PEŠTAN
we build trust

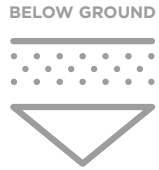
PIPING SOLUTIONS

Water and heating

HDPE RC WATER PIPES


E01 015 DVGW DW 8146CLO495 Ø450 PN10 PE100 SD

HDPE RC WATER PIPES



Water pipes made out of high density polyethylene PE 100 - RC

POLYETHYLENE PIPES - BASIC DATA

Polyethylene is the most famous product made of plastic in mass production. It is classic member of polyolefin material family. Chemical formula of PE is -(CH2 - CH2) which makes it ecologically compatible hydro-carbonic product. Pestan uses for it's production of PE pipes PE-HD, polyethylene of high density that is.

PE-HD pipes are of very high quality for which the tests under the norms DIN EN ISO 12162 and ISO/TR 9080 have proven their life time to be more than 100 years. Practical use also confirms the same, in application in gas, water or sewage networks. PE-HD pipeline systems, some of which are in function for over the 40 years, are characterized by great security in it's usage, low costs of maintenance.

Pestan is offering a wide range of PE pressure pipe systems, designed for potable water, gas (EN 1555 and EN 12201). Pestan pressure pipes are made of polyethylene HD: PE- 100.

Positive characteristics of polyethylene pipes are undoubtable. They are firm, resistant in touch with aggressive enviorment, resistant to corrosion and mechanical impacts. Advantage of PE pipes comparing them to others are: light weight, flexibility, very small pressure loss during friction, toughness in low temperatures, high chemical resistance, good connectivity and low price. PE has a great resistance to acids and greasy substances, insoluble in organic or non organic solvents in temperatures from 20C. They are very light and flexible so they offer economical application. Due to it's flexibility very long lines can be layed without using the fittings because pipes can follow the configuration of the grounds, like horizontal turnings of the pipeline routes. By applying PE pipes during the construction of the pipelines the share of fittings and armature in works is minimal. Also the length of pipes can be delivered by special requests for projects, that can diminish building expenses.

ADVANTAGES OF PE PIPES:

- High reliability and proven performance of functionality make PE a great choice, especially with buried systems.;
- Resistance to low temperatures - because of it's great expandability Pestan PE pipes do not make problems during application and works in low temperatures.;
- High resistance to impact - huge resistance to hydraulic impact, fraying and weariness eliminate the need for greater nominal pressures and decreases the values of investment;
- Comparations have shown that PE pies have greater resistance to abrasion then the other material, so PE is most wanted for this characteristics when transport of solutes is in question;
- Great hydraulic characteristics - smooth surface and resistance to turbulent flow which allows the flow to be greater;
- High chemical resistance - resistance to vast number of chemicals;
- Ability to get weld - Because of the good flexibility PE pipelines of greater longitude can be connected out of the trench and layed afterwards (which decreases the width of the trench) and welded connections will be strong and reliable.
- Wide spectre of application methods - PE pipes offer to the workers numerous solutions of integration , that can save time and money, for example it is prefered the installation without the trench or with very narrow trench.

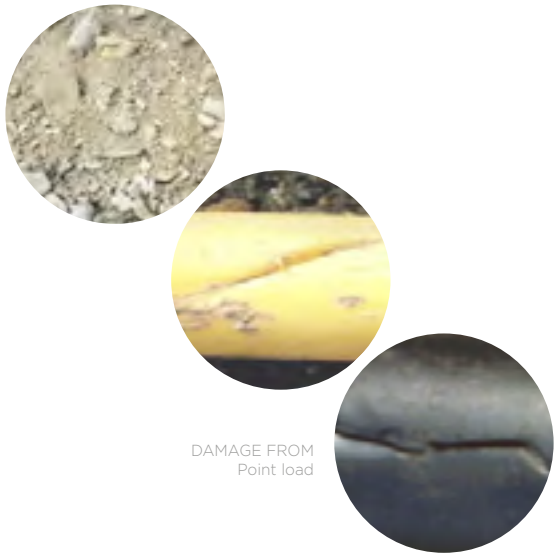
HOW DOES THE NEED FOR REINFORCED AND ENHANCED HDPE PE - 100 APPEAR

Sand coat around the pipe provides simple laying and protection from the rocks and stones. Conventional techniques of pipe placement are proven to be safe and reliable and they guarantee long term function of PE 80 and PE 100.

In last years the workers are more and more turning to new pipe laying techniques. Economic crysis and need for rationalization of spending made numerous producers question the price of making the sand coating for new pipelines and analyzing their necessity.
If it is possible put in the dirt dug out from the trench hole it can be used for filling instead of the sand.

Peštan RC - resistant to crack

Rejecting the sand coat can result in scratches on the surface of newly placed pipeline. (Permitted damage is 10% of wall thickness) Besides that it is possible that rocks do the pointy or linear pressure the outer wall for a longer period - along with workload such as working pressure , weight f the dirt, or traffic so it could make damage.
If the protective sand coat is rejected it is necessary that chosen pipeline is protected from superficial damage derived from scratches, especially from pointy pressure so it wouldn't make cracks during the strain. So the condition for applying the pipe like this is that the pipe is made of material who can handle the load.



DAMAGE FROM
Point load

New unconventional techniques have been developed, however, damaging pipes during these techniques can always be avoided which led to the evaluation of pointy load/pressure during the works. New and unconventional techniques are:

- Open trench without sand coating for decreasing spending.;
- Laying the pipeline by plowing;
- Directed drilling ;
- Relining, breaking the pipeline

Installation without digging an open trench, method of pipe laying - ploughing.

Installation without sand bedding

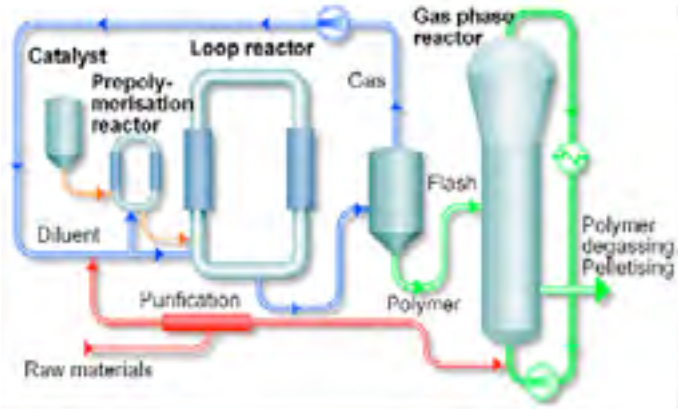
ADVANTAGES OF UNCONVENTIONAL METHODS ARE:

- Unconventional methods of installation bring significant decrease of spendings. Decrease of digging costs, bringing the sand and transport... It can all be decreased up to 50%;
- Problems of local inhabitants, decrease of incomes of local stores, redirection and slowed traffic represent indirect spendings of local community that don't occur with unconventional techniques.;
- Programs of efficient CO2 emission are necessary for solving the climate change problems in future. Emission of CO2 made from bringing the sand and putting away extra dirt from digging the site can be avoided with unconventional methods.
- Time means money and comfort. Swiftness in executing the works makes the difference in the eyes of local inhabitants. Projects too long can be often seen as troublesome and hard baring while swift projects with unconventional techniques can be done very fast and often unnoticed;
- In total unconventional techniques are good for the enviornment because of the decreased emission of CO2, landscape preservation, trees, land structures...

PE 100 RC

In manner of responding to challenges of unconventional methods in laying pipes PE 100, to empower resistance to pointy load and pressure and fast spreading of a crack, Borealis has developed new and advanced grain BorSafe HE3490-LS-H. This is the compound that Pestan uses in producing the PE 100 RC pipes.

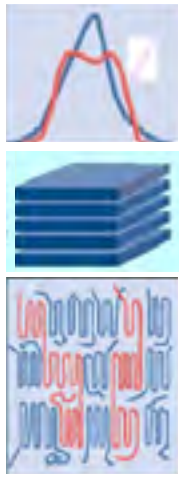
In business of pipes production the flexibility od two way or multi way process of producing PE material has provided a vast space for production of custom materials. The choice of catalysts, content and selective distribution in their content of polymer chains like the choice of parameters of process in every reactor affect the development of polymer structures and characteristics of final product. Two way process consists of two polymer reactors in row. In picture 1 it is shown the simplified view at basic principle of two way process. On illustration can be seen Borstar® drives with low pressure solution loop and gas phase reactor process. Catalyst enters the first reactor, where the polymer is formed as powder particles and through the polymerization of ethylene monomers and appropriate quantities of the comonomers, continuing in sequence mode in the second reactor.

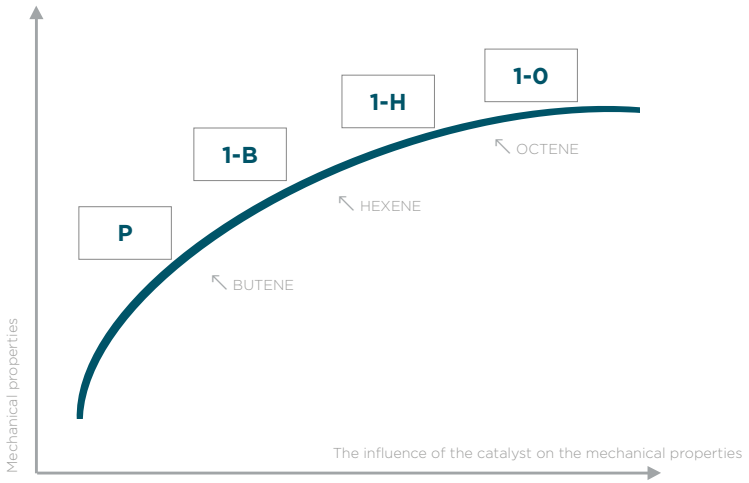


Bimodal polymerisation process Borealis Borstar technology

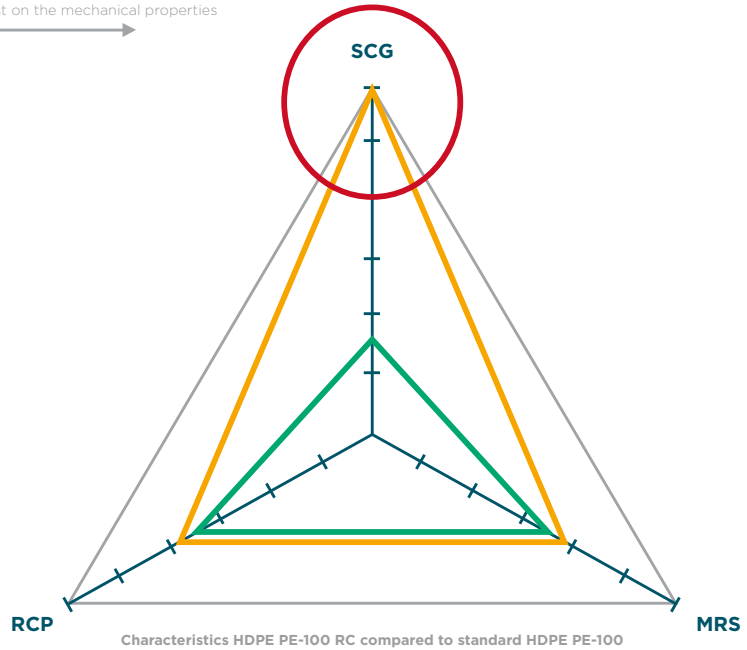
THE MAIN ADVANTAGES OF THE PROCESS ARE:

- Applies independent control of the reactor that operates distribution and comonomer adjust the molecular weight distribution (MVD);
- Blink between the reactors guarantee independent reaction mixtures. This may have produced a wide range of densities, from LLDPE to HDPE;
- Various comonomers can be incorporated in accordance with the needs, for example. butene and hexene;
- MFR2 of different reactors can vary within a wide range, from 0.1 to << more than 1000 g / 10 min;
- The process offers great flexibility as to the type of comonomer that can be incorporated in the correct regions of the polymer. For example, the use of the bimodal comonomer Hacken drives Borstar process results in polymers having an extremely high resistance slow crack growth.





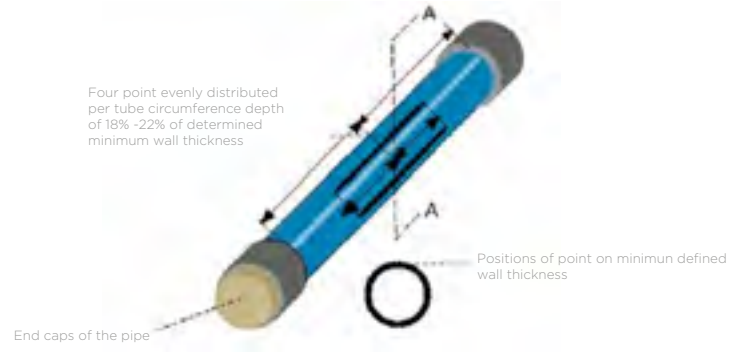
SCG
slow crack growth
RCP
rapid crack propagation
MRS
minimum reqired strength



Characteristics HDPE PE-100 RC compared to standard HDPE PE-100

ESTABLISHIN THE CHARACTERISTICS OF PE 100 RC PIPES

Therefore, PE-HDPE RC 100 is an enhanced HDPE PE-100, which has improved mechanical properties. Improved mechanical properties are the result of a shift catalyst in the process production. Namely, the catalyst for the production of HDPE PE-100 is a butene, and the catalyst is for the production of PE-100 HDPE RC hexene. The assays are described below, indicate the excellent properties RC PE 100 tubing. NPT - notch pipe test, indicating the resistance tube to the recesses that may arise in the trench due exposure pipe stone or the rest of the old pipeline. PLT - point load test demonstrates thinkable tube to point loading, simulating the load that occurs when the tube. Functioning exposed stone walls or a longer period. FNCT - full notch Creep test is the test of raw materials that are produced by PE 100 RC pipe.



Section AA

- **Notch test**

is the test method that is used in accordance with EN 12201, EN 1555, ISO4427 and ISO4437, formeasuring the resistance to slow crack growth. Notch test is performed according to ISO 13478 by what a piece of pipe defined cuts and then be tested by releasing water temperature 80 ° C under a pressure of 9.2 bar (SDR 11, PE 100) to the moment of cracking.
The results of this test indicate excellent properties HDPE PE 100 RC pipes. The requirements of the standard is more than 500 h, time of cracking of the standard HDPE PE-100 pipe is 1000-2000 h, and at this time in HDPE PE-100 pipe RC increased to 8670 h (one day), which is 4,3 more!

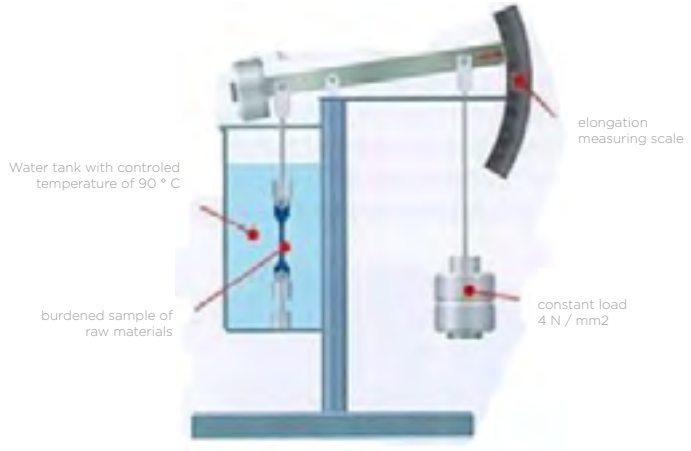
- **Point-Load Test method (PLT)**

is a testing method that simulates stones in a trench without sand cots. Test is perfomed on a way that the tube, which is exposed to internal pressure, is loaded with the external force (Simulation of a stone). This test was developed by the institute Dr Hassel. In order to shorten the time of cancellation pipes, the medium that is used in this test is not the water, but it is detergent Akropal N 100. Detergent that is placed at a temperature of 80 ° C is released under the pressure, and under these conditions the pipe is loaded with external force from 4 N / mm^2. Under these conditions the time of cancellation HDPE PE 100 RC pipe is> 8760 h which means that in the case of loading the water at a temperature of 20 ° C, life of the pipe HDPE PE-100 RC is more than 100 years. (Taken from the publication Dr Hassel).

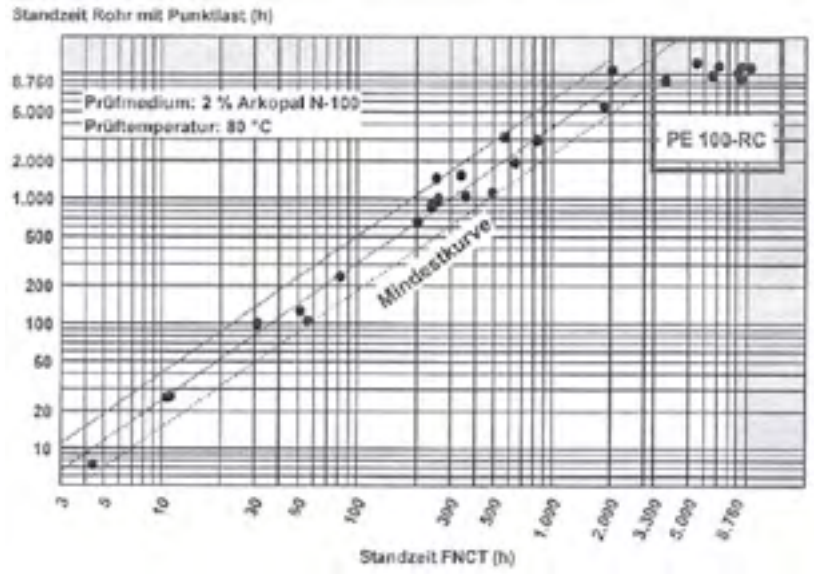
Point load test according to dr. Hessel

- **Full Notched Creep Test**

Test stretching of nicked raw material - is a test in which the test of rod material are cut sharply, and then when it is exposed to the water pool at a temperature of 90°C with constant stretching, tightening strain of a force is 4N/mm2 until they burst. Test simulates local stress concentrations and implemented according to ISO 16770th. How we may have estimate the predicted lifetime of pipes that are under additional point load, Dr.Hessel's engineering and technical testing of pipes are under internal pressure, with additional point load compared with the results of the FNCT test (3RInternational 4/2001 and 6/2001).



FNCT test - Full Notch Creep-Test (test istezanja) (ISO 16770)



Research Dr Hessel-a is covered with at least 30 test series in three decades with the target size of 8760 hours FNCT test. The correlation coefficient should be> 0.9 (dispersion results) with minimum requirements for the lower confidence limit of 2.5% (97.5% points must be above the line). Correlation is accredited in accordance with EN 17025, ISO / IEC. Based on this correlation, the stability of the FNCT-in for at least 2000 hours is taken as proof of the 100-year life of the pipe under concentrated load (Dr.Hessel in the journal 3R International 6/2001).

PEŠTAN RC

Peštan RC is a compact (full wall) tube made of an innovative, extremely robust plastic BorSafe HE3490-LS-H. Tube prepared like this provides increased security and longer lifetime of pipes compared to traditional PE pipes, even when it comes to extreme loads, such as notching pipes, gutters and spotty loads.

Peštan RC can be easily installed, as well as traditional PE pipes with equal ability. Welding and PE - 100 Pipes and fittings can be connected by connecting areas or electrofusion as well as other standard techniques for joining PE pipes. Peštan RC pipes are compatible with the world's leading manufacturers of fittings. Peštan RC does not require special material for the installation of which is its biggest advantage.

Peštan RC hose thanks to its excellent resistance to stress cracking insensitive to-point loads and therefore did not need her sandy bed.

Peštan's RC tube is flexible and mobile. These properties allow laying in the proceedings of milling. Because of its high resistance to point loading Peštan RC tube is suitable for laying technique in which the soil is excavated and used as fill material.

Open trenches for pipelines threaten undisturbed running of road traffic and disturb nearby residents. Permanently damaging the asphalt on roads. For these reasons technique of laying without digging of a trench is facing the increasing acceptance, since in addition to provide the possibility of laying pipes under rivers, lakes and traffic routes.

APPLICATION TECHNIQUES FOR PE PIPES

As mentioned earlier a number of techniques have been developed by laying, in order to exploit the benefits of using polyethylene, these techniques are briefly described in text below.

- **Laying in narrow trenches**

This is a modification of the classic pipe laying in the trench. By using short or long ditches you have to dig the trenches that are 100 mm wider than the pipe which is to be installed into ground. Coiled or pre-welded pipes are laid in this passage. Significant savings can be achieved with less excavation volume, the less broth material (sand for bedding) and reduced labor.

- **Pipe bursting**

This is an increasingly popular method for rehabilitation of existing pipeline in places where excavation method is unacceptable. With pipe bursting metode the existing tube is destroyed and a new PE 100 RC pipe is drawn into the resulting hole that provides a replacement with the same diameter pipe or with the help of destroyers, pipe diameter can increase compared to the replased tube

If the situation so requires, Today's hydraulic tools for bursting are capable for damaging the pipe and fittings, and with the further adaptation of tools it is possible to destroy even ductile and steel pipes.

NOTE. This method is technically challenging and requires expert trained staff and appropriate equipment. Depending on the material and the status of the old pipe, it may cause scratches and notches on the new pipe. Debris and stones are causing concentrated loads during the exploitation.

- **Laying plowing**

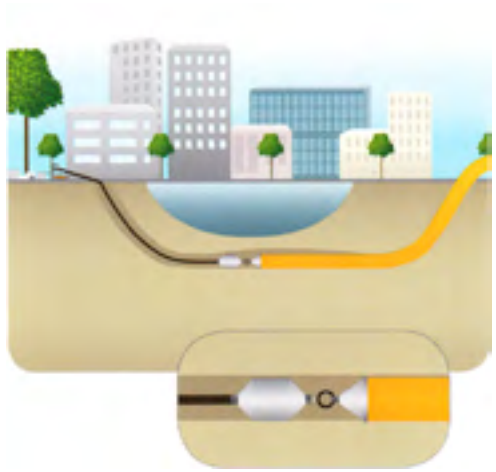
The technique were developed on the basis of Agricultural technology for laying and drain. This method is used for laying of the pipes for water and gas routes between settlements.

- **Slip lining**

Inserting of a small diameter of PE pipes, slip-lining in the existing Pipeline is one of many techniques for trenchless rehabilitation and repair of old pipeline.

With a slip lining it is inevitable to reduce the pipe diameter, although this can be minimized by thorough cleaning of old pipeline and selecting the largest possible diameter pipe for insertion..

The smaller diameter is compensated by an improved hydraulic characteristics of polyethylene, in some instances we have even higher throughput of the new pipeline.



- **Drilling**

Driling has become a frequently used method for trenchless setting of small diameters, and can deliver significant savings in relation to the installation of pipes from the excavation. Excavation is carried out for inbound and outbound caves, and it is ideal for passages, drilling pipeline under the road and out of sidewalk construction, gardens and places where there can be disrupted excavation of soils and plants.

Tool driling is percussion tool with pneumatic motor, that drilled a hole (the tunnel) and in most cases dragges a new PE pipe.

Experienced works contractors are required to perform these techniques installations, in order not to exceed a pre-allowed voltages welded pipe or the spool during threading.

- **Directional drilling**

This technique has also become an established method of installation for polyethylene pipes and it is used for passages under the road, rail railways and rivers and in places where excavation is difficult, expensive or impossible.

BENDING OF PIPES

One of the main advantages of PE is its flexibility and it can be used as an advantage for buried pipelines. Gradual changes of direction to point of 11.5 ° can be easily derived through bending of pipes without the need for additional valves and connecting costs.

Accepted rule for Pestan PE pipe systems (in hot conditions for SDR 11 pipes) is bending radius = 15 x JV (Outer diameter) of pipe. In cold conditions safe bending radius for SDR 17 pipes is 25xS.P.For very cold winter, weather conditions of this value increases to 35 x JV pipe.If you have a pipe with a thin wall, SDR 26 and SDR 33 you should increase this value up to 50%. Fittings and connections should not be installed on sections where the pipe is bent.

DETECTION OF TUBES

For detection of PE pipeline, the simplest and most economical method is to put in a trench and set with marker tapes that contains wire-track detection. Marker strips should be placed 300 mm above the top of the pipe.

CHARACTERISTICS AND ADVANTAGES OF THE HDPE PE-100 RC:

- Optimum protection against point source and surface pressure;
- Ideal for trenchless installation and without sand.
- Suitable for all modern welding technology, that can be applied with conventional joining methods used for PE 100;
- A simple and low cost-effective installation, similar to a traditional PE without a need for “Imported" backfill material
- Very long service of lifetime, even with external damages; excavated earth could be used as backfill material and significantly reduces installation costs;
- Other benefits. All other advantages of standard PE pipe systems are also applicable to Peštan RC, such as for example, cold bending, resistance to hydraulic shock and fatigue of material.

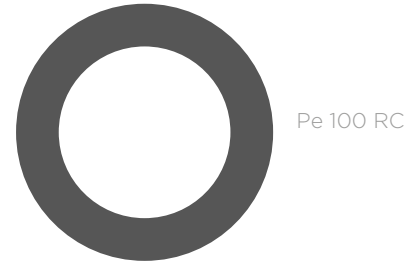
All BorSafe LS-H are certified as PE 100-RC (resistant to crack):

- Approved by independent institutes,
- Recorded in KRV in Germany,
- Regular testing and quality control

TYPES OF RC PIPES

Classification of pipe PE 100 RC CEV

There are several combinations of materials for the production of tubes, which allow the PE 100-RC material, and this combination is over minimum requirements applicable to PE 100th.

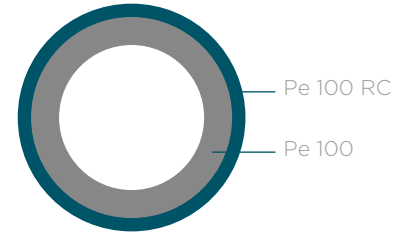


Type 1 Solid made of solid wall PE 100-RC

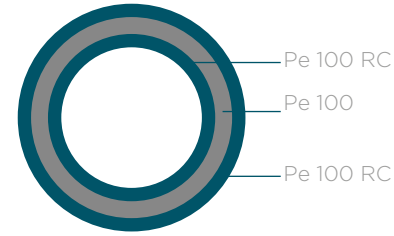
Pipes solid wall of one layer wall are made of PE 100-RC as defined by ISO 4065. These tubes can be made of full-color, blue or black water pipes with blue stripes to the applications which are made of such PE 100 RC materials.

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

The dual-layered tube is dimensionally integrated with protective layers which are made of PE 100 or PE-100 RC and they have a coextruded layer made of PE 100-RC.



Three-layer pipes with dimensionally integrated protective layers are composed of PE 100 and PE 100 -R c and have inner and outer co-extruded layer made of PE 100-RC. This production is based on a two-layer and three-layer tube with a different outer layer in blue color for water.



CATALOG OF PRODUCTS

	SDR27,6 (S-13,3) PN6			SDR17 (S-8) PN10			SDR11 (S-5) PN16			SDR9 (S-4) PN20		
D(MM)	CODE	S	KG/M	CODE	S	KG/M	CODE	S	KG/M	CODE	S	KG/M
16										11210200	2.0	0.09
20							11208501	2.0	0.12	11210201	2.3	0.13
25				11205102	1.9**	0.14	11208502	2.3	0.17	11210202	3.0	0.21
32				11205103	2.0	0.2	11208503	3.0	0.28	11210203	3.6	0.33
40				11205104	2.4	0.29	11208504	3.7	0.43	11210204	4.5	0.51
50	11201705	2.0*	0.31	11205105	3.0	0.45	11208505	4.6	0.67	11210205	5.6	0.79
63	11201706	2.3	0.46	11205106	3.8	0.72	11208506	5.8	1.06	11210206	7.1	1.26
75	11201707	2.7	0.63	11205107	4.5	1.02	11208507	6.8	1.47	11210207	8.4	1.78
90	11201708	3.3	0.93	11205108	5.4	1.46	11208508	8.2	2.14	11210208	10.1	2.56
110	11201709	4.0	1.36	11205109	6.6	2.18	11208509	10	3.17	11210209	12.3	3.81
125	11201710	4.6	1.78	11205110	7.4	2.78	11208510	11.4	4.11	11210210	14	4.3
140	11201711	5.1	2.21	11205111	8.3	3.49	11208511	12.7	5.12	11210211	15.7	6.17
160	11201712	5.8	2.86	11205112	9.5	4.55	11208512	14.6	6.73	11210212	17.9	8.04
180	11201713	6.6	3.66	11205113	10.7	5.76	11208513	16.4	8.5	11210213	20.1	10.17
200	11201714	7.3	4.5	11205114	11.9	7.11	11208514	18.2	10.49	11210214	22.4	12.58
225	11201715	8.2	5.68	11205115	13.4	9.01	11208515	20.5	13.27	11210215	25.2	15.92
250	11201716	9.1	7.01	11205116	14.8	11.05	11208516	22.7	16.33	11210216	27.9	19.57
280	11201717	10.2	8.78	11205117	16.6	13.88	11208517	25.4	20.47	11210217	31.3	24.6
315	11201718	11.4	11.03	11205118	18.7	17.57	11208518	28.6	25.9	11210218	35.2	31.11
355	11201719	12.9	14.02	11205119	21.1	22.36	11208519	32.2	32.88	11210219	39.7	39.5
400	11201720	14.5	17.78	11205120	23.7	28.27	11208520	36.3	41.75	11210220	44.7	50.12
450	11201721	16.3	22.61	11205121	26.7	35.81	11208521	40.9	52.87			
500	11201722	18.1	27.75	11205122	29.7	44.25	11208522	45.4	65.24			
560	11201723	20.3	34.82	11205123	33.2	55.43						
630	11201724	22.8	43.93	11205124	37.4	70.21