

# Reliable Water & Gas networks with high quality PE100-RC

Prepared by Borealis' and Borouge's  
Marketing, AD & TS and Sales Team for



**8<sup>th</sup> WATER LOSS FORUM**  
SU KAYIP VE KAÇAKLARI FORUMU  
23-24 Ekim / October 2024

EŞ ZAMANLI OLARAK  
IN CONJUNCTION WITH

[www.nodigturkey.com](http://www.nodigturkey.com)  
**NO-DIG TÜRKİYE**  
**2024**

**WOW İstanbul Otel ve Kongre Merkezi**  
23-24 Ekim / October 2024

**2. SU YÖNETİMİ, İÇME SUYU VE SULAMA SİSTEMLERİ,  
SU KAYIPLARI KONTROLÜ, ALTYAPI VE TEKNOLOJİLERİ FUARI**

**2<sup>nd</sup> WATER MANAGEMENT, POTABLE WATER AND IRRIGATION  
SYSTEMS, WATER LOSS CONTROL, INFRASTRUCTURE AND  
TECHNOLOGIES FAIR**

**Presenter : Ümit Çorbacıoğlu , Borealis' Sales Manager**

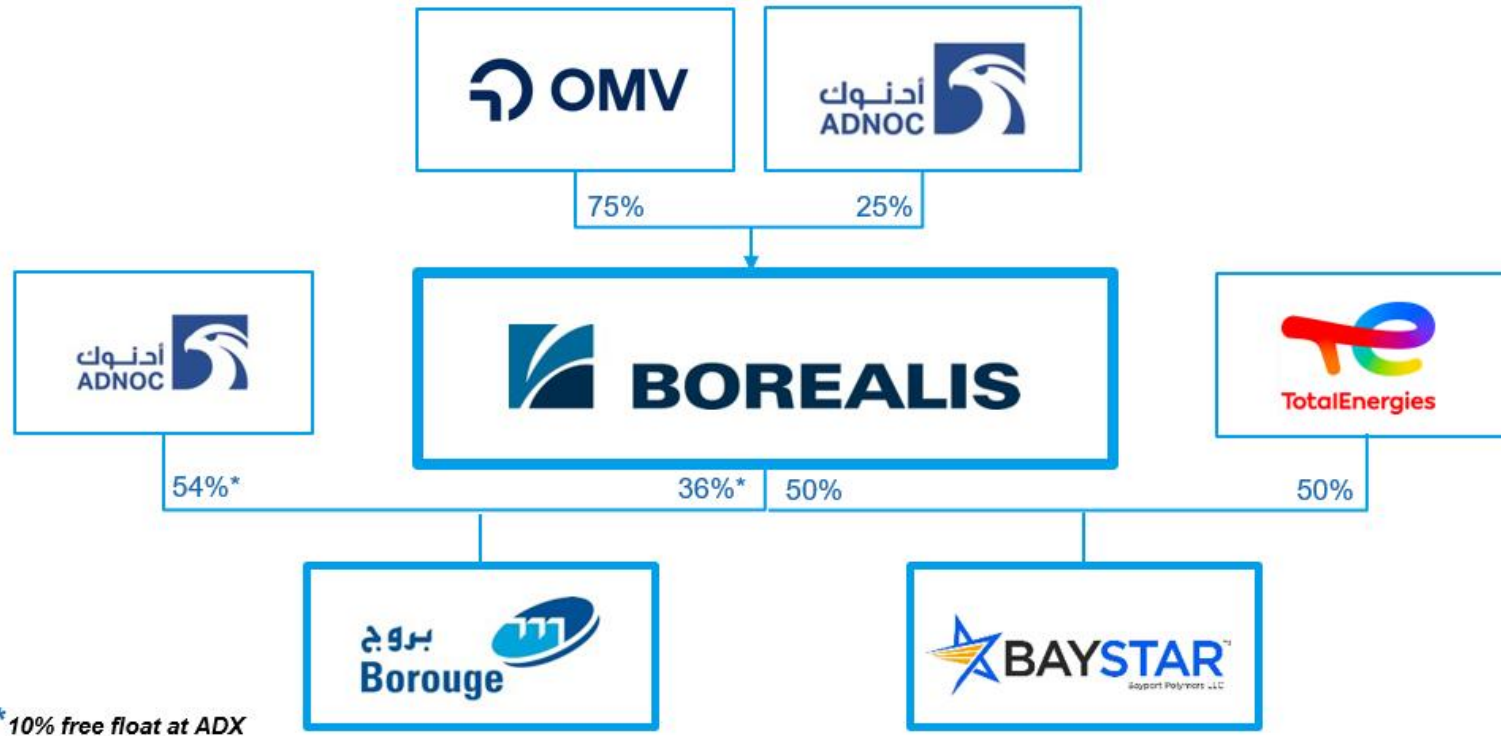


**BOREALIS**

بوريجه  
**Borouge**

## Who we are

We have an alliance of strong partners at our side



**BOREALIS** Nr 2 among polyolefin producers in Europe, 6000 employees worldwide, EUR 216 million net profit, 128 patents filed in 2023

**Borouge** One of the world's largest integrated polyolefin complexes with 5 millions of PO capacity per year ( 6,4 million ton by end of 2025)  
3030 employees from 50 nationalities worldwide

# Infrastructure

- **Borealis & Borouge** supply materials for advanced polyolefin pipe systems to the pipe industry to better serve communities and end users worldwide.
- **Water & Gas Supply**  
Outdoor water and gas pipes and fittings
- **Sewerage & Industrial**
  - Underground sewage and drainage
  - Road and rail drainage and storm water
  - In-house soil and waste
  - Industrial piping systems
- **Plumbing & Heating**  
In-house hot and cold water pipes, underfloor / wall heating and cooling
- **Oil & Gas**
  - Multi-layer coating for the protection of onshore and offshore oil and gas pipelines
  - PO solutions for oil and gas industry (liners, risers etc.)



# Why are we here today?

## Water Loss Forum & No Dig Turkiye

- **TURKIYE is a big country with**
- Important industrial investments
- Many preferred touristic destinations at the coasts and inland
- Large areas for agriculture
  
- **Big country with different challenges**
  - Increasing population in cities , expanding city borders from centre to outside
  - Urban traffic
  - Sudden heavy rains , flooded cities and fields
  - Dry seasons , decreasing water resources
  - Conscious consumption of water by the community ,agriculture and industry
  - Environmental protection ( clean water resources , sea, lake, river ,underground waters, reduction of CO<sub>2</sub> emission )
  - Countermeasures against earthquakes
  - Fire fighting ( e.g forest fires )
  
- Those are challenges, but at the same time, also represents manifold opportunities for the smart use of modern plastic pipe and fitting solutions
  
- Replacement of traditional materials by PE and PP for many industries, offering clear benefits to the pipeline owner



**Corrosion free, flexible, lightweight and expected lifetime >100 years**

# Advantages of polyethylene (PE) pressure pipe systems versus traditional materials



## Key reasons (1): Flexibility

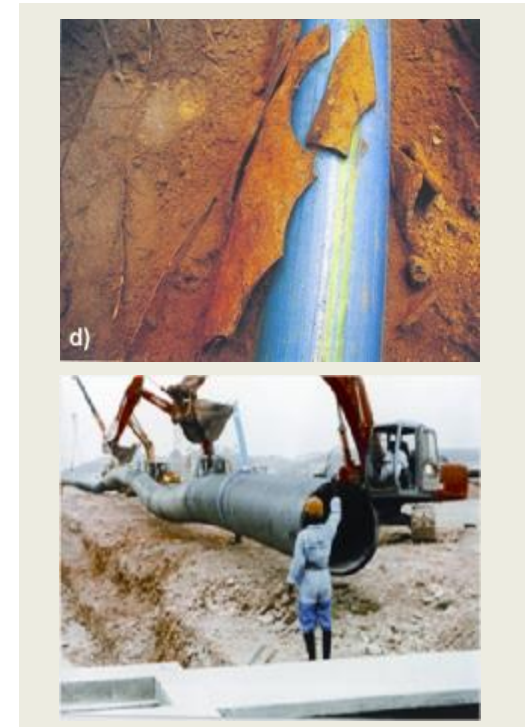
- PE can be coiled and wound on a drum in sizes up to 180mm diameter
- Pipes can follow curving trenches, less bows required and welded
- Faster installation
- **Less joints and connections, less welding**
- **Can accept ground movements**



## Key reasons (2): Toughness

- First pipes installed more than 50 years ago and are still in use although first gen. materials
- Modern materials: **expected lifetime > 100 years for both applications water & gas at 20°C\***
- Resistance to external notches, scratches, etc... have constantly improved
- Recent materials are almost insensitive to external damages and can be installed in rough conditions, called PE100-RC

\*= TEPPFA + PE100+ publication available



## Key reasons (3): Corrosion free

- Iron and steel pipes fail due to corrosion - **Unpredictable.**
- Protective coatings become damaged and lead to even higher rates of corrosion - **Unpredictable.**
- The type of soil can lead to external corrosion of metal pipes
- Corrosion products colour the water brownish
- Corrosion particles influence the house installation pipes made of copper (pitting)
- Cathodic protection for a lifetime required for steel pipes.

PE is highly resistant to corrosion: > **LONG LIFE - NO MAINTENANCE**





## Key reasons (4): Leak tightness

- PE systems can be fusion welded using electrofusion and butt fusion
- The fusion joints are homogeneous
- Continuity of the pipeline- one material only
- The pipe system is fully end load resistant No pull out even under severe ground movement
- Even under Earthquake conditions there are no failures (Japan)
- **Root penetration not possible for welded system**
- **Leak tight systems for safe handling of drinking water, gas, sewage, chemicals**



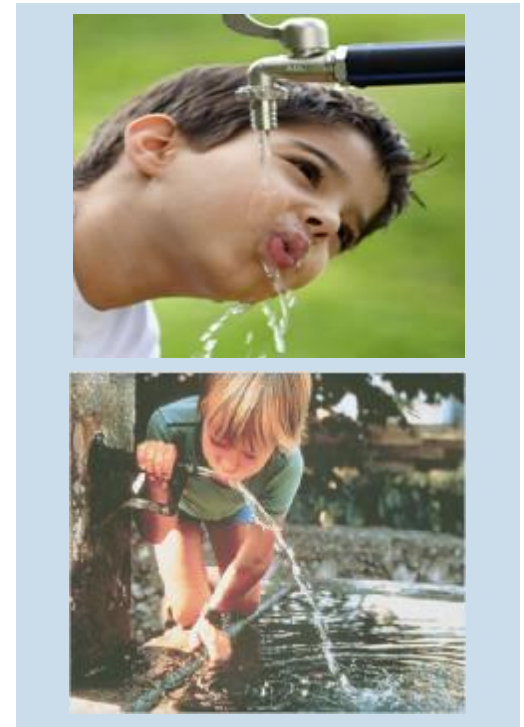
## Key reasons (5): Light weight

- Example for a  $\varnothing$  160 mm pipe:
  - PE = 7 kg/m
  - DI = 24 kg/m
  - Steel = 29 kg/m
- Easier and cheaper to transport
- Easier ( and safer ) to handle on site
- Easier to install – cost saving on overall installation costs
- **Save CO<sub>2</sub> emissions**



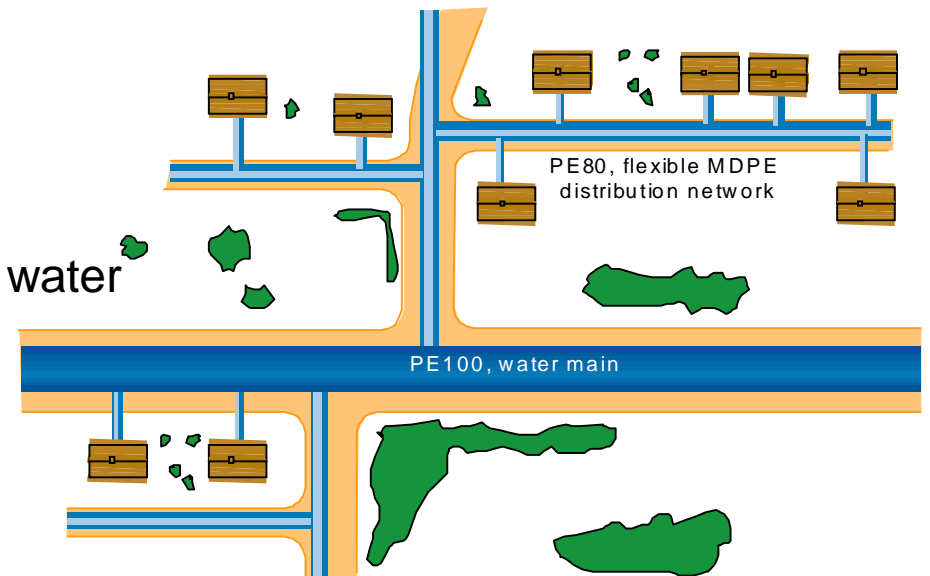
## Key reasons (6): Water neutrality

- PE is neutral towards water
- Insensitive to change of water quality over the lifetime (pH value, hardness)
- Low friction coefficient
- No encrustation- deposit: no loss of flow over time (hydraulics)
- Organoleptic properties and microbiological growth are regularly controlled by external labs



## Key reasons (7): All dimensions available PE Water pipeline system in all dimensions

- PE pipes are generally available from 20 to new record of 3500mm OD extruded pipe
- One type of material for the complete network from water mains to house connections including fittings and valves
- Resistant to corrosion
- Resistant to ground movements
- Resistant to most chemicals in the ground and water
- >100 years expected lifetime



## Key reason (8): Adapted to modern installation techniques

- Modern techniques help saving money and time
- Relining is ideal for cities – Less disruption of the traffic and inhabitants of the city
- Ploughing in- narrow trenching are more and more used in rural environment
- Directional drilling is solving complicated problems ( river or road crossing...)



**In all these cases, PE100-RC is considered by specialists as the best material due to its unique properties.**



# BorSafe™ Products for Water Pipes (TS-EN12201, ISO4427)



**BorSafe™ Water**

**Black**

**Blue**

**PE80 MDPE: ME3440 (-W)**

**HE3470-LS**

**HE3490-LS**

**HE3490-IM-W**

**HE3490-LS-H**

**HE3490-LS-HP**

**HE3490-LS-HW**

**HE3490-ELS-H**

**HE3490-SLS-H**

**PE80 MDPE ME3444**

**PE100RC HE3494-LS-HP**

**Dark blue strip material HE3495-LS-H for PE100**

**Red-brown strip material HE3497-LS-H for pressure & vacuum sewage systems**

Borouge  
Extra Low Sag grade =  
Borealis  
Super Low Sag grade =

# BorSafe™ PE solutions for pipe and fittings applications

**Borealis & Borouge have 50 years of Pipe heritage plus expertise in qualifications and industry standards.**

## **Key benefits of BorSafe™ pipe grades based on Borstar® Technology:**

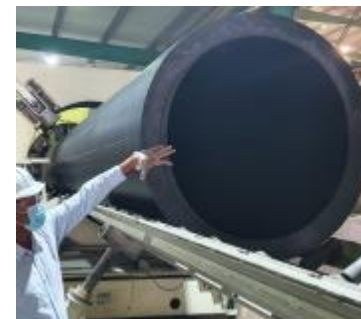
- outstanding combination of mechanical properties, durability & flexibility
- Superior resistance to slow crack growth
- Boru sisteminden beklenen servis ömrünün 100 senenin üzerinde olması
- Solutions for demanding installation techniques
- Tailored low sag behaviour
- Easy processability even up to **3,5 m outer diameter with Borsafe Extra Low Sag**

**PE100RC resins** : Borsafe HE3490-SLS-H and Borsafe HE3490-ELS-H

Large Diameter and thick wall pipe solutions

**ProjecPipe Sizes:** 1,000 to 2,000mm in diameter, with SDRs 11-26

Pipes produced by Union Pipe Industry in U.A.E.



Sensitivity: External

## BorSafe™ PE100 grades in PE100+ Assosiation's List

- PE100+ assosiation has been founded by Borealis , Elenac and Solvay in 1999 .
- Truly international assosiation currently comprising 15 PE manufacturing companies from different geographic locatios of the world as members.
- Both Borealis and Borouge are members of PE100+ assosiation.
- Borealis' and Borouge's PE100 grades are periodically tested by the authorised laboratories and listed as PE100+ Quality Materials accordingly .

The objectives of PE100+ Assosiation are :

- Guaranteeing consistent quality at the highest level in both the production and usage of PE 100+ pipe materials.
- Creating a marketing platform to **promote the effective use of polyethylene ('PE') piping** to the pipe installers and end-users in generall .
- Testing the quality of member's PE100 resins periodically according to the test criterias of PE100+ Assosiation and updating the list of the PE100+ quality grades of the resins .



### PE100+ QUALITY MATERIALS

Valid until 31<sup>st</sup> December 2024

The PE100+ Association ensures the very highest quality of PE100 products by continuously monitoring three fundamental properties:

- 1) Creep Rupture Strength,
- 2) Stress Crack Resistance and
- 3) Resistance to Rapid Crack Propagation.

Network engineers have identified these to be crucial for increasing the use of PE pipes in gas and water distribution networks.

Property	Test Method	PE 100+ Association requirements
Creep Rupture Strength	Pressure test at 20°C and 12.0 MPa	≥ 200 h
Stress Crack Resistance	Pipe notch test at 80°C and 9.2 bar	≥ 500 h
Resistance to Rapid Crack Propagation	S4 Test at 0°C	$p_c \geq 10$ bar

All tests are performed on 110mm - SDR 11 pipe.

On behalf of the PE100+ Association, [Kva-Gaslec Certification B.V.](#), an independent testing authority in the Netherlands repeats those test rounds together with various independent and internationally respected laboratories on a yearly basis.

The following products (manufacturers in alphabetical order) met the PE 100+ requirements

Product	Manufacturer	Production Country
BorSafe™ HE3490-LS	Borealis	Sweden
BorSafe™ HE3490-LS-H	Borealis	Sweden
BorSafe™ HE3490-LS-HP	Borealis	Finland
BorSafe™ HE 3490-SLS-H	Borealis	Finland
BorSafe™ HE3492-LS-H	Borealis	Sweden
BorSafe™ HE3494-LS-HP	Borealis	Finland
BorSafe™ HE3490-LS	Borouge	United Arab Emirates
BorSafe™ HE3490-ELS-H	Borouge	United Arab Emirates
BorSafe™ HE3490-LS-H	Borouge	United Arab Emirates
BorSafe™ HE3492-LS-H	Borouge	United Arab Emirates

# PE100 RC – The preferred choice for normal and alternative installation techniques

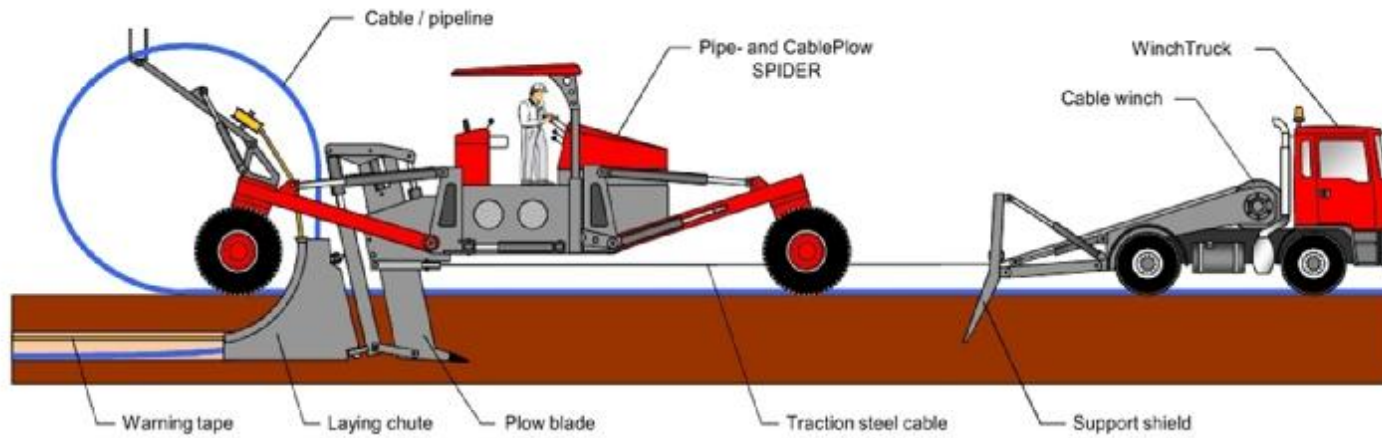
## Why do we need materials with better resistance?

- **New more demanding installation techniques have been developed**
  - Open-trench without sand bedding for cost reduction
  - Horizontal Directional Drilling (HDD)
  - Relining, pipe bursting...
- **New techniques are creating new constraints to pipes:**
  - External scratch, rock impingement (point-load), pipe under stress
- **Innovative solutions are developed to further improve the durability of the networks**





# New pipe installation: Mole Ploughing



Fast installation, little surface effects



Open trench not possible, but with pipe plough in wet fields it works!

Source: PE 100+ Association

© Borealis & Borouge

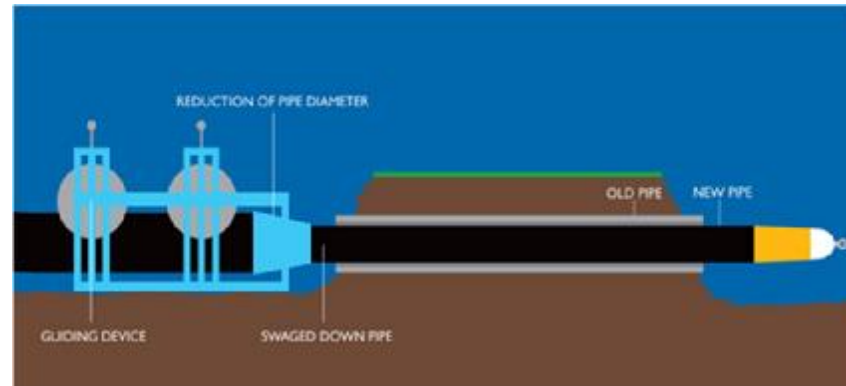
Sensitivity: External

# Refurbishment: Pipe Relining

## Loose (Slip) Lining



## Close Fit



**Die Reduction**



**Roller Reduction**

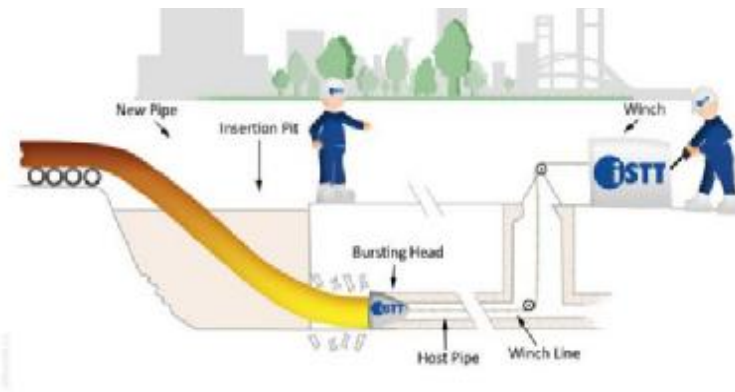


**Folded U-Liner**

Source: PE 100+ Association  
© Borealis & Borouge

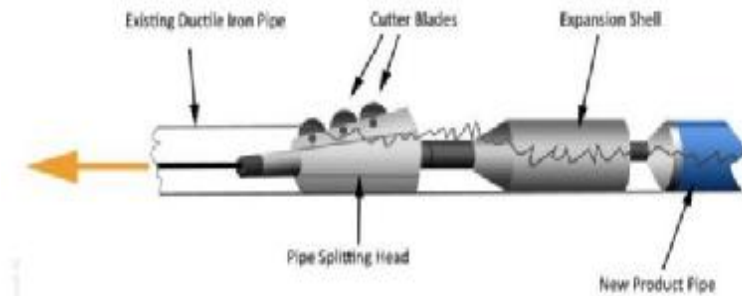
# Refurbishment by destruction of old pipe

## Pipe Bursting



**Crack brittle pipes:  
clay, asbestos, cast iron, PVC**

## Pipe Splitting



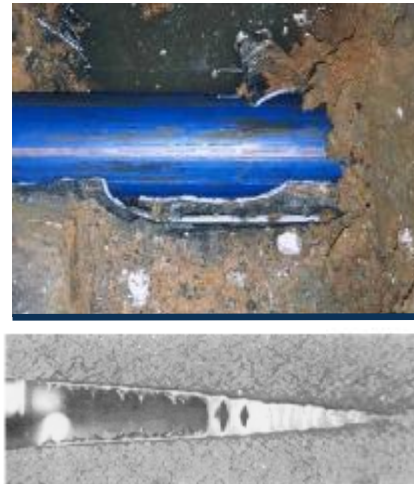
**Cut Ductile pipes:  
ductile iron, lead, plastic**

## PE100-RC versus traditional materials

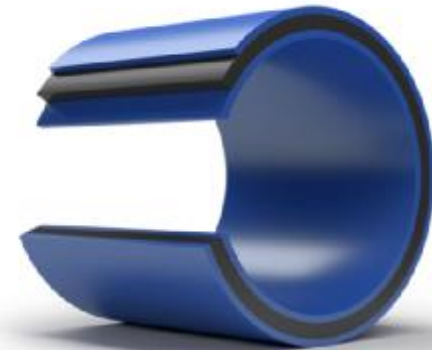
- PE100-RC (Resistant to Crack) is largely used to substitute more traditional materials like ductile iron, GRP, steel - for gas, water, industrial pipelines
- PE100-RC can be traditionally installed, but also in alternative methods
- No Dig - trenchless installations + renovation + sandless installation
- >> cost saving potential but also environmental and sustainability benefits (CO<sub>2</sub>)



**Sandless installation using the backfill creates point loads by stones**



**Pipe bursting creates scratches**



## PE100-RC - Adapted to modern installation techniques

- Modern techniques help saving money and time
- Relining is ideal for cities- Less disruption for the traffic and inhabitants of the city
- Ploughing in- narrow trenching are more and more used in rural environment
- Directional drilling is solving complicated problems ( Railway, river or road crossings...)



**In all these cases, PE100-RC is considered by specialists as the best material due to its unique properties.**



**PE100-RC has joined EN and ISO standards, including four new test methods**

# EN and ISO application standards for polyethylene pressure pipes

Integration of PE100-RC is completed in EN European Standards for Water and Gas

Application	Standard	Description	Status
Water	EN 12201	• Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE)   Part 1-5	In force since January 2024    TS-EN12201 since March 2024
	ISO 4427	• Plastics piping systems for water supply and for drainage and sewerage under pressure • Polyethylene (PE)   Part 1-5	Revision until end of 2024
Gas	EN 1555	• Plastics piping systems for the supply of gaseous fuels — polyethylene (PE)   Part 1-5	In force since July 2021    TS-EN1555 since September 2021
	ISO 4437	• Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE)   Part 1-5	In force since February 2024
Ind.	EN ISO 15494	• Plastic piping systems for industrial applications • Polybutene, polyethylene, polyethylene of raised temperature resistance, crosslinked polyethylene, polypropylene • Metric series for specifications for components and the system	Draft ready for vote by the end of 2024

## What kind of changes will be there for the PE100-RC?

Designation	Classification by MRS in MPa (ISO12162)	Standard
PE40	4	EN 12201, ISO 4427 - only for water – <b>PE40 may phase out soon ...</b>
PE80	8	EN1555, ISO 4437, EN 12201, ISO 4427
PE100	10	EN1555, ISO 4437, EN 12201, ISO 4427
PE100-RC		EN1555, ISO 4437, EN 12201, ISO 4427

Pressure testing according to ISO 9080

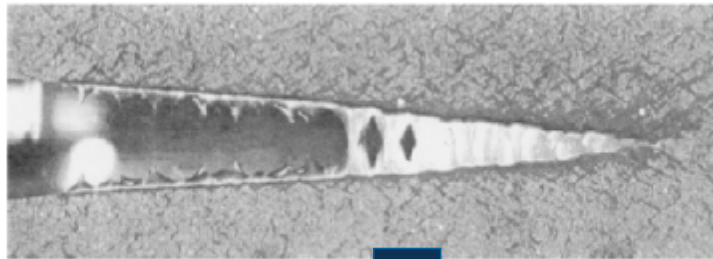
- “PE100-RC” as separate, new material designation in EN and ISO standards
- “RC” definition: **Raised Crack** resistance
- Minimum mechanical requirements of PE100 and PE100-RC are the same in the EN/ISO standards **with exception of** the Slow Crack Growth resistance (SCG)
- Due to the same MRS (minimum required strength), the dimensions of pipes related to outer diameter, wall thickness and SDR **are the same for PE100 as for PE100-RC**

# What does a high resistance to Slow Crack Growth (SCG) mean as key criterion for PE100-RC?

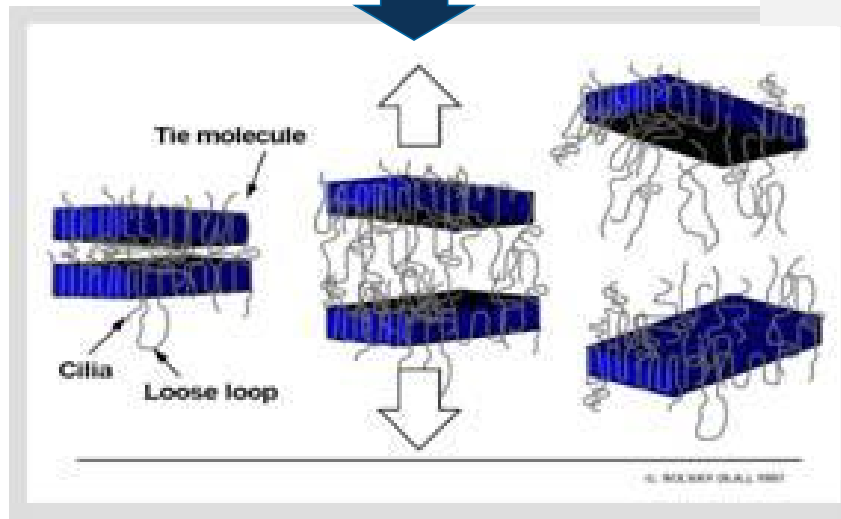


1) Scratches, notches during handling, transport and installation

(here driving the PE pipe into the existing line through the metal fractures caused by bursting of the old ductile iron pipe )



2) Crack propagation under constant stress (**Pressure** in and outside of the pipe )



3) Each tie molecule resists the crack propagation

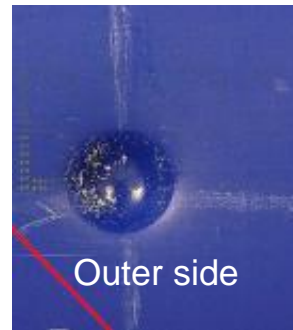
## Practical example: Point-load effects on pipes



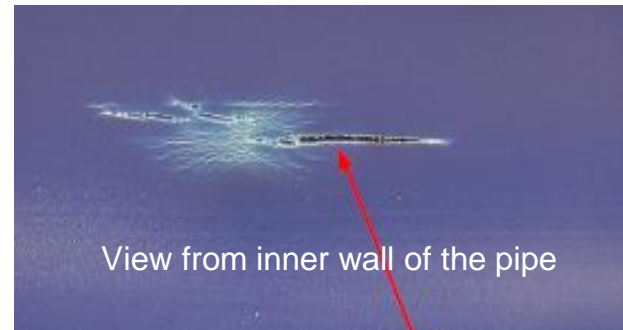
Rocky soil



Point loading effects on 1st generation PE pipes several years after installation



Outer side

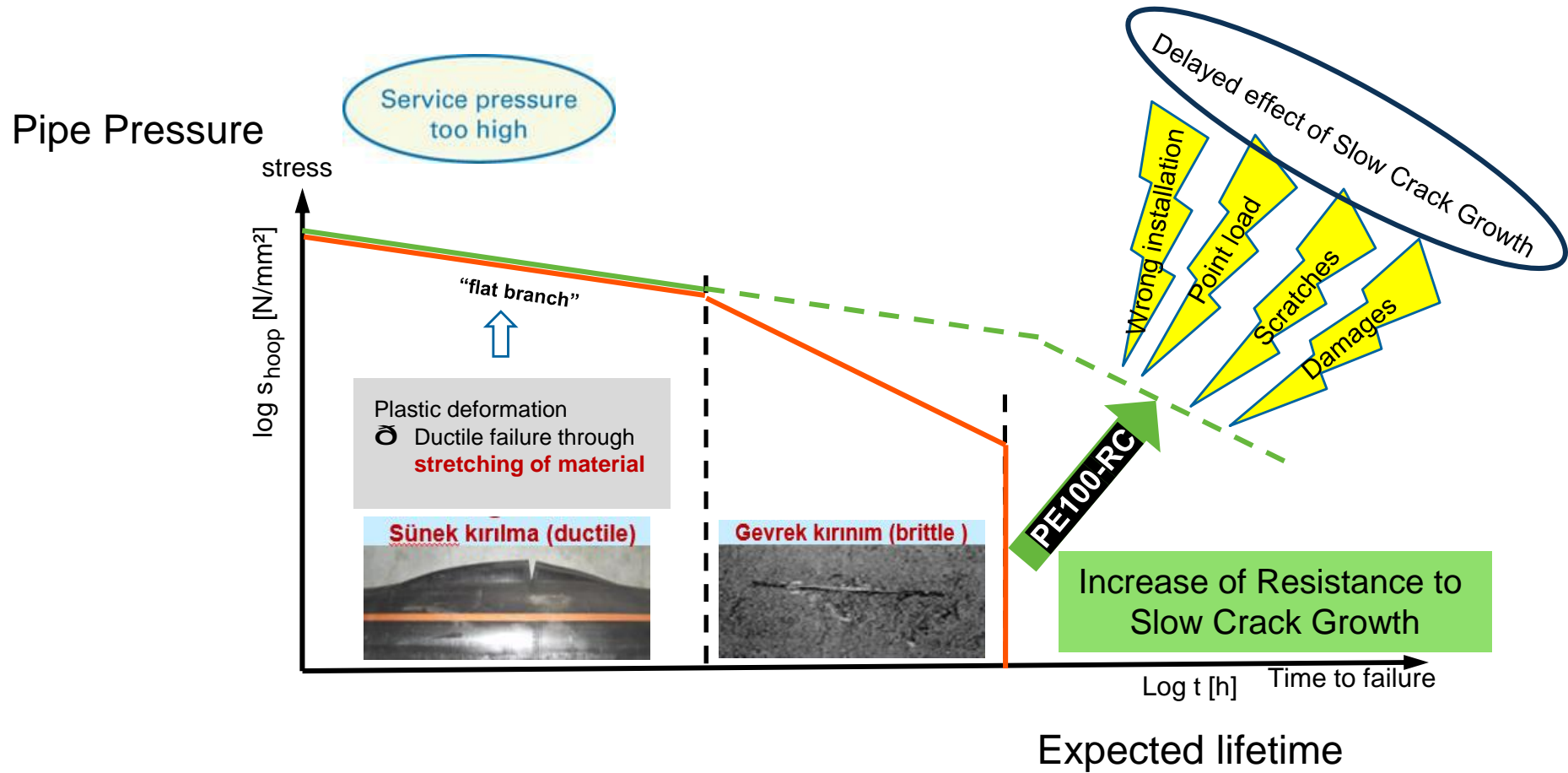


View from inner wall of the pipe

**Currently there is no ISO test method for Point Load Test ready .Standardisation project is closed .**



# Increased resistance to Slow Crack Growth extends the expected service lifetime of plastic pipe systems



## PE100-RC requirements in TS-EN 12201

### Characteristics of the compound in form of granules

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Resistance to slow crack growth for PE 100-RC Strain – Hardening test (SHT)	$\langle G_p \rangle \geq 53,0 \text{ Mpa}$	Test temperature Thickness Test speed and number of test pieces	80 °C 300 µm Shall conform to ISO 18488	ISO 18488
Resistance to slow crack growth for PE 100-RC Cracked Round Bar test (CRB)	$\geq 1,5 \times 10^6$ cycles at an interpolated stress range ( $\Delta\sigma$ ) of 12,5 MPa	Test temperature Type of test Diameter of test piece Waveform/frequency Number of test pieces	23 °C In air 14 mm Sinusoid 10 Hz Shall conform to ISO 18489	ISO 18489
Resistance to slow crack growth for PE 100-RC Accelerated full notch creep test (FNCT)	No failure during test period	Test temperature Environment Concentration Test piece dimension Reference tensile stress and test period Failure mode Number of test pieces	90 °C Lauramine oxide 2 % 10 mm square 4 MPa, $\geq 550$ h, or 5 MPa, $\geq 300$ h Brittle Shall conform to ISO 16770	ISO 16770

## PE100-RC requirements in TS-EN 12201

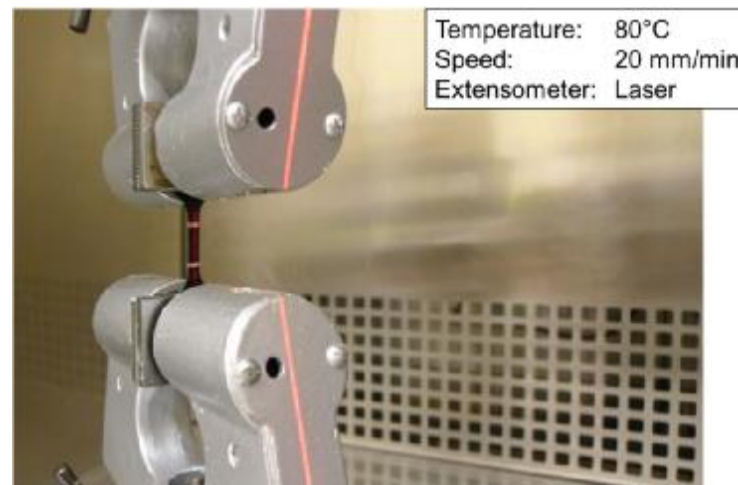
### Characteristics of the compound in form of pipe

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Resistance to slow crack growth for PE 100-RC Accelerated Notched Pipe test (ANPT)	No failure during the test period	Pipe dimension Test temperature Internal test pressure: for PE 100-RC Test period Type of test Concentration Number of test pieces	dn: 110 mm SDR 11 80 °C 9,2 bar  300 h Water-in-nonylphenol* 2 % Shall conform to ISO/DIS 13479;2020	ISO/DIS 13479:2020

\*= Arkopal only offered outside of the pipe to act on the notch tip

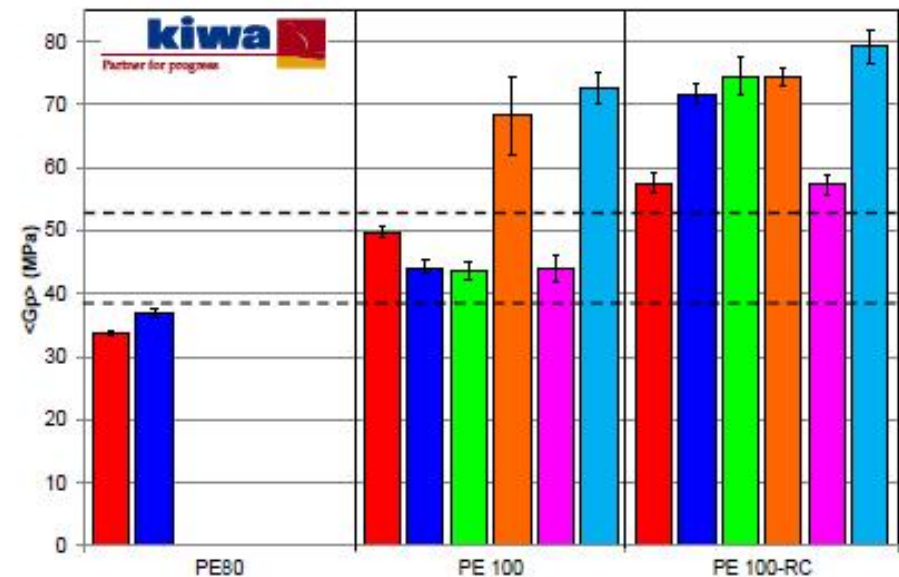
## SHT = Strain Hardening Test ISO18488

- 1) The resistance of PE against SCG is determined by the disentanglement of the tie molecules.
- 2) Strain hardening allows discrimination between materials
- 3) No detergents are used
- 4) Test temperature 80°C in climate chamber
- 5) The  $\langle G_p \rangle$  “Strain Hardening Modulus” is taken from the tensile test curve



## SHT Strain Hardening Test ISO18488

- 1) Fastest method and suitable for resin QC test
- 2) Distinction between PE100-RC and normal PE100 or in case of material mixtures possible...
- 3) Small sample quantity required
- 4) Quick method for end users to check delivered pipes and fittings
  - a. Regrind pipe or fitting into small pieces
  - b. Press new plate 300 $\mu$ m thick
  - c. Punch out sample
  - d. Check for SHT level



Source: DVGW study

# BorSafe™ PE100RC grades in PE100 RC+ List

Ø In addition to the existing PE100 Quality material list, the PE100+ Association published the “PE100-RC+ Quality material” list, which covers only the approved PE100RC grades of its members.

August 2024

Ø In addition to Borsafe PE100 RC Black products, Borealis' blue and orange colored compounds are also included in the PE100-RC+ list.



## PE100-RC+ QUALITY MATERIAL LIST

Valid until 31<sup>st</sup> December 2024 <sup>1)</sup>

The PE100+ Association ensures the very highest quality of PE100 materials by continuously monitoring three fundamental properties:

- 1) Creep Rupture Strength
- 2) Resistance to Rapid Crack Propagation
- 3) Stress Crack Resistance

Network engineers have identified that the following properties are crucial for PE100-RC pipes which are used in challenging applications such as the trenchless installation of gas and water distribution networks. In order to get a PE 100-RC material listed as PE100-RC+ the requirements specified in the table below must be met.

Property	Test method	Requirement	Initial qualification	Annual check	Test method	Specimen
Creep Rupture Strength	Pressure test at 20 °C and 12,0 MPa <sup>2)</sup>	≥ 200 h	2 successful test rounds in a row	1/year	ISO 1167	Pipe 110 mm SDR 11
Resistance to Rapid Crack Propagation	Pc 54 at 0 °C <sup>3)</sup>	≥ 10 bar	2 successful test rounds in a row	1/year	ISO 13477	Pipe 110 mm SDR 11
Stress Crack resistance	Accelerated Notch Pipe test ANPT in 2% Nonyl-Phenyl-Ethoxyfate solution <sup>2)</sup> 80 °C – 9,2 bar	≥ 300 h	2 successful test rounds in a row	1/year	ISO 13479	Pipe 110 mm SDR 11
Stress Crack resistance	Strain Hardening Test (SH) from regrinded pipe <sup>3)</sup>	≥ 53,0 MPa	2 successful test rounds in a row	1/year	ISO 18488	Regrind from pipe 110 mm SDR 11
Stress Crack resistance	Cracked Round Bar Test CRB <sup>3)</sup>	≥ 1,5 x 10 <sup>6</sup> cycles	2 successful test rounds in a row	-	ISO 18489	Granules
Stress Crack resistance	Accelerated FNCT test (AFNCT) in 2% Lauramine-Oxide solution 90 °C – 4,0 MPa <sup>2)</sup> alternatively 90 °C – 5,0 MPa	≥ 550 h ≥ 300 h	2 successful test rounds in a row	-	ISO 16770	Granules

1) New PE100-RC materials can be added at any time during the year as soon as these materials pass all the test requirements  
 2) To be tested as initial material qualification and also annually in each test round  
 3) Only to be tested as initial material qualification in 2 consecutive test rounds

For further information please contact:  
 PE100+ Association, P.O.Box 137, NL-7300 AC Apeldoorn, The Netherlands. Mail to: [contact@pe100plus.com](mailto:contact@pe100plus.com). The “PE100+ Quality Materials” is also placed on [www.pe100plus.com](http://www.pe100plus.com)

On behalf of the PE100+ Association, [Kiwa Gastec Certification B.V.](http://www.kiwa.com), an independent testing authority in the Netherlands, executes the above test schedule at various independent and internationally respected laboratories.

The following products (manufacturers in alphabetical order) met the PE 100-RC+ requirements

Product	Manufacturer	Production Country
BorSafe™ HE3490-LS-H	Borealis	Sweden
BorSafe™ HE3490-LS-HP	Borealis	Finland
BorSafe™ HE3490-SLS-H	Borealis	Finland
BorSafe™ HE3492-LS-H	Borealis	Sweden
BorSafe™ HE3494-LS-HP	Borealis	Finland
BorSafe™ HE3490-LS-H	Borouge	United Arab Emirates
BorSafe™ HE3490-ELS-H	Borouge	United Arab Emirates
BorSafe™ HE3492-LS-H	Borouge	United Arab Emirates
ELTEX® TUB 121 N6000 (black)	INEOS O&P	Belgium
Hostalen CRP 100 RESIST CR black	LyondellBasell	Germany
LITEN® PL 60-006	ORLEN Unipetrol RPA s.r.o.	Czech Republic
SABIC® Vestolen A RELY 5922R 10000 (black)	SABIC	Germany

<https://www.pe100plus.com/Open/News/Info/document/3351.pdf>

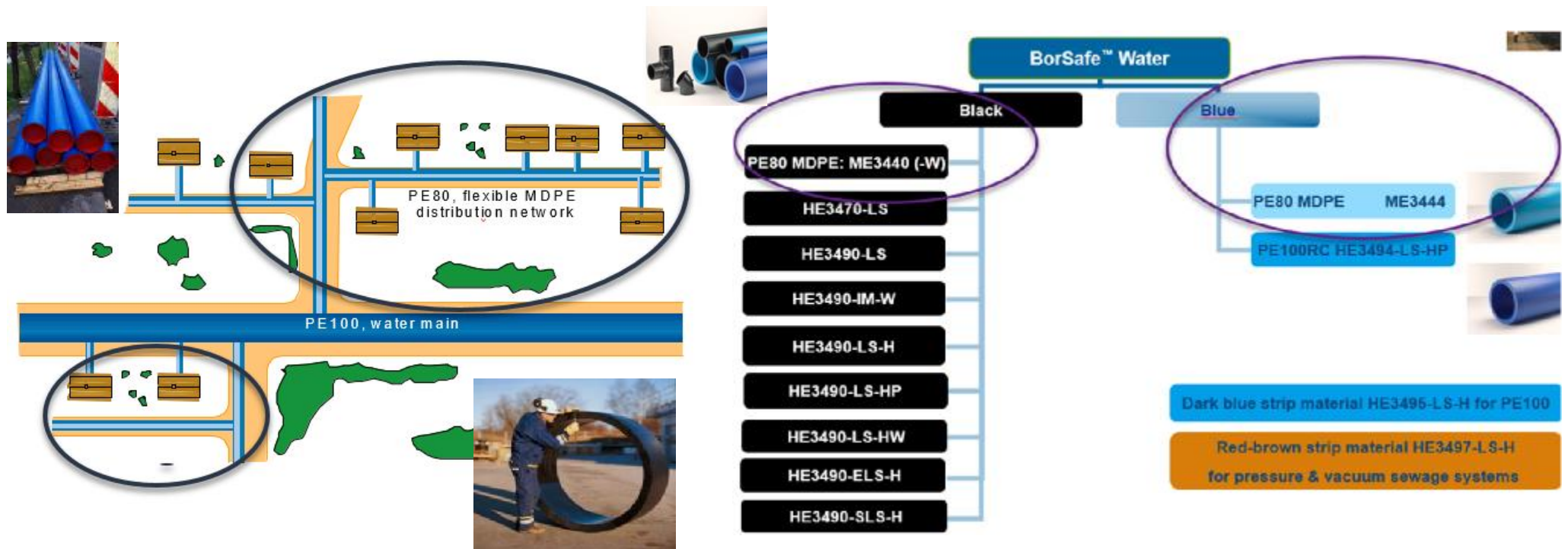


# House Connection Pipes

## PE 80 Medium Density Polyethylene

## PE80 Medium Density Polyethylene For house connection pipes

- Polyethylene : one type of material for the complete network from water mains to **house connections** including fittings and valves.



## All good with plastic pipes?

### Only if you choose the right and use it correctly...

High failure and leakage rate in house connection and smaller diameter pipes, why?

Investigation has shown the following main reasons:

#### 1. Unsuitable PE materials used

- a. Supposed PE32 \* and PE40 resins are still in use
- b. Natural base material alone or insufficient black or blue colouring ( salt +pepper concept)
- c. No suitable stabilization additives against heat and UV radiations
- d. Most of those LDPE and LLPDE materials have low ESCR

#### 2. No professional installation

- a. Improper sand bedding material and compaction of the soil for standard materials
- b. Forced jointing of mis-aligned pipes
- c. Improper shaving of surface and cleaning before Electrofusion welding
- d. Contaminations
- e. Wrong jointing methods
- f. Mistakes in use of mechanical fittings

\* PE32 does not exist in TS-EN 12201 since 2005



PE40 pipe damage

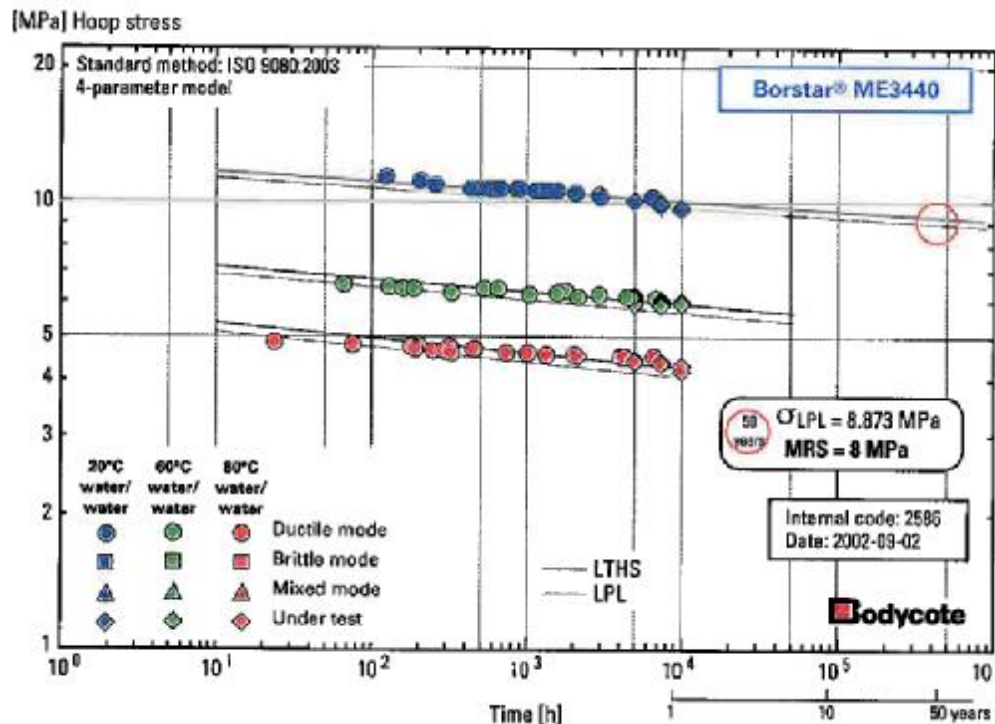


No standard fitting used



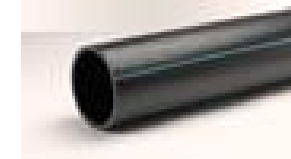
## Specify and require a ISO9080 long term pressure evaluation of the materials used for house connection pipes

- Ø Ready made compounds in black and blue colour for pressurized pipes produced by quality minded resin supplier have it..... however, this is not the case for mixtures produced by adding colour masterbatches , additives during pipe extrusion to natural PE granules
- Ø Full technical file according to EN12201 and ISO4427
- Ø Drinking water contact certificates



ME3440

ME3440-W






ME3444



## Savings with PE80 pipes versus PE40 pipes

### Dimensions of water pipes made of PE40 and PE80 for PN10 (TS-EN12201 Part 2 and ISO4427 Part 2)

	PE40*			PE80		
Outer diameter mm 	Wall thickness	Inner diameter 	Weigth/m	Wall thickne ss	Inner diameter 	Weigth/m
32	4,4	23,2	0,38	2,4	27,2	0,22
40	5,5	29	0,59	3	34	0,36
50	6,9	36,2	0,93	3,7	42,6	0,55
63	8,6	45,8	1,46	4,7	53,6	0,87
75	10,3	54,4	2,1	5,6	63,8	1,22
90	12,3	65,4	3	6,7	76,6	1,75

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### Savings :

- Less pipe weight = less polymer consumption
- Service life cost with certified PE80 compounds
- Less energy consumption to extrude the pipe
- Less CO<sub>2</sub> emission, lower carbon foot print

### Option 1 : decrease of outer diameter

PE40 Pipe of 63mm x 8,6mm is replaceable by PE80 Pipe 50mm x 3,7mm

- Weight reduction : 62 %  
from 1,46 to 0,55 kg /m

### Option 2 : decrease of wall thickness

Both pipes in PE40 and PE80 with the same outer diameter : 63 mm

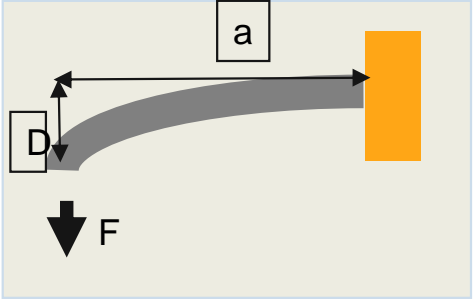
Wall thickness of PE40 pipe : 8,6 mm

Wall thickness of PE80 pipe : 4,7 mm

- Increase of flow rate with bigger inner diameter
- Weight reduction : 40%  
from 1,46 to 0,87 kg/m

Sensitivity: External

# Flexibility : Results



Outer Ø /wall thickness	<b>63 mm x 4.7 mm</b>	63 x 4.7	63 x 8.6	75 x 10.3
SDR	<b>13,6</b>	13,6	7,4	7,4
Inner Ø	<b>53.6</b>	53.6	45.8	54.4
Material	MDPE80 <b>BorSafe ME3440</b>	HDPE80	PE40	PE40
E-mod (Mpa)	<b>800</b>	1000	400	400
Bending Stiffness	<b>reference</b>	+25%	-20%	+53%

BorSafe ME3440 is 25 % to 50 % more flexible for identical inner diameter ( water flow) than other PE pipe material .



## Why BorSafe™?

- BorSafe™ means **Safe for gas pipes and fittings**
- BorSafe™ means **Safe for Drinking Water pipes** and fittings with focus on Purity
- BorSafe™ stands for **50 years pipe experience** and dedication to tackle the new challenges in a changing world
- BorSafe™ stands for **quality and service, reliability and trust** provided by our whole team
- BorSafe™ solutions will **support sustainable solutions** and a cleaner world



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# Thank you

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