularly durable.



Milling

This laying method are usually applied in rural areas and outside of traffic zones. With the milling technique, a suitable machine is used to cut a pipe trench into the soil, and the PE 100 RC pipes is simultaneously placed on the trench bottom by means of a so-called installation box. As the trench is in most cases not walkable, this box serves as a trench support in the installation of the pipeline. Once the pipe has been laid, the trench is mechanically backfilled and compacted with the previously milled-out material, i.e. no sand bed is needed.



Trenchless pipe replacement

- * Horizontal Directional Drilling - HDD
- * Relining
- * Burst-lining

Horizontal Directional Drilling (HDD) is a method of installing underground pipelines, through trenchless methods. It involves the use of a directional drilling machine, and associated attachments. Soil is loosened and flushed out in various stages using a drilling fluid. The first step is to create a pipe duct by means of a pilot bore. Then, in further steps the final pipe duct is widened and the pipe is introduced with the help of an insertion device.

This means very minimal surface disturbance and low reinstatement costs. We can drill under buildings, rivers, roads, through hills and rock.



Relining of An Old Waterpipe

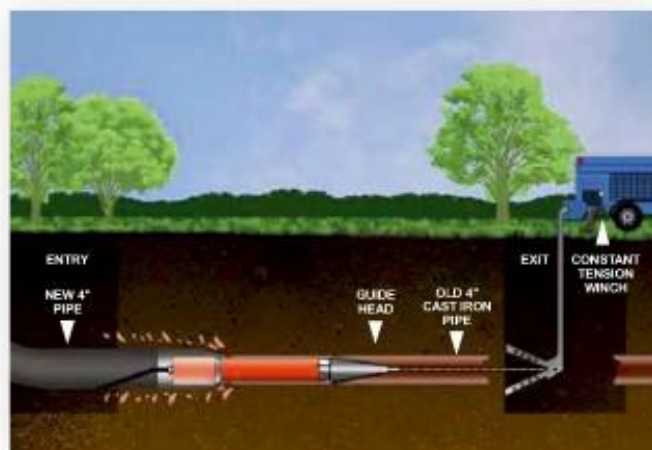
Relining with pipe is a trench-free procedure, by which PE 100 RC is pulled into the existing carriage from the manhole. The individual pipes are connected with an electrical or butwelding technique.



Pipe Bursting

Burstlining, a trenchless pipe - bursting method, is used for repairing damaged pipelines by retaining or enlarging the hydraulic cross-section.

Together with the in-situ soil, the broken material compacted into the ground forms an annular space, into which the new pipeline attached to the bursting unit is introduced.



Bedding and Backfilling

Based on the proof of resistance to slow crack growth, pipes made of PE 100-RC are suitable for laying without a sand bedding. Thus, additional work in order to replace the excavated material with a sand bed in accordance with EN 805 (transport, disposal) is not necessary. The pipe properties are such that no restriction of the grain size of the bedding and backfilling materials is necessary.

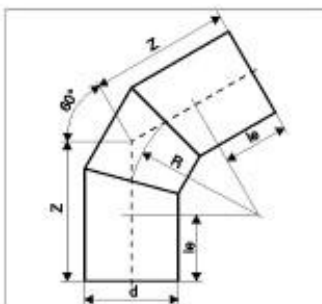
● 3.2 JOINING TECHNIQUES

The standardized dimensioning for internal pressure load of PE 100 pipes is also valid for alternatively installed pipes. **PE 100 RC MULTILAYER PIPE** can be joined with technics as standard PE 100 pipe, but welding and electrofusion, as PE 100 RC is inseparable part of the pipe wall. The fitting using in this system are made from same material as PE 100 RC

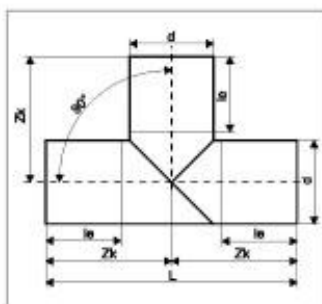
● 4.FITTINGS

PE 100 RC MULTILAYER PIPES provides project-related supplies and a number of special fittings upon request. For laying without a sand bedding, the latter are made of PE 100-RC. A selection is shown below - manufacturing in accordance with the customer specifications possible:

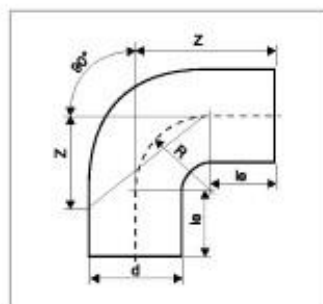
Sagmented bends



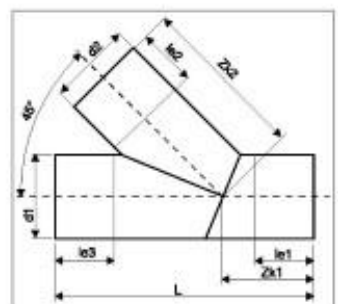
Sagmented T-pieces



Sagmented drawn bends



Branches





#1 PE 100 RC MULTILAYER PIPE TECHNOLOGY IN THE WORLD

PE 100 RC pipes for pipe-laying without sand
embedding and for the renovation of pipelines

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