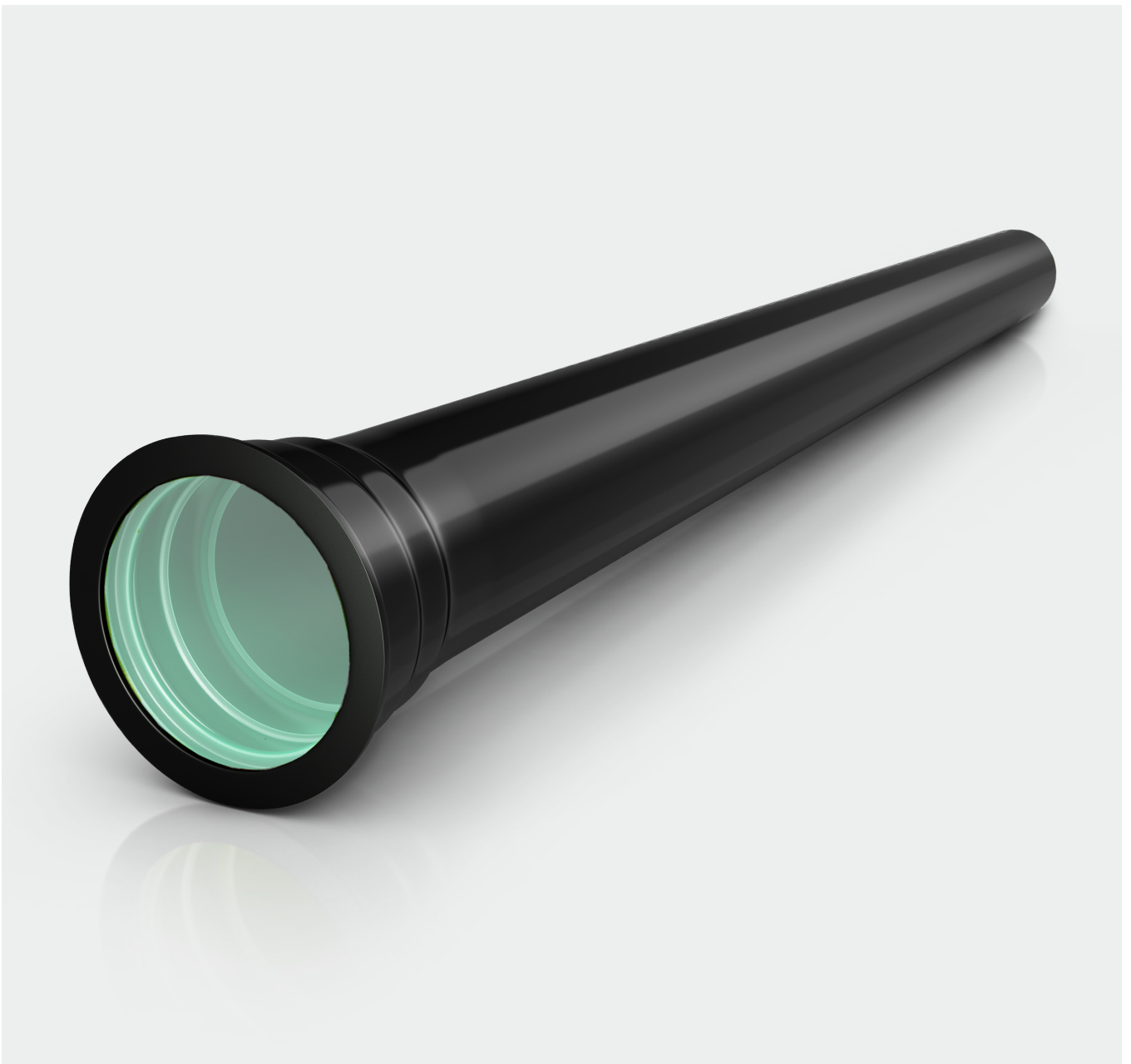


ECOPUR – Unique full protection thanks to integral polyurethane (PUR) coating technology

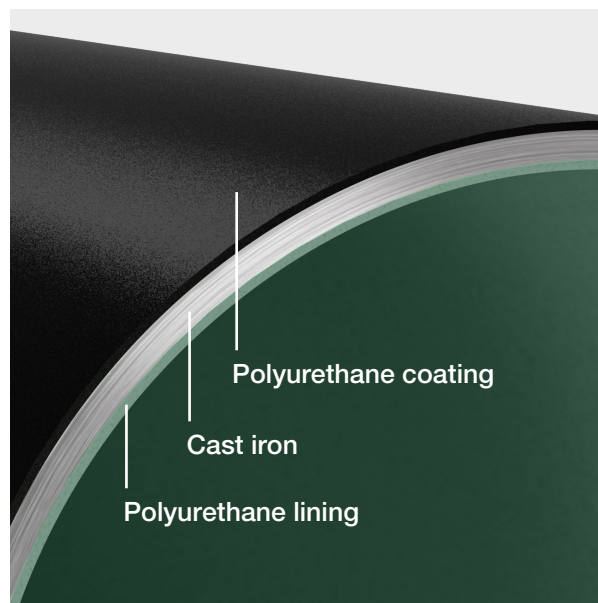
For use in all soils – efficient protection against aggressive media and stray currents



ECOPUR – Top performance, even when exposed to current

In applications where even electrical corrosion must be ruled out, ECOPUR pipes are the first choice – which of course is also down to their technical operating life of 140 years. ECOPUR is the fully protected pipe made of ductile cast iron with pore-free polyurethane internal and external coating. The integral PUR coating with a thickness of 0.9 mm provides complete protection as an electrically insulated system, including thrust protection. In an independent test carried out by the Swiss Society for Corrosion Protection (SGK), ECOPUR pipes emerged as the clear front-runner.

According to EN 15189, the polyurethane coating is considered to be a reinforced coating in accordance with EN 545 Annex D.2.3. and EN 598 Annex B.2.3. This means that ECOPUR can be used in all soil types, regardless of corrosiveness, from pH 1 to pH 14, and in where stray currents occur. This full protection ex factory is activated immediately once the pipes are assembled, without requiring any additional work by the installer. The PUR lining with a layer thickness of 1.3 - 1.5 mm is suitable for all types of water, including low-lime and lime-dissolving water and industrial wastewater with pH values of 1 - 14. The minimal wall roughness of $k = 0.0014$ mm (in accordance with SVGW W4), coupled with the largest possible nominal internal diameter, guarantees maximum hydraulic performance.



Special features for installation and assembly

The flexible PUR coating follows the deformations of the cast iron and adapts to the shape of the pipe. On drilling holes in or cutting pipes, the PUR coating remains intact without breaking or chipping off. No peeling off or separate sleeve protection is required. This makes ECOPUR the most easy-to-install pipe on the market. The smooth surface of the PUR external coating minimises frictional resistance in the ground and reduces the insertion forces when using trenchless laying methods. In conventional trench installation, the excavated material can be fully used to fill the trenches.

ECOPUR – benefits at a glance

- Technical operating life of up to 140 years
- The only ductile cast iron pipe with the same uniform coating type all-around the pipe (polyurethane PUR)
- Integral full protection
- Electrically insulated – winner in the test carried out by the Swiss Society for Corrosion Protection (SGK)
- Long-term experience in working with PUR technology since 1972
- External PUR is considered to be a reinforced coating in accordance with EN 545 and EN 598, usable in all soil types, regardless of corrosiveness (pH 1 - 14), and in applications where stray currents occur
- PUR lining is suitable for all waters, wastewater and gas
- Lowest wall roughness $k = 0.0014$ mm (according to SVGW W4) and largest nominal inside diameter for highest hydraulic performance
- Easiest installation of all available pipe systems
- Sponge city capable, full use of excavation material and excavation space as water reservoir

Use

- Municipal water supply and sewerage
- Projects with trenchless installation
- Industry and mining (use in media from pH 1 - pH 14 is possible)
- Turbine pipes and anergy networks: Ideal hydraulic performance
- Due to highest static strength characteristics the ideal solution for projects:
 - With very small or very large pipe covers
 - In non-loadbearing soils
 - Using post installation (one support per pipe)
 - On bridges or supporting walls (can be installed as a self-supporting system with one support per pipe)
 - Ideal for very high traffic and earth loads (airports, rail transport, motorways)
 - In areas subject to aggressive media, stray currents and electrical corrosion as well as in tunnels



Ductile cast-iron pipes – for sustainability in the life cycle

High operating reliability, economical operation and a long operating life are key criteria when selecting a suitable pipe material for the construction of a pipe system.

In addition to the classic drinking water supply and wastewater disposal, the excellent technical properties of ductile cast iron enable the use in high-performance applications. As a result, cast pipe systems have become an increasingly popular solution for alternative applications.

Whether they are used for industrial applications (e.g. fire extinguishing systems, discharge of process water), in the energy industry, for pressure pipes in hydroelectric power plants, for „cold“ district heating networks, in industrial snow-making or for alternative trenchless installation technologies, ductile cast-iron pipes have gained acceptance as a superior pipe material.

Ductile cast-iron pipes – with their outstanding properties – provide major advantages throughout the entire range of services:

Technical

- High pressure resistance with large safety reserves
- Maximum static load-bearing capacity, high and low covers are possible
- Innovative thrust-protected/longitudinal positive locking joints
- High-performance solutions thanks to wall thicknesses, coatings and linings being optimised according to the application
- Certified in accordance with EN 545/598, audited by MPA NRW

Economic

- Very long service life up to 140 years with consistently good material properties
- Standard fittings made of ductile cast iron for optimised solutions in line management and connecting pipes
- Angleability up to 5°, saves fittings
- Easy handling and assembly, low maintenance
- Economically the most efficient solution on the market

Ecological

- Push-in socket systems with 100% tight pipe connections
- Linings and coatings suitable for foodstuffs
- Protection of drinking water and ground water by diffusion-tight pipe walls
- Ecological, environmentally friendly material, sustainable and recyclable
- Swiss/German quality products

The systematic use of ductile cast-iron pipe systems increases the average operating life in the networks, which means that the required investment cycles remain manageable in a controllable manner

Innovative PUR lining – energy efficient and mechanically robust

In order to make full use of the exceptional properties of ductile cast-iron pipes, vonRoll hydro has developed and perfected a polyurethane (PUR) lining. PUR boasts the highest standards of hygiene and unrivalled corrosion protection whilst ensuring the maximum possible flow through the pipe.

Ductile cast-iron pipes with a polyurethane lining are standardised in EN 545 and EN 598. The polyurethane (PUR) lining is applied to the ground and blasted inner surface of the pipes in accordance with standard EN 15655 using a two-component thermal spraying process and separates the flow medium from the iron with high electrical impedance. The PUR lining meets the requirements of the German Environmental Protection Agency's „Guideline for Hygienic

Assessment of Organic Coatings in Contact with Drinking Water“ as well as the requirements of the DVGW Worksheet W 270.

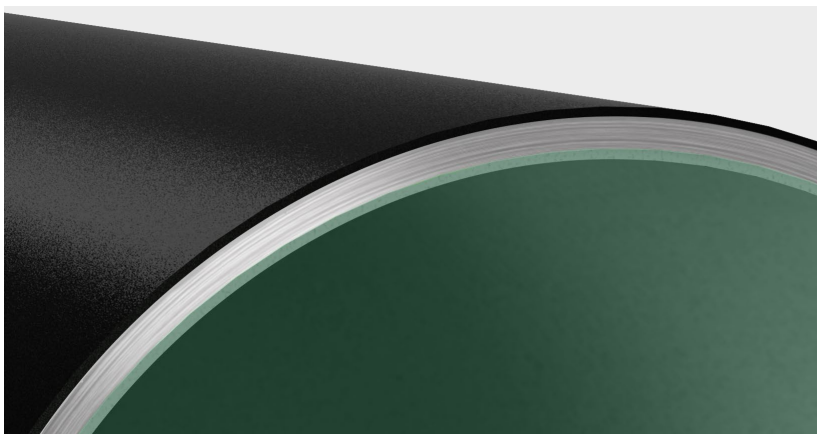
In addition, the PUR lining can permanently withstand various chemical and mechanical loads (e.g. soft, acidic or salt water, debris in wastewater or high-pressure cleaning) and ensures resistance against all types of wastewater.



Polyurethane (PUR)-coated cast-iron pipes are ideal for energy-efficient use in various supply and disposal networks.

The successful, innovative vonRoll PUR lining exhibits unparalleled performance values:

- Suited to all types of water and wastewater from pH 1 to pH 14
- Suited to soft and lime-dissolving water
- Hydraulically smooth, the wall roughness is $k = 0.0014$ to mm (in accordance with SVGW W4)
- Largest hydraulic internal cross-section
- Minimal pressure losses
- Ideal hydraulic performance
- Specific electrical resistance of PUR: $> 10^8 \Omega \cdot m^2$
- Dielectric strength: 35 kV/mm
- Drinking water approval (SVGW/DVGW)
- No deposits or incrustations



The PUR lining

- is predestined for pump operation where high energy efficiency is decisive
- actively reduces the operating costs of the system
- is ideal for wastewater pipes with minimum gradients

Pore-free PUR coating – resistant, electrically insulating coating system for highly corrosive environments

Ductile cast-iron pipes with a polyurethane coating are standardised in EN 545 and EN 598. The PUR coating is applied to the ground and blasted external surface of the pipes using a two-component thermal spraying process. The entire manufacturing process is carried out in accordance with EN 15189.

Leading-edge compound materials technology

The combination of ductile cast-iron and PUR boasts excellent mechanical characteristics. The best properties of ductile cast iron and PUR are permanently combined, which massively increases the service life of the piping system.

Robust polyurethane (PUR)

The mechanical, chemical and thermal stability of PUR is particularly high because the macromolecule of the thermoset material is three-dimensionally cross-linked.

PUR is shockresistant and exhibits no cold flow. The adhesion between the PUR coating and the ductile cast iron is regularly tested and certified by the Materials Testing Office MPA NRW.

Long-term corrosion prevention

The pore-free, integral PUR coating permanently protects the pipes from mechanical and chemical damage. It provides full protection against electrocorrosion, for example caused by stray currents, direct current (DC) railways or inhomogeneous bedding.

Due to the electrically insulating pipe connections, each pipe forms a galvanic island in itself and is therefore not electrically conductive. The PUR coating as passive corrosion protection remains unchanged over the entire service life of the pipe.

Embedding in all types of soil

The PUR coating is immune to aggressive soils and is suitable for neutral as well as acidic or heterogeneous soils. One pipe type for all soils also reduces storage costs!

The increasing occurrence of stray currents in the ground is the primary reason for the increased use of integrally protected cast-iron pipes with PUR coatings over time.

The outstanding properties of the polyurethane (PUR) coating are determined according to EN 15189 by the two requirements of adhesive tensile strength and pore-free status.

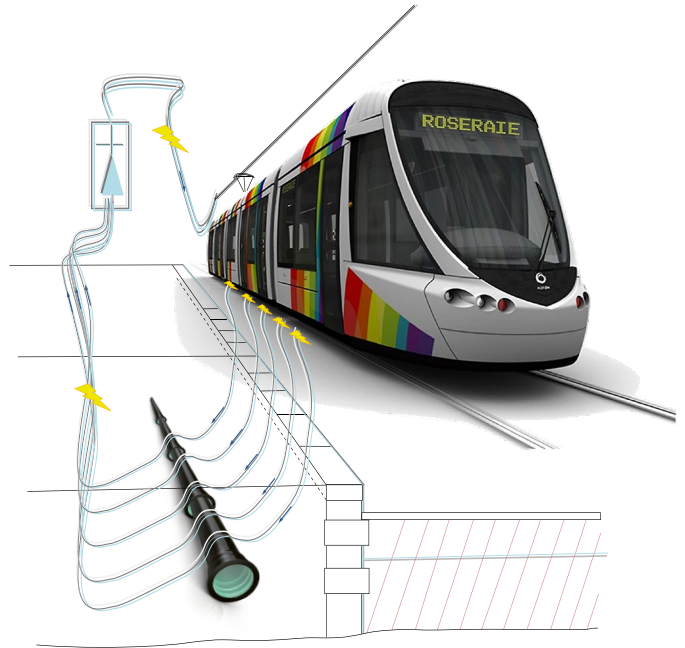
Ductile cast-iron pipes with a PUR coating allow permissible grain sizes from 0 to 63 mm, with a maximum grain size of 100 mm, round or broken.



Ductile cast-iron pipes with a PUR coating are suitable for an almost unlimited range of application areas

Protection against stray currents

The PUR coating protects ductile cast-iron pipes against corrosion, such as that caused by stray current. Ductile cast-iron pipes with PUR coating are suitable for all types of soil with any degree of aggressiveness, and can also be used in groundwater or brackish water.



Trenchless laying

Installing pipelines with trenchless technologies is often the optimal solution in undercrossings, for culvert pipelines or in urban areas.

On account of their high loading capacity, vonRoll ECO-PUR ductile cast-iron pipes are especially well suited to trenchless pipeline construction. The exterior coating in PUR is extremely robust from the mechanical point of view and its bonding to the cast-iron surface is excellent.



Open laying method

The sturdy vonRoll ECOPUR pipe requires no special bedding. The pipes can easily be embedded with suitable excavation material. Expensive gravel bedding is not necessary. This also saves transport and construction costs. The sturdy and impact-resistant PUR coating stands up to even the hardest pipelaying conditions.



Simple to handle and process

Often, pipes have to be cut to size or fitted with house mains connections. Shortening vonRoll ECOPUR pipes to the required length presents no problems and can be done without peeling and without damaging the PUR coating. Tapping for a house connection is just as easy.

Economic benefits of external PUR coating

- No need to replace the soil or use additional pipe bedding, the excavated soil can be reused
- Cost and time savings since no excavated material needs to be removed and deposited
- Long-term corrosion protection and thus long service life (according to DVGW up to 140 years)
- Cost optimisation through time savings in handling and processing

ECOPUR - A pipe using individual, solution-oriented joint techniques

ECOPUR pipes are available in all socket joint technologies offered by the vonRoll hydro Group.

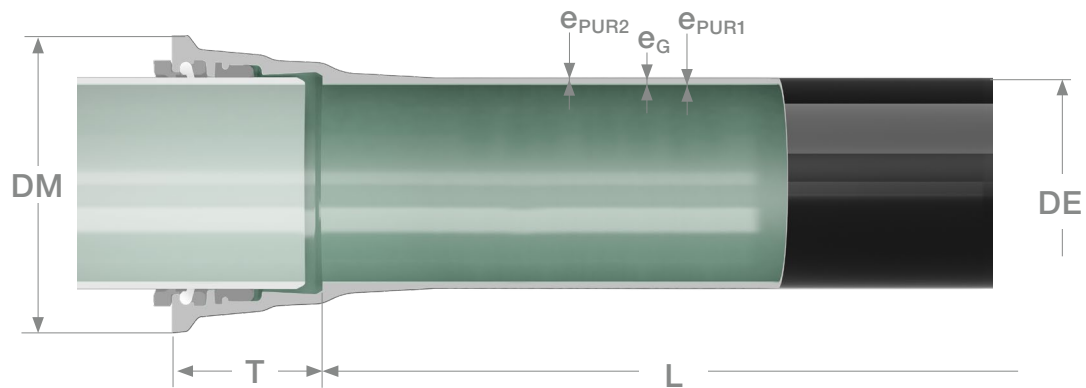
The socket joints in our ductile cast-iron pipe systems have impressive properties:

- Guaranteed tight connections (positive and negative pressure)
- Flexible, deflectable up to 5°
- Root-resistant joint technology
- Electrically insulating joint system
- Longitudinal force-locking, with frictional locking or positive locking
- For high-pressure applications, operating pressures of up to 100 bar
- Perfect for trenchless installation



ECOPUR HYDROTIGHT socket pipe

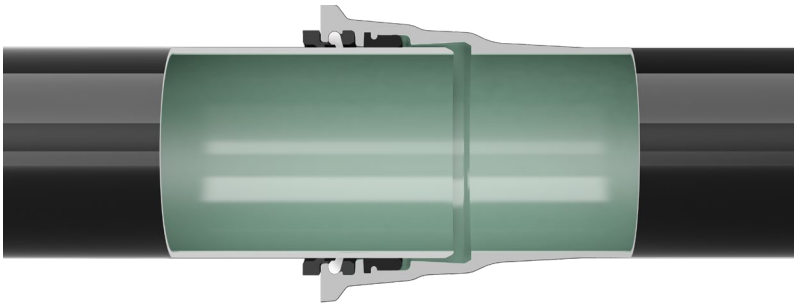
Ductile cast-iron pipe in accordance with EN 545
 HYDROTIGHT push-in socket with double chamber
 Lining: Polyurethane (PUR) in accordance with EN 15655
 Coating: Polyurethane (PUR) in accordance with EN 15189



DN	Pipe class	L mm	DE mm (nominal)	e _G mm (minimal)	e _{PUR1} mm (nominal)	e _{PUR2} mm (nominal)	DM mm	T mm	Weight kg/m (theoretical)
80	C100	6000	98 ^{+1/-2.7}	4.7	1.3	0.9	167	119	14.3
100	C100		118 ^{+1/-2.8}	4.7	1.3	0.9	188	120	17.3
125	C64		144 ^{+1/-2.8}	4.0	1.3	0.9	215	123	21.9
150	C64		170 ^{+1/-2.9}	4.0	1.3	0.9	242	126	27.1
200	C64		222 ^{+1/-3.0}	5.0	1.5	0.9	295	131	35.3
250	C50		274 ^{+1/-3.1}	4.8	1.5	0.9	352	131	46.8
300	C50		326 ^{+1/-3.3}	5.7	1.5	0.9	410	130	60.1
350	C40		378 ^{+1/-3.4}	5.3	1.5	0.9	464	135	72.9
400	C40		429 ^{+1/-3.5}	6.0	1.5	0.9	517	145	90.9

Thrust-resisting ring HYDROTIGHT FIG. 2807

(frictional locking)



DN	Fig. 2807B bar	Fig. 2807A bar	possible deflection
80	25	40	3°
100	25	40	3°
125	25	40	3°
150	25	40	3°
200	25	40	3°
250	16	25	3°
300	16	25	3°
350	–	16	3°
400	–	16	3°

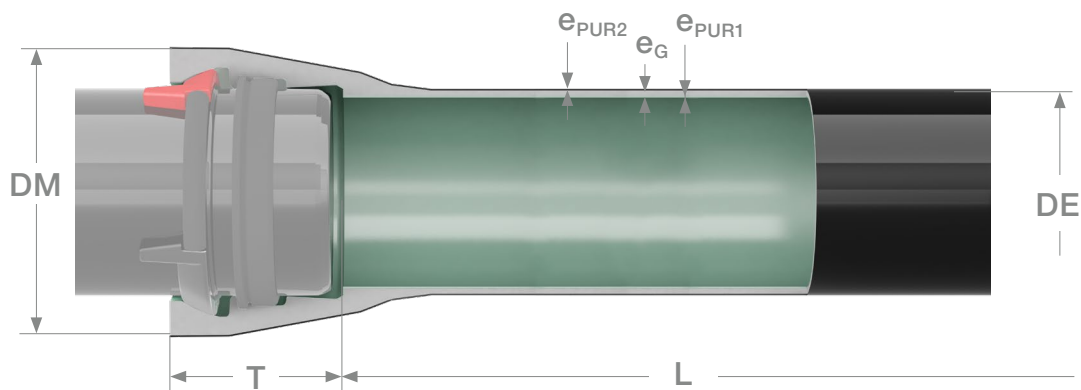
ECOPUR BLS socket pipe

Ductile cast-iron pipe in accordance with EN 545

BLS push-in socket with double chamber

Lining: Polyurethane (PUR) in accordance with EN 15655

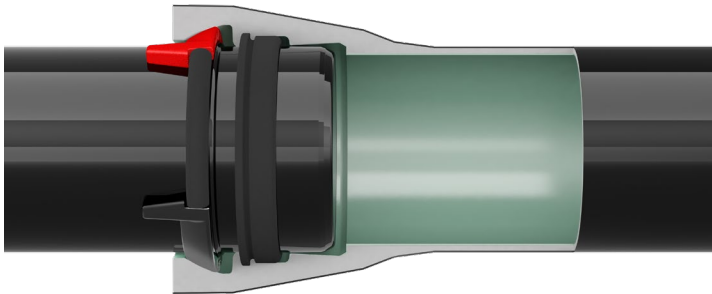
Coating: Polyurethane (PUR) in accordance with EN 15189



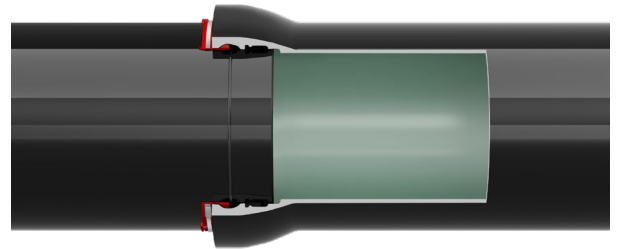
DN	Pipe classe	L mm	DE mm (nominal)	e _G mm (minimal)	e _{PUR1} mm (nominal)	e _{PUR2} mm (nominal)	DM mm	T mm	Weight kg/m (theoretical)
80	K10	6000	98 ^{+1/-2.7}	4.7	1.3	0.9	158	127	14.9
100	K10		118 ^{+1/-2.8}	4.7	1.3	0.9	184	135	18.0
125	K10		144 ^{+1/-2.8}	4.8	1.3	0.9	208	143	23.0
150	K10		170 ^{+1/-2.9}	5.1	1.3	0.9	241	150	28.2
200	K9		222 ^{+1/-3.0}	4.8	1.5	0.9	295	160	36.7
250	K9		274 ^{+1/-3.1}	5.2	1.5	0.9	359	165	48.9
300	K9		326 ^{+1/-3.3}	5.6	1.5	0.9	412	170	62.2
400	K9		429 ^{+1/-3.5}	6.4	1.5	0.9	523	190	90.9
500	K9		532 ^{+1/-3.8}	7.2	1.5	0.9	638	200	123.4
600	K9		635 ^{+1/-4.0}	8.0	1.5	0.9	734	175	161.7
700	K9		738 ^{+1/-4.3}	8.8	1.5	0.9	851	197	206.2

Thrust-resisting ring BLS

(positive-locking)



BLS DN 80 - DN 500



BLS DN 600 / 700

DN	Number Lock	PFA bar	Permissible tensile strength kN (DVGW)	Possible deflection	Min. curve radius m	Lock set weight kg
80	2 / 3 ¹⁾	100/110 ¹⁾	70	5°	69	0.4 / 0.7 ¹⁾
100	2 / 3 ¹⁾	75/110 ¹⁾	100	5°	69	0.4 / 0.8 ¹⁾
125	2 / 3 ¹⁾	63/110 ¹⁾	140	5°	69	0.6 / 1.1 ¹⁾
150	2 / 3 ¹⁾	63/75 ¹⁾	165	5°	69	0.8 / 1.4 ¹⁾
200	2 / 3 ¹⁾	40/63 ¹⁾	230	4°	86	1.1 / 1.9 ¹⁾
250	2 / 3 ¹⁾	40/44 ¹⁾	308	4°	86	1.5 / 2.7 ¹⁾
300	4	40	380	4°	86	2.7
400	4	30	558	3°	115	4.4
500	4	30	860	3°	115	5.5
600	9	32	1200	2°	172	9
700	10	25	1400	1.5°	230	11

¹⁾ With high-pressure lock!

The push-in socket connection technologies of the vonRoll hydro group are designed for a wide range of applications and guarantee maximum operational safety - particularly for high performance applications!

Full range of fittings – for every installation situation

A complete range of socket fittings is available for all connection technologies of the vonRoll hydro Group. The full protection philosophy is guaranteed by means of an integral epoxy resin thick film in accordance with EN14901 and the increased requirements according to GSK/RAL-GZ 662.



The fully protected fittings range of the vonRoll hydro Group is suited to unlimited use in soils of any corrosiveness (in accordance with EN 545) and fulfils the most demanding requirements both during installation and during continuous operation

ECOPUR pipes are ideal for any installation situation – even when exposed to electric current!



ECOPUR pipes are the tailor-made solution for installation areas exposed to particular hazards and for the most difficult underground conditions:

- In highly aggressive or contaminated soils (contaminated sites)
- In case of stray current hazard due to railway lines, earthing systems, cathode protection, etc.
- For extinguishing water pipes in road and railway tunnels with an aggressive tunnel environment
- For installation in groundwater
- For all soils, regardless of corrosiveness (pH 1 to 14)
- For trenchless installation such as burst lining or directional drilling process

