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Introduction

Piping systems

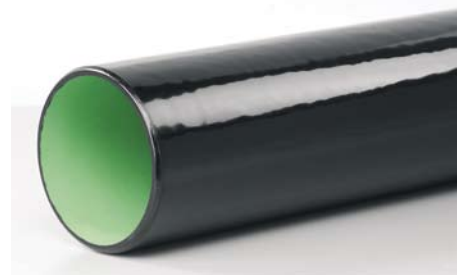
As one of the most important Swiss manufacturers of **piping systems made of ductile cast-iron**, vonRoll hydro develops, manufactures and sells a modular, perfectly matched system of components that meets all the needs of municipal **water and gas suppliers**.

For many years now, ductile cast iron, which, apart from its high strength, is also characterised by its elasticity, has been a popular material for the manufacture of pressurised piping.

The **ecosys® full-protection piping system**, which features pipes coated both inside and outside with PUR as well as fittings protected by an integral coating of epoxy resin, is worth particular mention.

This excellent combination of materials and the well-tried sleeve-coupling technology allow this system to offer the following advantages:

- **Long service life**
- **Economic pipeline construction**
- **Optimum corrosion prevention – inside and out**
- **Suitable for all types of water from soft to hard**
- **Impeccably hygienic internal lining**
- **High mechanical stability**
- **Excellent flow characteristics**
- **Easy to cut and drill**
- **SVGW certification for drinking water and gas**



Depending on environmental conditions, pipe-class and dimensions, **vonRoll's piping system** with sleeve connectors can be supplied on request for project-specific solutions for **over 63 bar**: see "pressures for sleeve-coupled piping and adapters to EN 545:2002 standards", page 6/4.3.

The piping systems with sleeve connectors, screw or flange couplings are manufactured using the latest technologies and conform to **EN 545 and ISO 2531 standards** (or, when specially mentioned, our own standards) and have been **certified by SVGW / DVGW**

Coatings for pipes and fittings

- ecopur®** Mechanically sturdy yet flexible pressure pipe manufactured in ductile cast iron using centrifugal casting, coated **inside and out** with corrosion-resistant, smooth **polyurethane (PUR)**. Perfectly suitable for **all** types of soil.
- ducpur®** Mechanically sturdy yet flexible pressure pipe manufactured in ductile cast iron using centrifugal casting, with a corrosion-resistant, smooth **polyurethane (PUR) inside lining** and **zinc/bitumen external coating**. Together with ducpurPLUS PE-corrosion-prevention foil, also suitable for aggressive soils.
- ecofit®** Adapter fittings manufactured in ductile cast-iron using sand casting, with integral epoxy resin coating. Perfectly suitable for **all** types of soil.

Our catalogue range of pressure pipes and adapter fittings

	DN	80	100	125	150	200	250	300	350	400	500	600	700
Sleeve-connector piping system													
Flanged piping system													

Larger nominal diameters available on request

Pipes of all diameters are **6 meters long**

Pipe classes according to EN 545 and ISO 2531 standards

- Sleeve-coupled pipes K9 standard
- Flanged pipes K12 standard

Other classes of pipe are available on request.

Overview of connection techniques

	Sleeve connectors	Flanged coupling
Sealing system	Tyton® seal	Flat seal
Connection variant	With or without restraint clamp	
Electrical conductivity of the coupling system	Not electrically connected	Not electrically connected
Deflection without restraint clamp	DN 80-300 up to 5° DN 350-400 up to 4° DN 500-700 up to 3°	No deflection possible
Deflection with restraint clamp	DN 80-700 up to 3°	No deflection possible

Subject to alteration without notice

Ductile cast iron

Material characteristics for centrifugally-cast pipes and adapters according to EN 545

Mechanical characteristic	Symbol	Unit	Pipes	Adapters
Minimum tensile strength	Rm	MPa	420	420
Yield point	Rp 0.2	MPa	300	300
Minimum elongation after fracture	A	%	10	5
Minimum vertical pressure rating		MPa	550	550
Burst pressure rating		MPa	300	300
Longitudinal bending strength		MPa	420	420
Density	ρ	kg/dm ³	7,05	7,05
Elasticity module	E	MPa	1,7x10 ⁵	1,7x10 ⁵
Thermal expansion coefficient	α	1/K	10x10 ⁻⁶	10x10 ⁻⁶
Hardness		HB	< 230	< 250

Ductile cast iron

Ductile cast iron with spherically-formed graphite.



(Pictured using a scanning electron microscope)

Coatings

Polyurethane (PUR)

Polyurethane protects piping made of ductile cast iron against corrosion and ensures meeting hygienic standards for drinking water at the same time. Polyurethane is used for both the inside lining and the outside coating. Because of polyurethane's elasticity, the coating remains intact even if the pipe is deformed.

The PUR coating was developed in 1972. In comparison with other coatings, the internal polyurethane lining exhibits a high resistance to various different media such as drinking water, wastewater, de-mineralised water, industrial water and gas, as well as to aggressive solutions such as sulphuric acid. The PUR outside coating is suitable for all kinds of soil.

Specific properties of Polyurethane

Composition	Polyurethane is composed of a two-component resin. Its three-dimensionally linked molecular structure gives it its mechanical stability. Polyurethane is a thermosetting plastic with no solvents. It meets EN 545 and ISO 2531 standards
Wall thickness	<p>Polyurethane PUR inside lining</p> <p>DN 80-150 = 1.3 mm</p> <p>DN 200-700 = 1.5 mm</p> <p>Polyurethane PUR outside coating (ecopur®)</p> <p>DN 80-700 = 0.9 mm</p>
Colour	<p>inside: green</p> <p>outside: black</p>
Density	1.4 – 1.5 kg/dm ³
Continuity	continuous coating, no cracks
Bonding strength	<p>> 14 Mpa</p> <p>(EMPA recommends: 2.5 Mpa on a saturated sample)</p> <p>Bonding strength is tested at regular intervals by our laboratories.</p>
Dielectric resistance	> 10 ⁸ Ωm ²
Temperature	<p>Water: up to 40°C (constant); up to 80°C (short term)</p> <p>Air: 120°C</p>
Impact resistance	40 Nm at 20°C
Effect of salt spray	no effect after 1000 hours
Expansion	> 10%
Friction coefficient	k > 0.01 mm



Resistance to chemicals	<ul style="list-style-type: none"> - Acidic or basic with pH values between 1 and 14 - Anorganic solvents - Sulphuric acid (wasterwater) - industrial wastewater
Thermal expansion	20 x 10 ⁻⁶ 1/K
Deposits	none
Use of chlorine	The chlorine concentration in drinking water and the selective amount used when disinfecting have no influence on the quality of the polyurethane.
Quality Assurance	Contract with EMPA in Dübendorf, Switzerland
Certification for PUR	<ul style="list-style-type: none"> - Swiss Association for Gas and Water (SVGW) - Swiss Federal Office of Health (BAG) - Water Byelaws Advisory Service - Singapore Institute of Standards and Industrial Research - for: Bulgaria, Spain, Italy, Lithuania, Poland, Czech Republic, Rumania etc.

Epoxy Resin Coating

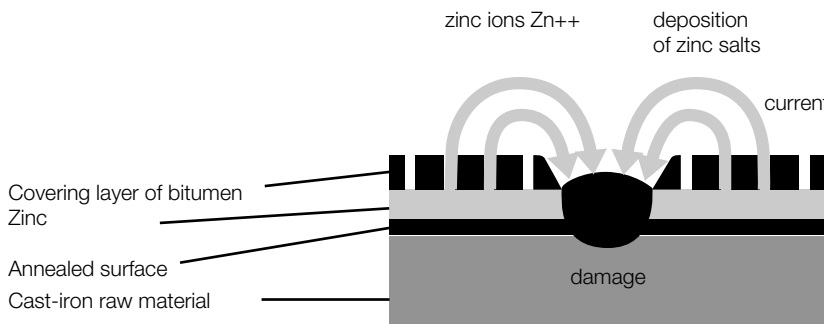
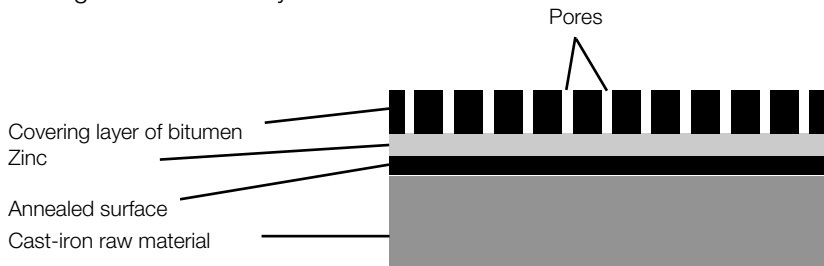
The **adapter fittings are provided with an integral coating of epoxy resin with a thickness of at least 250µm**. Coating with epoxy resin powder is a well-ried and pore-free way of protecting adapters and fittings used in water and gas supplies against corrosion. The epoxy resin inside lining, which is as smooth as glass and free of pores, offers comprehensive protection of the foodstuff drinking water, and, of course, fulfils all statutory requirements on hygiene. The epoxy resin coating is an organic protective coating and is environment-friendly in its use.



Zinc-Bitumen external coating

The **ducpur® pipes are provided with a zinc-bitumen external coating**. The zinc coating is at least 150 g/m² according to the EN 545 standard. The zinc coating is covered with a layer of bitumen of at least 70µm.

A special property of the zinc coating is its **self-healing** effect if local damage occurs. A macro-element is formed at the point of damage, whereby the cast-iron surface represents the cathode and the galvanised surface of the pipe the anode. The zinc ions migrate to the exposed cast-iron surface and thus cover the damaged area with a layer of zinc once more.



Permissible operating pressures for pipes, adapters and restraint clamps

Without taking up lateral forces

(secured against thrust using constructional means)

for water \leq published operating pressure PFA in bar

Sleeve connector	See table "Pressures according to EN 545:2002 for push-in joint pipes and adapter fittings. Page 6/4.3
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for gas \leq 1 bar (corresponds to the "low to midle pressure" level as defined in the SVGW guidelines)

With mechanical connection that takes up lateral forces

for water \leq published operating pressure PFA in bar

Sleeve connector	See table "Permissible pressures for thrust-resistng rings". Page 6/4.4
Flange	The values shown in the table (PN) are appropriate to the hole configuration according to DIN EN 1092, part 2. These values represent the permissible operating pressure.

for gas \leq 1 - 5 bar (corresponds to the "high pressure" level as defined in the SVGW guidelines)

For adapter fittings with mixed types of connections (sleeve coupler/flange), the nominal pressure for the flange is decisive.

Labelling

Pipes and adapter fittings according to EN 545

All pipes and adapter fittings are permanently and legibly labelled with at least the following information:

Manufacturer Year of manufacture Label for ductile cast iron Nominal diameter DN	Cast in the sleeve for pipes Cast in the item's surface for adapter fittings
Nominal pressure for flanges and indication of this standard	Cast on the flange
Wall thickness class, if not K9	Printed on the pipes

Sealing rings

for water	DN, year of manufacture, manufacturer's code, name of seal, EN 681-1, EPDM
for gas	DN, year of manufacture, manufacturer's code, name of seal, EN 682, NBR

Standards

- EN 545 Pipes, adapter fittings, accessories made of ductile cast iron and their connections for water piping – Requirements and testing procedures
- EN 681-1 Elastomer seals – Requirements on materials for piping seals for applications in water supply and wastewater disposal
- EN 805 Water supply – Requirements on water supply systems and their components used outside buildings
- ISO 2531 Ductile cast-iron piping, adapter fittings and accessories and their connections for water or gas applications
- PrEN 682 Elastomer seals – Requirements on materials for piping seals for supply piping and associated components for gas and liquid hydrocarbons
- EN 969 Pipes, adapter fittings, accessories made of ductile cast iron and their connections for gas piping – Requirements and testing procedures.

Certificates and approvals

Piping systems from vonRoll hydro sa are **SVGW / DVGW certified**



Only in this way can one be sure that statutory requirements concerning hygiene are perfectly fulfilled and that all standards and testing procedures are adhered to.

Abbreviations

DN	Nominal diameter of pipe
DE	Outside diameter of pipe as defined in EN 545 and ISO 2531
DI	Effective calculated pipe inside diameter $DI = DE - 2e$
DM	Outside diameter of sleeve
T	Sleeve depth in mm, identical for pipes and adapter fittings
e_G	Wall thickness of centrifugally cast pipe made of ductile cast iron K9 according to EN 545 and ISO 2531 standards
e_{PUR1}	Wall thickness of polyurethane inside lining according to manufacturers standards
e_{PUR2}	Wall thickness of polyurethane outside coating = 0.9 mm
e	Wall thickness of ducpur® and ecopur® K9 sleeve-coupled pipes $e = e_G + e_{PUR1} + e_{PUR2}$
L	Pipe length in mm
PFA	Operating pressure
PN	Connection dimension equivalent to nominal pressure in bar