



INTEGRAL

Ductile iron
sewage pipelines



INTEGRAL CATALOGUE

■ Introduction	page 2
■ INTEGRAL - The applications	pages 3 to 6
■ INTEGRAL - The technical answers	page 7 to 12
Mechanical strength	page 7
Leaktightness / Impermeability	page 8
Mechanical safety: Savings generated by the nature of the material	page 9
Mechanical strength	page 10
Respecting the water stream	page 11
Hydraulic capacity	page 11
Abrasion resistance	page 12
Soil corrosiveness	page 12
Chemical resistance / septic fermentation	page 13
Pressure system	page 14
■ Quality and standards compliance	page 15
■ System presentation	page 16
■ Product catalogue	page 17 and 22
Pipes	page 17
I.M. joint gravity fittings	page 18
I.M. joint fittings and connection pieces	page 19
STANDARD joint pressure fittings	page 20
Access	page 21
Access devices	page 22

Introduction

– LEAKTIGHT – STRONG – DURABLE –

By 2005, all towns with a population of more than 2000 people must be connected to a wastewater system feeding into a wastewater treatment plant.

The targets are both quantitative and qualitative as they include the definition of mandatory outcomes.

The first result must be the protection of the natural environment. This no longer means simply removing wastewater far from private residences for health reasons, it now means transferring this same wastewater to a treatment plant.

To guarantee the protection of wetland areas, and more generally the environment itself, the sewers must transport the effluent, without leakage or infiltration, from private residences through to the treatment plant, sometimes several kilometres away. Leaktightness of sewer mains actually helps protect treatment plants by preventing treatment lines from being overloaded with parasitic infiltration water. It thus guarantees proper operation of facilities over time.

The pipe system adopted must be leaktight.

The second requirement expected of capital infrastructure is that it be long-lasting.

Long service life is an implicit choice for installations: the commonly expected lifespan for a wastewater system is at least 50 years. This means that needs have to be clearly defined, ie, infrastructure size and service conditions, and that there is no risk of the system having to provide service outside its design capacity.

This also means that the materials used must be able to withstand the pressures of time: optimising public capital expenditure also means avoiding premature renewal of faulty infrastructure.

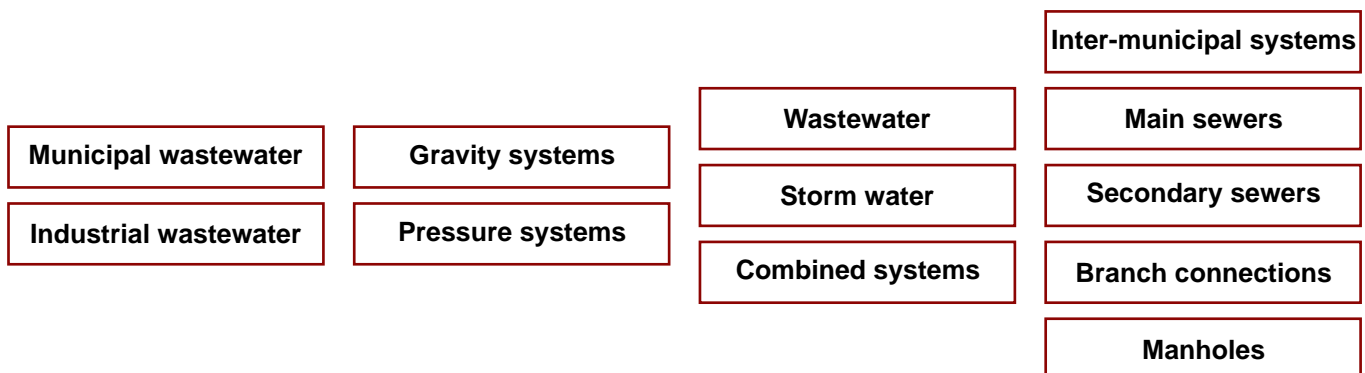
The pipe system chosen must be durable.

Given their specifications, INTEGRAL pipes provide all the necessary guarantees for a leaktight and long-lasting system.

The choice of pipes upstream from the waste water treatment plants can be one of the determining factors in the length of a wastewater structure's service life.

The nature of the pipe system and changes in its behaviour must be taken into consideration when calculating the service life for this type of equipment. It may be more or less prone to allowing clear water infiltration, slowing effluent flow or the formation of H2S (wastewater retention zone, deformation, etc.).

SAINT-GOBAIN PAM provides the market with a complete range of pipes and fittings for all wastewater requirements, whatever the effluent source:



INTEGRAL: guaranteed leaktightness from domestic outfall through to the treatment plant.

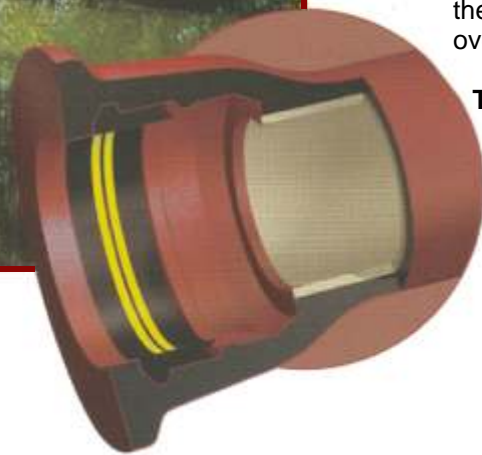
INTEGRAL - the applications

— LEAKTIGHT — STRONG — DURABLE —

■ Environmental protection

Leaks and effluent losses

Checks infiltration



THE INTEGRAL ANSWER

■ A perfectly leaktight pipe system

All INTEGRAL parts, pipes and fittings are made of ductile iron and provide exceptional mechanical properties.

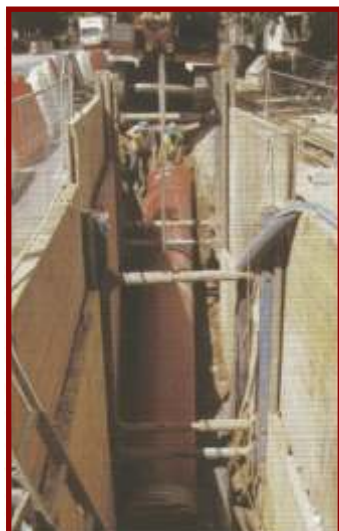
Strong and impermeable, they adapt to changes in their environment without breaking or cracking and they exclude all possibility of infiltration. Moreover, they are not open to parasite connections.

STANDARD joints are used for junctions: they are activated by compression and have well and truly proven their suitability in water distribution applications.

The elastomers used for joint gaskets are carefully selected for their ability to maintain their physical/chemical characteristics over time.

The INTEGRAL system is leaktight: it does not lose any wastewater and it does not allow any clear water infiltration.

■ Safety and environmental needs



Changes in the mechanical context

Operation hazards

Soil loads



THE INTEGRAL ANSWER

■ Material durability

The ductile iron used for INTEGRAL pipes benefits from the same extraordinarily durable properties of cast iron.

Combining flexibility with strength, ductile iron has remarkable bending and yield strength qualities.

Unbreakable, ductile iron overcomes the potential problems from clean breaks or insidious cracks.

INTEGRAL pipes are able to withstand considerable mechanical stresses, site and operation hazards without any damage. They can resist soil loadings, landslides, earth movements, wheel loadings, etc.

The external protective coating of galvanic zinc, covered with red epoxy paint, provides adequate protection for the pipes in most types of soil.

INTEGRAL - the applications

— LEAKTIGHT — STRONG — DURABLE —

■ Requirements of gravity system

- Hydraulic capacity and respecting the water stream
- Abrasion resistance
- Chemical resistance



THE INTEGRAL ANSWER

■ Long service functions

Rigid and straight, INTEGRAL pipes, in 6 to 8 m lengths, guarantee continuity in the water stream.

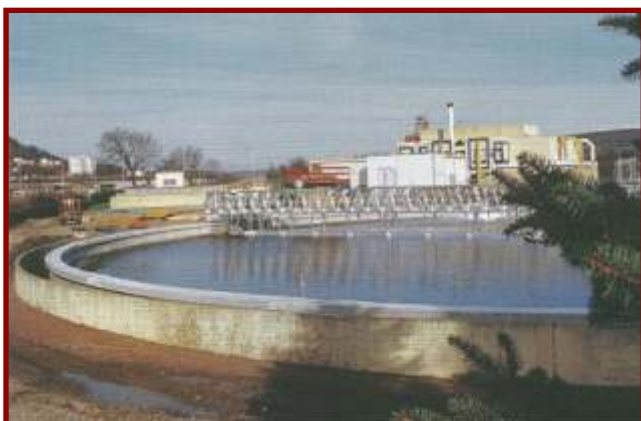
The hydraulic capacity of INTEGRAL ductile iron pipes is evidenced by the fact that the internal diameter is at least equivalent to the nominal diameter (ID = DN).

Junctions are few and self-centring, and so do not create any obstacles to the flow.

The pipes are lined with very compact and perfectly smooth cement mortar that actually promotes smoother flow, is abrasion-resistant, and provides excellent chemical stability.

■ Changes to operation parameters

- Population growth
- Accidental overload



THE INTEGRAL ANSWER

The capacity of a system to fulfil its role over time necessarily implies that future or exceptional service conditions have been factored into the initial design calculations.

The safety margin provided by INTEGRAL pipes means the system can handle an exceptional overload, without jeopardising its leaktightness.

INTEGRAL pipes can operate at high flow rates, up to the service maximum, without networks having to be resized. They are able to withstand hydro-cleaning at high pressures without any deterioration: this feature facilitates the extraction of any foreign bodies.

INTEGRAL - the applications

— LEAKTIGHT — STRONG — DURABLE —

■ Adaptability - Safety

Range of installation areas

Possibility of modifying routes to bypass obstacles



THE INTEGRAL ANSWER

■ A complete and homogeneous range

From DN 80 to DN 2000

A complete range of pipe and fittings in ductile iron to meet all project configurations.

As a result of their characteristics, these systems are multi-purpose: they can be laid through the most difficult terrain thus simplifying routes: steep slopes, rocky areas, in the water table, on river beds ... The ingeniousness of some fittings even means obstacles can be bypassed without redesigning the actual layout.

A range of anchored joints means INTEGRAL pipes can be self-anchored thus enhancing service safety and doing away with the need for concrete thrust blocks.

A set of standardised and certified products.

■ Global yield



Easy to install

Clever products to help laying operations

Immediate and lasting leaktightness

Low maintenance

THE INTEGRAL ANSWER

■ Solid and simple pipes

Thanks to their mechanical strength, INTEGRAL pipes are simple to lay under deep or shallow cover, and compaction and backfill are limited to the strict minimum.

Laid in compliance with standard practices, INTEGRAL pipes guarantee immediate leaktightness, confidence during testing, and at no additional cost.

The long lengths and the limited number of joints reduce opportunities for build-up of debris, thus also reducing the need for network maintenance or service.

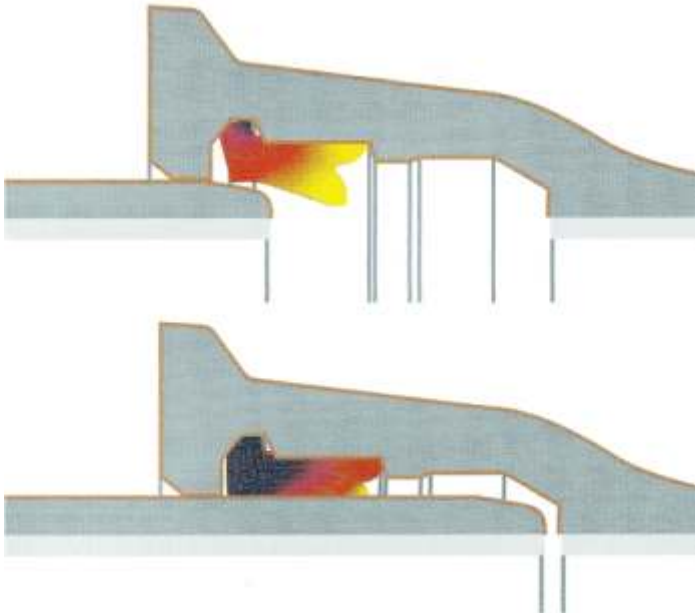
The supply cost should be seen from the view of total project cost, which also includes indirect costs along with medium and long-term factors.

INTEGRAL - the applications

– LEAKTIGHT – STRONG – DURABLE –

■ Pressure resistance

Service hazards: overpressure, waterhammer
Network homogeneity



■ Service and boundary lines

Ready-to-use solutions
Development of simplified adjustments



THE INTEGRAL ANSWER

■ Pipes for pressure sections

SAINT-GOBAIN PAM's expertise extrapolated from its knowledge of drinking water supply system, the high safety coefficient of ductile iron, and the performance of elastomer gaskets, mean INTEGRAL pipes can be manufactured to operate as gravity or pressure systems, even with accidental pressure peaks.

the compatible and homogeneous pipe and fittings, guarantee optimum service from one end of the system to the other.

air and other specific valves are available to complete the package.

THE INTEGRAL ANSWER

■ Ergonomic parts

Swivel branch:
Rotation 360°
Angle 45°

- Ideal solution for bypassing obstacles

Round connection chamber DN 250, 300 and 400, chamber only or single block unit with fixed or rotatable downstream branch.

Angle branches and bends.

connection pieces to interface with other materials.

A set of parts designed in liaison with contractors to ensure the greatest degree of flexibility for laying services connection lines.

INTEGRAL - the technical answers

■ Mechanical strenght

The behaviour of ductile iron pipes is midway between flexible and rigid materials. From a mechanical point of view, they benefit from the advantages of both.

The cast iron used for the INTEGRAL system is a ductile, and so elastic, material that provides above 10 percent elongation at rupture. Although the stress placed on the system is never this great, it does present a significant safety margin.

Underground pipes can, over time, be subjected to differential soil compaction in unstable sites, for example, or to settlement caused by water destabilising the trench bottom. Because of their strength and elasticity, ductile iron pipe systems are able to absorb the inevitable stresses from the surrounding area without breaking or dislodging.

Underground pipes are also subject to mechanical stresses from the backfill (soil or permanent loadings) plus intermittent loadings (traffic or wheel loadings). It is thus important to choose a pipe with a sufficient safety coefficient to avoid problems such as breakage, cracking, bending, or ovalisation that will lead to a breakdown in the water stream.

Elastomer is the ideal material for ductile iron pipe gaskets as it provides the system with flexibility and an element of safety when passing through uneven or unstable soils. For extensive and uniform soil subsidence, the elastomer gasket makes the pipeline behave like a flexible chain that absorbs the mechanical stresses. This same property means it is not necessary to install rocker pipes adjacent to manholes.

The rigidity of ductile iron guarantees that INTEGRAL pipe systems are never deformed; they maintain their linearity and ensure water stream continuity at all times.



Crush resistance of a PRY pipe



Crush resistance of a PVC pipe



Crush resistance of a ductile iron pipe

Products undergoing standard crushing tests

DN	Stiffness kN/m ²	Ovalisation %
150	80	2.1
200	60	2.4
250	54	2.7
300	47	3.0
400	30	3.2
500	22	3.4
800	20	4.0
1 000	16	4.0

What may appear to be a paradox is in fact a very interesting feature, because it is the combination of these characteristics that ensures INTEGRAL pipe systems will not only last for many years but their leaktightness is preserved intact over time despite the many hazards (see page 9).

INTEGRAL - the technical answers

■ Leaktightness / Impermeability

INTEGRAL pipe systems are comprised of a uniform range of pipe and fittings designed to install networks that will remain consistently leaktight.

While the INTEGRAL system in ductile iron presents excellent mechanical properties, **the joint is the key point in guaranteeing structure leaktightness, in both gravity and pressure systems.**

INTEGRAL pipe junctions (STANDARD or I.M.) are made by simply inserting the spigot in the socket and exerting radial pressure: the compression ratio can be as high as 30 to 40%.

The elastomers used withstand the most stringent tests for their area of application. They are selected on the basis of their ability to maintain their mechanical and physical-chemical properties over time.

The leaktightness performance of the INTEGRAL system joints, under extreme service conditions can absorb the mechanical stress to which joints may be subject over time, such as shearing, deflection or accidental loadings.

The compression ratio used for elastomer joints prevents seepage, dripping, and root or stone penetration through the joint, all of which cause network leakage. The specific design of SAINT-GOBAIN PAM joints makes compression disjuncting impossible in the event of shear forces.



NITRILE* HR is used for all gaskets throughout INTEGRAL systems as it withstands all types of effluent found in wastewater networks. It can even withstand hydrocarbon pollution. This quality complies with the requirements of European standard:

EN 681-1 type WG.

* NITRILE = N.B.R. (identifiable by its yellow markings).

■ Performance of the INTEGRAL system

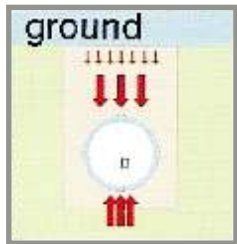
	Internal pressure	External pressure	Shear force	Works tests
GRAVITY FLOW water air	2 bar 200 millibar	1 bar -	30 x DN (in newton)	32 bar -
PRESSURIZED	> 20 bar	1 bar		32 bar

INTEGRAL, is your guarantee of a leaktight system from the moment it is installed, confidence during testing, and over the years to come.

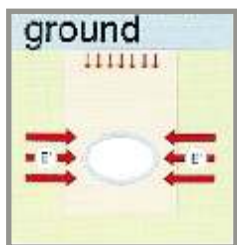
INTEGRAL - the technical answers

■ Mechanical safety: Savings attributable to the type of material

The properties of ductile iron provide INTEGRAL system with significant advantages in terms of installation: it is a very sturdy material making backfill and compaction operations, in particular, much simpler.

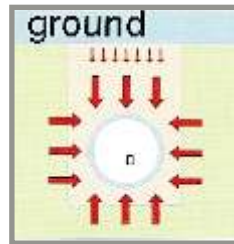


Rigid pipes concentrate the soil loadings and thus require careful attention to the bedding angle to avoid any risk of fragile ruptures (in the event of trench bottom destabilisation, for example).



Flexible, deformable pipes require solid support along their haunches and thus require careful backfilling in order to limit ovalisation (which otherwise reduces the useful section and may cause leaks at the joints).

INSTALLATION SAFETY OF THE INTEGRAL SYSTEM



INTEGRAL ductile iron pipes are semi-rigid. The elasticity of the material means installation conditions are less strict, and so more economical. Better than any other system, it is able to withstand certain inevitable installation hazards without suffering any damage.

The performance of the INTEGRAL system combined with the relative independence from installation conditions results in:

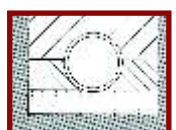
- Installation savings in most usual cases (simplified compaction, re-use of trench soil as backfill, etc.);
- Inherent safety in the case of highly problematic projects (installation in the water table, unstable soil, shallow or deep installation depths, etc.).

SAINT-GOBAIN PAM has integrated in the design of its sturdy INTEGRAL systems, the need for a product providing high available safety in order to offset, insofar as possible, size uncertainties and installation hazards.

There are three main types of installation:

BASIC - STANDARD - CONTROLLED that can be defined as follows:

- **BASIC installation:** flat trench bottom. Bed and pipe surround backfill with soil free of rocks and lightly compacted (initial bedding angle of 60°). This more or less corresponds to compacted installation in soil type 3 and extraction of the shoring after complete backfill.
- **STANDARD installation:** trench bottom in sand, gravel, etc. Bed and pipe surround backfill free of rocks and compacted up to the pipe crown (bedding angle of 90°). This corresponds to controlled compaction installation in type 2 soil, and withdrawal of shoring by layers after compaction.
- **CONTROLLED installation:** trench bottom in sand, gravel, etc. Bed and pipe surround compacted in successive symmetrical layers, then uniformly up to 0.10 m above the pipe crown (bedding angle 120°). This corresponds to controlled compaction installation in soil type 1 with withdrawal of shoring by layers before compaction.



Cf. "Fascicule 70" for the definition of soils.

INTEGRAL - the technical answers

- Mechanical resistance
- Fascicule 70

"Fascicule 70, CCTG des ouvrages d'assainissement" [Fascicule 70 General Technical Specifications for wastewater structures] (August 1992 edition) stipulates that the mechanical resistance of pipes in their environment be substantiated. The calculation method defined for all materials modulates a certain number of parameters to determine the admissible depth of cover.

NB: To assist you, SAINT-GOBAIN PAM has developed a pipe mechanical sizing program in compliance with "Fascicule 70" on the basis of applicable standards. Please consult us.

Other mechanical sizing method can be used, such as the ATV-A127 german method or the ANSI/AWWA C150/A21.50 american method.

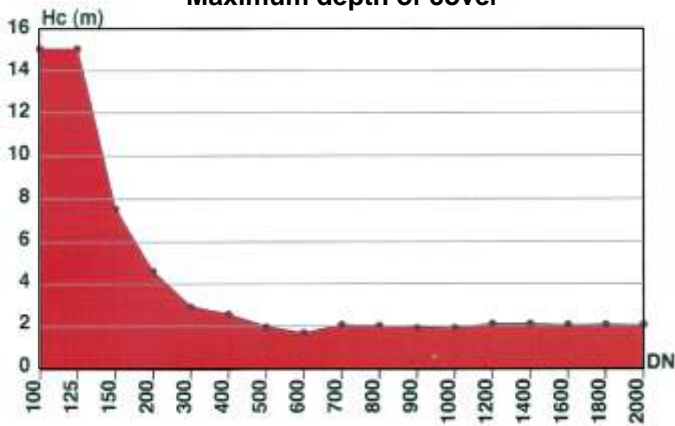


The following graphs plot the cases most frequently encountered. They are the result of calculations made in compliance with "Fascicule 70".

■ Depth of cover (Hc)

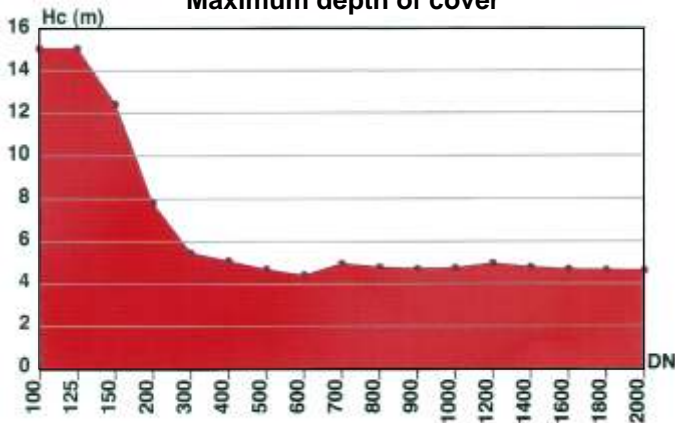
FASCICULE 70

**BASIC INSTALLATION
INTEGRAL PIPE
Maximum depth of cover**



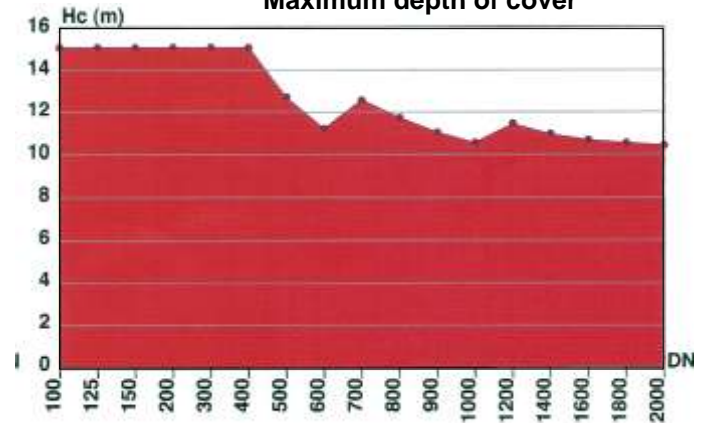
FASCICULE 70

**STANDARD INSTALLATION
INTEGRAL PIPE
Maximum depth of cover**



FASCICULE 70

**STANDARD INSTALLATION
INTEGRAL PIPE
Maximum depth of cover**



INTEGRAL - the technical answers

■ Maintaining the water stream

A wastewater pipe must be able to absorb changes in its environment without undergoing any deformation, crushing or ovalisation that might otherwise result in a rupture in the water stream.

The mechanical properties of ductile iron guard against breakage and misalignment in the event of any soil movement or adjacent excavations.

Benefitting from the safety coefficients of ductile iron, rigid and straight, INTEGRAL pipes guarantee the quality of the water stream :

- The long pipe lengths, and smooth internal walls facilitate self-cleaning;
- Fittings have the same section as the pipes and the elastomer gasket guarantees centring of all parts, thus reducing the risk of debris accumulation.

French standard NF EN 476 stipulates the acceptable values for water stream continuity at assembly points.

< 6 mm for DN up to 300
0.02 x DN for DN > 300 (max. 30 mm)

The admissible tolerance in INTEGRAL system junctions is always less than the standard's requirements.

See *Leaktightness - Impermeability*

■ Hydraulic capacity

Wastewater systems need to be sized bearing in mind all factors including, intermittent operation with peak daily flows, and possible changes to the demographic context.

In addition to the safety coefficient of ductile iron, the INTEGRAL system has many hydraulic advantages providing operators with peace of mind for the future:

- a perfectly smooth internal wall: **the high alumina cement mortar is deposited by centrifugation, it is extremely compact and facilitates flow;**
- the internal diameter is at least equivalent to the nominal diameter:
 - **inherent safety margin for higher flow rates (peak flow rate or population growth, for example),**
 - **network dimensions can thus be set at optimum levels;**
- the pipes are perfectly straight and non-deformable: under loads, the admissible ovalisation is limited to 4% (extreme conditions).

The flow coefficient K, in the Manning-Strickler formula, is 105 for cast iron.

The water stream and flow capacity are always maintained.



INTEGRAL

Flexible Material



INTEGRAL - the technical answers

■ Abrasion resistance

Systems transporting wastewater also contain foreign matter; this is all the more true in the case of combined systems. In gravity flow systems, site topography often results in high flow rates, so this foreign matter can cause abrasion.

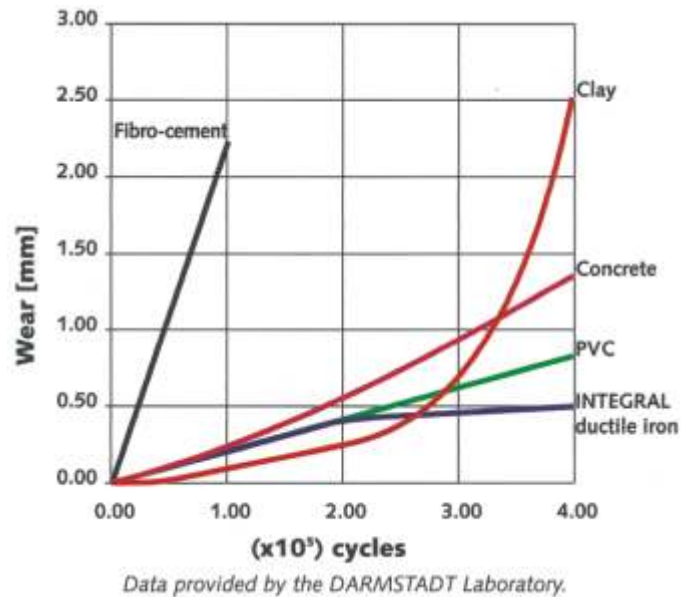
There are two types of abrasion:

- Scratch wear, limited if the pipe wall is harder than the particles;
- Impact wear, limited if the surface material is elastic.

The ideal would be to have material that is both very hard and very flexible.

High alumina cement mortar provides excellent resistance under normal flow conditions and can withstand high exceptional flow rates, even temporary, without any damage or risk for the pipe's lifespan, such as reduced thickness or mechanical strength.

- Our technical-sales support and research teams can examine any special cases, notably in mountainous regions.
- Significant project savings can be made by eliminating flow control chambers and manhole backdrops.



■ Soil corrosiveness

Pipes are subject to stresses in the environments in which they are laid, including soil and backfill corrosiveness. The general corrosiveness indices are calculated using topographical and geological readings. These readings can be fine-tuned on site by measuring the soil resistivity and analysing samples.

INTEGRAL pipes have a 200 g/m² coating of sprayed metallic zinc.

A red epoxy pore-sealer is then added.

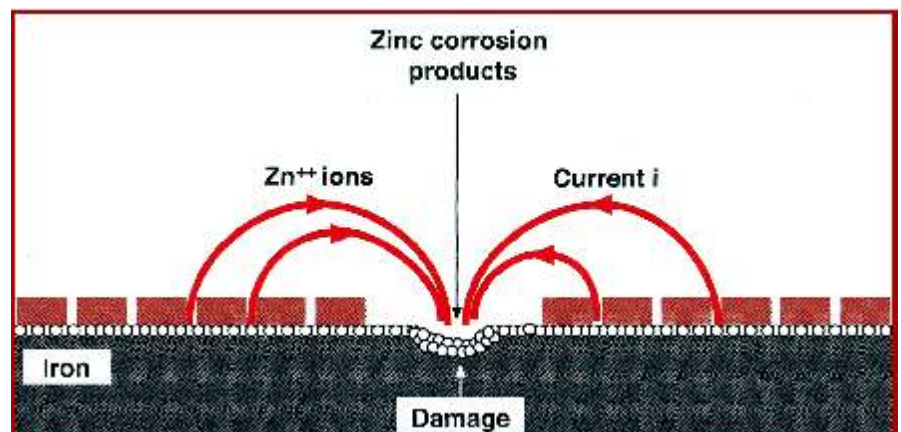
The zinc provides:

- galvanic protection by converting to stable and insoluble zinc salts.
- damage self-healing: the Zn⁺⁺ ions migrate through the pore-sealer to plug any damaged areas.

Fittings are coated with red epoxy.

Experience with the INTEGRAL system has proven that these coatings are effective in most soils. Some soils have very low resistivity (and so are more highly corrosive). Such cases need to be assessed in order to recommend, if necessary, additional protection or special coatings.

The SAINT-GOBAIN PAM technical-sales teams will carry out soil surveys on request.



INTEGRAL - the technical answers

■ Chemical Resistance

For wastewater pipelines, the main danger comes from inside. Two types of problems may affect the pipe's lifespan:

- the aggressiveness of some types of effluent transported,
- and septic fermentation as a result of intense bacterial activity and/or poor ventilation.

Wastewater systems are liable to receive accidental industrial effluents. Although accidental, such effluent still changes the balance and low pH in the effluent transported. It is thus important to choose a pipe material and type of joint that take into account such chemical hazards in order to ensure the system's long-term operation.

The scope of application for the internal linings used with INTEGRAL systems - high alumina cement mortar and epoxy - and the type of joints guarantee safe use, even for certain industrial applications.

Please consult us

High alumina cement mortar internal lining

Tests and practical experience have shown that high alumina cement mortars are able to withstand septic fermentation and occasional acid attacks (for more details, please refer to the general document "*Canalisations INTEGRAL en fonte ductile pour l'assainissement 1999*").

■ Particular cases: septic fermentation

Some difficult wastewater system service conditions as well as the transport of wastewater over great distances can lead to changes in effluent quality, such as septicity, production of sulphides, and the release of H₂S. Certain accidental circumstances, such as high effluent temperatures and/or high sulphate content, can have the same effect and be a source of serious problems:

- production of bad odours
- risk of intoxication for service personnel
- structure corrosion
- wastewater treatment plant malfunctions

While it is essential to optimise the design and operation of systems to ensure the long-term viability of infrastructure and protect plant, it is also important to choose a pipe system that does not compound these phenomena. Moreover, if such situations are expected or foreseen to exist on a continuous basis, it is preferable to choose INTEGRAL pipes with a "High Safety" polyurethane internal lining. See *INTEGRAL PH1 range*.

The photos opposite illustrate the damage that can be caused, notably at the water line.

Epoxy used for fittings

An epoxy resin film is deposited over entire parts by dipping them in a fluidised bed. This provides chemical resistance at least identical to that of the pipes.

The application process guarantees a regular layer over the entire surface of parts treated.

(Average minimum thickness: 250 microns.)

Nitrile gasket

In contact with the effluent, elastomer joint gaskets must be able to withstand attacks by chemical products and the risks associated with the presence of hydrocarbons and oils in particular.

A yellow marking indicates to users that this is a Nitrile NBR non-food quality gasket.

Standards NF T 46-013 (French) and ISO 1817 define the test methods and performance levels to be achieved.

Type of product	Type of Integral lining	pH range at 20°C	
		Continuous service	Accidental
INTEGRAL pipe	High alumina cement	4 to 12	3
INTEGRAL PH 1 pipe	Polyurethane	1 to 13	< 1
Fittings	Epoxy	1 to 13	< 1
Gaskets	NBR	1 to 12	< 1



CHF



Portland B



High alumina cement



Portland A

Sample No 3 highlights the excellent performance of high alumina cement mortar.

INTEGRAL - the technical answers

■ Pressure systems

Inter-district systems may include long pressure sections that follow irregular or the most direct routes. The topographical conditions may require the installation of pumping stations followed by sewer mains operating under pressure.

The operation of sections under pressure requires the use of pipes with a high safety coefficient. The high pressures found and their variation demand the use of a quality material able to withstand water-hammer and negative pressure. The pipes and joints must demonstrate high mechanical performance levels to absorb these stresses, and any accidental phenomena.

The experience acquired by SAINT-GOBAIN PAM with pressure systems for water distribution enables us to guarantee the same performance levels for the INTEGRAL system, even at service extremes, such as, high pressure, water-hammer, and negative and boosted pressures.

The use of INTEGRAL pipes for pressure systems is admissible up to an allowable operating pressure (PFA) of 6 bar.

As there is some fear of the risk of sulphide formation in these sections, measures need to be taken at the outlet from the pressure section when the effluent returns to gravity flow to reduce H₂S₀₄ acid attack:

- Either by appropriate chemical treatment (ferrous sulphates - oxygenation - hydrogen peroxide);
- Or by installing pipe sections that are not affected by acid attacks.

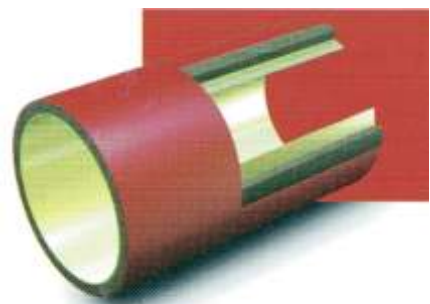


The INTEGRAL PH1 range is the natural adjunct to the INTEGRAL pipe range. It has high mechanical strength and a passive anti-corrosion internal lining.

The high thickness (about 1.5 mm) of the polyurethane deposited inside the pipe means the INTEGRAL PH1 system can transport practically all aggressive fluids found in the industrial sector.

The non-porosity of the internal polyurethane film is checked with a holiday detector.

Consult our technical-sales teams for details about these specific applications. Particularly a specific range of products has been developed for hot countries climate.



A complete range of fittings especially for these systems is available so all layouts are feasible. In order to provide a complete system, SAINT-GOBAIN PAM also offers gate valves, knife gate valves, and sewage air valves.

Please consult us.



Quality and Compliance with Standards

The SAINT-GOBAIN PAM Quality Assurance system is based on the EN ISO 9001 standard that certifies control over the process: design, development, manufacture, installation and associated services.

All plants where INTEGRAL products are manufactured have been certified ISO 9001 by an independent entity.

SAINT-GOBAIN PAM products comply with European and international standards (EN and ISO). Compliance with these standards is certified by independent entities.

These standards define the product or the service in terms of the result; each product, pipe or fitting is individually works tested with internal pressure tests.



■ Product compliance

Specification	European standard	International standard
Ductile iron pipes, fittings, accessories and their joints for sewerage applications - Requirements and test methods	EN 598	ISO 7186
Cement mortar internal lining	EN 598	ISO 4179
Gaskets - Materials specifications	EN 681-1	ISO 4633

■ Quality marks

The INTEGRAL pipe system bears the mark that certifies compliance to French and European standards and also includes additional service characteristics that are important for specifiers.

■ INTEGRAL safety contracts: our commitment

On takeover, leaktightness tests are useful, but alone they are not enough. The important thing for any operator is that the leaktightness also withstands the test of time. INTEGRAL pipes are leaktight and they will stay that way.

In certain countries of the European Union, if a leaktightness defect should be proven by a test within five years following system commissioning, SAINT-GOBAIN PAM might undertake to repair the fault at its own cost under its INTEGRAL RELIABILITY contract.

Product catalogue

■ The pipes

■ INTEGRAL pipes

Internal lining: high alumina cement mortar.

Designed to transport effluent and operate as gravity or pressure system, for pH from 4 to 12.



DN	Reference	Length (m)	OD (mm)	Metric mass (kg)
80	AS 08 A6 RD	6	99.5	14.2
100	AS 10 A6 RD	6	119.5	18.5
125	AS 12 A6 RD	6	145.5	23.0
150	AS 15 A8 RD	6	170.0	24.5
200	AS 20 A8 RD	6	222.0	33.0
250	AS 25 A8 RD	6	274.0	42.5
300	AS 30 A8 RD	6	326.0	53.5
350	AS 35 A8 RD	6	378.0	73.5
400	AS 40 A8 RD	6	429.0	86.5
450	AS 45 A8 RD	6	480.0	102.0
500	AS 50 AS RD	6	532.0	117.0
600	AS 60 AS RD	6	635.0	151.0
700	AS 70 A7 TO	7	738.0	207.0
800	AS 80 A7 TO	7	842.0	253.0
900	AS 90 A7 TO	7	945.0	301.0
1000	AT 10 A7 TO	7	1048.0	356.0
1200	AT 12 A6 VD	8.26	1255.0	520.0
1400	AT 14 A6 VD	8.19	1462.0	695.0
1600	AT 16 A6 VD	8.18	1668.0	869.0
1800	AT 18 A6 VD	8.17	1875.0	1059.0
2000	AT 20 A6 VD	8.15	-	1280.0

■ INTEGRAL PH1 pipes

Internal lining: polyurethane.

Designed to transport highly corrosive effluent, for pH from 1 to 13.



DN	Reference	Length (m)	OD (mm)	Metric mass (kg)
80	AS 08 B8 RD A	6	99.5	13.0
100	AS 10 B8 RD A	6	119.5	15.9
125	AS 12 B8 RD A	6	145.5	19.2
150	AS 15 B8 RD A	6	170.0	20.6
200	AS 20 B8 RD A	6	222.0	27.2
250	AS 25 B8 RD A	6	274.0	35.7
300	AS 30 B8 RD A	6	326.0	45.0
350	AS 35 B8 RD A	6	378.0	55.8
400	AS 40 B8 RD A	6	429.0	70.0
450	AS 45 B8 RD A	6	480.0	83.0
500	AS 50 B8 RD A	6	532.0	95.4
600	AS 60 B8 RD A	6	635.0	121.0

For larger ON, please consult us. Available up to ON 2000.

■ INTEGRAL TT pipes

External coating: polyurethane.

Internal lining: high alumina cement mortar

Designed for extremely corrosive soils.



DN	Reference	Length (m)	OD (mm)	Metric mass (kg)
150	AS 15 A6 RP	6	170.0	29.2
200	AS 20 A6 RP	6	222.0	39.2
250	AS 25 A6 RP	6	274.0	51.0
300	AS 30 A6 RP	6	326.0	64.2
350	AS 35 A8 RP	6	378.0	73.4
400	AS 40 A8 RP	6	429.0	86.7
450	AS 45 A8 RP	6	480.0	101.7
500	AS 50 A8 RP	6	532.0	116.8
600	AS 60 A8 RP	6	635.0	150.8

For larger ON, please consult us. Available up to ON 2000.

■ INTEGRAL ISOPAM pipes

External coating: polyurethane foam between iron and HDPE casing.

Internal lining: high alumina cement mortar

Designed to protect effluent from freezing, when laid aboveground (bridge crossings, etc.).

From DN 150 to DN 600. Length 6 metres.



Product catalogue

- I.M. joint gravity fittings
- Round saddle



DRILLING

Swivel branch



Sewer DN	Branch dn	Reference	Mass (kg)
250 and 300	125	AS 25 E6 FR	19
250 and 300	150	AS 25 E6 GR	21
350 to 600	125	AS 40 E6 FR	19
350 to 600	150	AS 40 E6 GR	21
350 and 400	200	AS 40 E6 JR	29
450 to 600	200	AS 50 E6 JR	29
700 to 1200	125	-	-
700 to 1200	150	AS 70 E6 GR	21
700 to 800	200	AS 70 E6 JR	29
900 to 1200	200	AS 90 E6 JR	29

90° Saddle branch



Sewer DN	Branch dn	Reference	Mass (kg)
250 and 300	150	AS 25 E8 GD	9.3
350 to 600	150	AS 40 E8 GD	8.3
700 to 1200	150	AS 70 E8 GD	7.6
300	200	AS 30 E8 JD	12.9
350 and 400	200	AS 40 E8 JD	12.0
450 to 600	200	AS 50 E8 JD	11.1

45° Saddle branch



Sewer DN	Branch dn	Reference	Mass (kg)
250 and 300	150	AS 25 E9 GD	9.3
350 to 600	150	AS 40 E9 GD	8.3

- Square saddle



CROSS CUTTING

Swivel branch



Sewer DN	Branch dn	Reference	Mass (kg)
200	125	AS 20 E6 FK	20.3
200	150	AS 20 E6 GK	22.4
250	125	AS 25 E6 FK	21.8
250	150	AS 25 E6 GK	23.3
300	125	AS 30 E6 FK	22.0
300	150	AS 30 E6 GK	23.9
300	200	AS 30 E6 JK	29.1

67°30 Saddle branch (2 stirrups)



Sewer DN	Branch dn	Reference	Mass (kg)
250	150	AS 25 E3 GT	24.5
300	150	AS 30 E3 GT	25.8
400	150	AS 40 E4 GT	32.0
400	200	AS 40 E4 JT	34.5
500	150	AS 50 E4 GT	36.0
500	200	AS 50 E4 JT	37.0
600	150	AS 60 E4 GT	40.0
600	200	AS 60 E4 JT	41.0

Gasket, stirrups and bolts included

INTEGRAL connector to concrete sewer



Sewer DN	Branch dn	Reference	Mass (kg)
Wall thickness = 60	150	AS 15 E5 GD	6.5
	200	AS 20 E5 JD	9.4

Product catalogue

- I.M. joint gravity fittings and connection pieces
- “Intermetarial” coupling (iron and PVC)



DN	Reference	Mass (kg)
150	AS 15 M 1AA	7.2
200	AS 20 M 1AA	11.7
250	AS 25 M 1AA	12.2
300	AS 30 M 1AA	19.8

- INTEGRAL bend with I.M. joint

90° bend - 1/8th (double socket)

DN	Reference	Mass (kg)
125	AS 12 C3 BD	9.7
150	AS 15 C3 BD	12.2
200	AS 20 C3 BD	18.2



22½ bend - 1/16th (double socket)

DN	Reference	Mass (kg)
125	AS 12 C3 DD	7.2
150	AS 15 C3 DD	9.1
200	AS 20 C3 DD	13.7

11¼ bend - 1/32nd (double socket)

DN	Reference	Mass (kg)
125	AS 12 C3 ED	7.5
150	AS 15 C3 ED	9.3
200	AS 20 C3 ED	13.3

- 67½° angle branch



Spigot on double socket

Sewer DN	Branch dn	Reference	Mass (kg)
150	125	AS 15 E1 FN	25.5
200	125	AS 20 E1 FN	37.5
200	150	AS 20 E1 GN	38.5
250	125	AS 25 E1 FN	53.0
250	150	AS 25 E1 GN	54.0
250	200	AS 25 E1 JN	55.0
300	125	AS 30 E1 FN	77.0
300	150	AS 30 E1 GN	77.0
300	200	AS 30 E1 JN	78.0
300	250	AS 30 E1 KN	79.0

Gasket included

All spigot

Sewer DN	Branch dn	Reference	Mass (kg)
150	125	AS 15 E0 FD	19.0
200	125	AS 20 E0 FD	29.5
200	150	AS 20 E0 GD	30.0
250	125	AS 25 E0 FD	41.0
250	150	AS 25 E0 GD	41.5
250	200	AS 25 E0 JD	42.5
300	125	AS 30 E0 FD	62.0
300	150	AS 30 E0 GD	62.0
300	200	AS 30 E0 JD	63.0
300	250	AS 30 E0 KD	64.0



- Reduction joint

Sewer DN	Branch dn
125 x 100	AP 12 J8 E
150 x 100	AP 15 J8 E
150 x 125	AP 15 J8 F
200 x 150	AP 20 J8 E



- Ductile iron connection piece

INTEGRAL with PVC	DN	OD INTEGRAL (mm)	OD PVC (mm)	Reference	Mass (kg)
	125	143	125	AG12L1FD	3.5
	150	170	160	AG15L1GD	4.6
	200	222	200	AG20L1JD	6.6

Product catalogue

■ STANDARD joint pressure fittings

■ GSS coupling for sewage

DN 125 to DN 600
Complete



■ Flange spigot

DN 80 to DN 1000



■ Flange socket

DN 80 to DN 1000
Push-in joint gaskets included



■ 11¼ bend - 1/32nd with push-in joint

DN 80 to DN 1000
Push-in joint gaskets included

■ 22½ bend - 1/16th with push-in joint

DN 80 to DN 1000
Push-in joint gaskets included



■ Flange branch on double socket

DN 80 to DN 1000
Push-in joint gaskets included



■ 45° bend - 1/8th with push-in joint

DN 80 to DN 1000
Push-in joint gaskets included

■ All socket tee with push-in joint

DN 80 to DN 300
Push-in joint gaskets



■ Blank flange

DN 100 to DN 1000



Product catalogue

■ Access

Access to the network for service operations or to insert cleaning, test or inspection equipment is essential for any wastewater system.

These access structures are generally subject to wheel loadings. These loadings are transferred to the pipes as shear stresses and can be a source of significant problems.

In addition to the standard functions (inspection, branch connections, maintaining the water stream, etc.), the structure's design must also guarantee system leaktightness.

■ Access trap DN 250 to DN 800

Ductile iron device providing access to the pipe, ensures perfect leaktightness and also allows cleaning and inspection equipment to be inserted into the pipe.



■ Cleaning tee DN 400

For equipment only, this tee is mounted on a gravity mains and is used to insert cleaning and inspection equipment.



■ Connection chamber DN 400

Used to locate or service a branch connection. Lateral branch pipes can be fitted using an adaptor piece.



■ Leaktight cleaning chamber 400 X dn



■ Inspection tee DN 400

Ensures gravity pipe leaktightness at its passes through the manhole and also allows cleaning and inspection equipment to be inserted. Fitted with a cover and counterweight.



■ Connection chamber DN 250

Used to locate and service a branch connection.



■ Single block connection chamber DN 250

In ductile iron, this single block chamber can be fitted with a sealable expansion plug, fitted with a cover and counterweight.



■ Rotatable connection chamber DN 300

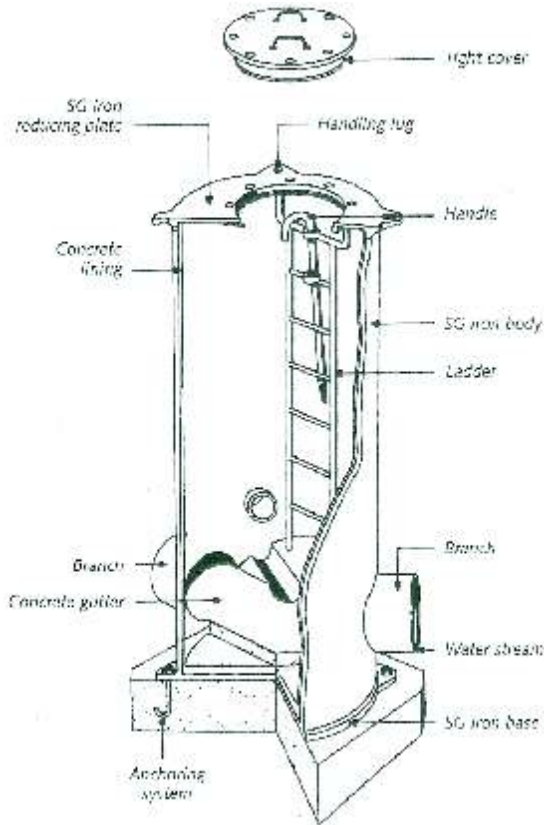
With a rotatable downstream branch to facilitate installation.



Product catalogue

■ Access

■ Ductile Iron manholes



This manhole is manufactured on request after a feasibility study.

Please consult us.

Delivered in a single piece, the structure is ready for installation and connection.

It is shop welded from components in ductile iron (body, covers, invert, branches, etc.), or steel (special branches and ladder).

Concrete gutter can be manufactured on request. The various branches should be connected with the system pipes preferably using joints allowing angle deflection.

This type of manhole is able to withstand significant mechanical stress and loads and has a very high level of leaktightness.

■ Welded inlets

These welded inlets are manufactured on request on INTEGRAL pipes.

When ordering, please state the exact position of the inlet in relation to the pipe socket.

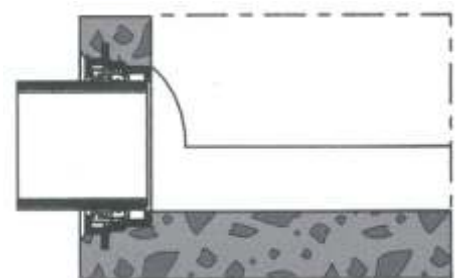
Please consult us.



■ Manhole collars



The manhole collar is used to form a flexible and leaktight connection between the pipe and the manhole chamber. These collars are designed to be anchored either to prefabricated manholes or to manholes poured-in-place.





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INTEGRAL Ductile iron sewage pipelines

- **Design**
 - Mechanical design
 - Hydraulic design
 - Chemical attack calculation
 - Abrasion calculation
 - Soil survey
 - and septic fermentation as a result of intense bacterial activity and/or poor ventilation.
- **On-site technical assistance**
- **After-sales service**



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