FLOWTITE JACKING PIPES
NOW YOU CAN HAVE THEM
HOW YOU WANT THEM
OUR COMMITMENT TO YOU

Great research makes great Flowtite pipes! Flowtite is the culmination of intense innovation, research and testing – over and over again, year after year. Our Flowtite Technology centre in Norway has the world's largest and the most modern laboratory for the development and testing of GRP pipes. We will never stop developing Flowtite, and never cease to keep it ahead of competition!

WELCOME TO THE WORLD OF FLOWTITE NON CORRODIBLE JACKING PIPES

TODAY’S GROWING URBAN AREAS often make it impractical to perform open trench excavations and disrupt the surface conditions in order to install, replace or renovate underground piping systems. In such cases trenchless technology is an obvious choice.

It includes the microtunnelling process of boring a hole and pushing or jacking the new pipe into the created excavation. This process is ideal for jacking under structures like roads and railways.

Flowtite offers products that meet these specific application needs - Flowtite GRP Jacking Pipes.

The Flowtite manufacturing process is unique in that it easily permits manufacturing of a custom product to meet the specific project requirements.

With the ability to make custom diameters, lengths and wall thickness, Flowtite can create the optimum pipe size to match the capacity of the equipment of the tunnelling machines. This allows longer jacked pipe runs.

Flowtite represents one of the world’s leading technologies of GRP pipes, satisfying the needs of the water and the wastewater pipe market for nearly 50 years.

Flowtite GRP Jacking Pipes are available in a range of standard sizes for trenchless installation. In addition, custom sizes are available upon request to meet specific project requirements.
FLOWTITE JACKING PIPES
NOW YOU CAN HAVE THEM
HOW YOU WANT THEM

It’s not an introduction offering - it’s the technology that makes us able to provide you with pipes the way you want them. The Flowtite winder is a machine that can manufacture a wide range of diameters and lengths! The pipe length can be customized according to specific requirements to fit the site conditions and jacking equipment. Such flexibility helps to maximize installation efficiency and reduce construction and shipping costs.

NO LIMITATION BY STANDARD LENGTHS

Such parameters as wall thickness, inner and outer diameters, single pipe length, pressure rating, geometry and ring stiffness are flexible for Flowtite GRP jacking pipes, so they can be adjusted to fit any project and installation equipment requirements. With Flowtite jacking pipes, you can have any pipe length, even in smaller quantities. You are not limited by standard lengths with Flowtite!

FLEXIBLE DIAMETER

With Flowtite jacking pipes, you can choose any pipe diameter within the range DN300 - DN4000. Inner and outer diameters of Flowtite jacking pipes are fully adjustable to each specific project requirements. You are not limited by standard diameters anymore!

ZERO CORROSION

GRP is a corrosion-free material. Coatings - internal or external, chemical inhibitors, cathodic protection and corrosion allowances - are not required anymore! The lifetime of pumps and other in-line equipment is extended through the complete absence of rust particles.

STRONG AS STEEL, LIGHT AS PLASTIC

Flowtite jacking pipes are lighter than concrete pipes with the same capacity. High axial compressive strength of the Flowtite jacking pipes allows reduced wall thicknesses and longer single drive lengths. It maximises cost savings and optimises the ratio between price and performance. In addition, Flowtite jacking pipes allow consistent distribution of concentrated compressive stress during curved jacking operations, which helps to avoid damages.
NOW YOU CAN HAVE THEM
IN THE LENGTHS YOU WANT THEM

WITH FLOWTITE JACKING PIPES, YOU CAN HAVE ANY PIPE LENGTH, EVEN IN SMALLER QUANTITIES
You are not limited by standard lengths with Flowtite. If you can optimize the length, you do not need to rearrange the gear as often. That saves you time and money!

A WEIGHT REDUCTION OF 30% OR MORE MATTERS WHEN PIPES ARE LOWERED DOWN INTO THE SHAFT
Safer to the operators, friendlier to the lifting gear, and easier to handle in the shaft.

SO MUCH LIGHTER!
NOW YOU CAN HAVE THEM

IN THE DIAMETER YOU WANT THEM

Any diameter within the range of
DN300 - DN4000

ANY DIAMETER YOU WANT
With Flowtite jacking pipes, you can get any
diameter within the range of DN300 - DN4000.
You are not limited by standard diameters anymore!
FLOWTITE Jacking Pipe. The System
All you need for construction and renovation of an underground pipeline

Flowtite GRP Jacking Pipe Systems are designed and manufactured for construction and renovation of underground pipelines using trenchless methods. Trenchless constructions allow avoiding disruption of the surface, leaving landscapes and structures unaffected.

GROUT AND LUBRICATION INJECTION PORT
Flowtite pipes can be supplied with Grout and Lubrication Injection ports to facilitate installation. The injection ports comprise an insert, check valve and plug; they are typically 25 mm (1”) in diameter. Other diameters are available on request.

JACKING PIPE COUPLINGS
Flowtite GRP Jacking Pipe couplings have an outside diameter equal to the pipe external diameter. Couplings are available in different types depending on the application.

STANDARD OR CUSTOM-MADE FLOWTITE JACKING PIPES
Flowtite GRP Jacking pipes are available in the standard diameter range or custom designed to fit the requirements of a particular project application.

TRAILING PIPES
Trailing pipes are used in an intermediate jacking station assembly, following the leading pipe with the intermediate jacking station between them.

ADJUSTMENT PIPE
Adjustment pipe is directly connected to the micro-tunneling machine during installation. On one end it is adjusted to fit the dimensions of each particular machine and on the other end it has a coupling to connect with a standard or custom-designed jacking pipe.

LEADING PIPES
These pipes are used for intermediate jacking station arrangements. Such arrangements are commonly utilised on long runs, where jacking forces exceed the maximum capability of the system. The leading pipes are produced with a long rebate on one spigot end, allowing extension and retraction of the intermediate jacking station during installation.
FLOWTITE GRP JACKING PIPE

The pipes are classified by the diameter, ring stiffness, allowable jacking force and joint type.

<table>
<thead>
<tr>
<th>TECHNICAL DATA, FLOWTITE JACKING PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Materials</strong></td>
</tr>
<tr>
<td>Resin, glass fibre, sand</td>
</tr>
<tr>
<td><strong>Material Density</strong></td>
</tr>
<tr>
<td>1800 - 2200 kg/m³</td>
</tr>
<tr>
<td><strong>Longitudinal Compressive Strength</strong></td>
</tr>
<tr>
<td>min 90 MPa</td>
</tr>
<tr>
<td><strong>Hoop Flexural Modulus</strong></td>
</tr>
<tr>
<td>12000 - 18000 MPa</td>
</tr>
<tr>
<td><strong>Axial Modulus</strong></td>
</tr>
<tr>
<td>7000 - 9000 MPa</td>
</tr>
<tr>
<td><strong>Operating Temperatures</strong></td>
</tr>
<tr>
<td>-50°C – +70°C</td>
</tr>
<tr>
<td><strong>Corrosion Protection</strong></td>
</tr>
<tr>
<td>None required</td>
</tr>
<tr>
<td><strong>Abrasion Resistance</strong></td>
</tr>
<tr>
<td>Abrasion resistant liner, water jet cleaning</td>
</tr>
</tbody>
</table>

**PIPE CLASSIFICATION**

<table>
<thead>
<tr>
<th>Standard Diameter Range (OD)</th>
<th>300 - 4000 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiffness Range (SN)</td>
<td>10000 - 1000000*</td>
</tr>
<tr>
<td>Pressure Range (PN)</td>
<td>up to 10 bar</td>
</tr>
<tr>
<td>Allowable Jacking Force</td>
<td>up to 18 000 kN* depending on DN and SN</td>
</tr>
<tr>
<td>Joint Types</td>
<td>SE, GR, SR and FPC</td>
</tr>
</tbody>
</table>

**COUPLING TYPES**

<table>
<thead>
<tr>
<th>PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>GR</td>
</tr>
<tr>
<td>SE</td>
</tr>
<tr>
<td>FPC</td>
</tr>
</tbody>
</table>

Flowtite GRP jacking pipes are produced in standard lengths of 1, 2, 3 and 6 m, as well as in customised lengths. The pipe length can be adjusted to the specific project requirements to fit the site conditions and jacking equipment. Such flexibility helps to maximize installation efficiency and reduce shipping and construction costs.

For information on the availability of Flowtite® GRP jacking Pipes and to discuss project requirements, please contact your local supplier or visit www.flowtite.com.

* These parameters vary depending on application purposes and pipe DN. For more information, please refer to the Technical Data Tables.

Location Las Vegas, USA, 2016

Project Installation of a 6 meter long Flowtite jacking pipe during construction of the Paradise Whitney Interceptor (PWI) pipeline.
Flowtite GRP Jacking pipes are ideal for pipeline construction or renovation in such areas as crossings, culverts under the roads, highways, railroads and buildings.

Flowtite GRP Jacking pipes can be used as casing pipes or small tunnels for protection of underground utility lines and similar.
FLOWTITE JACKING JOINTS
AVAILABLE IN DIFFERENT TYPES AND PRESSURE CLASSES FOR YOUR PROJECT NEEDS

GR JOINT
GR Joint includes a GRP sleeve with EPDM rubber seals fitted into grooves in the pipe spigots. GR Joint is suitable for both pressure and non-pressure applications. The GRP sleeve can be produced in any diameter to fit the project and installation requirements.

SE JOINT
SE Joint includes a Gr.316 stainless steel sleeve with an integral EPDM rubber seal. SE Joint is suitable for both pressure and non-pressure applications and able to withstand high jacking forces during installation.

FPC JOINT
FPC Joint is designed for pressure applications and utilizes a Flowtite GRP pressure coupling design. This joint is suitable for installations with lower jacking forces due to deep rebates on pipe spigot ends.

SR JOINT
SR Joint includes a stainless steel sleeve. The inner surface of the sleeve fits tightly to the EPDM rubber seal embedded into a special groove on the pipe spigot. SR Joint is applicable for both pressure and non-pressure applications and often preferred for smaller diameter pipes.

Flowtite GRP jacking pipe couplings have an outside diameter equal to the pipe external diameter. Couplings are available in different types and pressure classes depending on the application.

The standard seals used in each pipe joint are EPDM. Other rubber compounds are available on request. All rubber seals comply with ISO 4633.
DO YOU HAVE ANY QUESTIONS?
WE CAN HELP YOU

Flowtite specialists are there for you whenever you have a question or need help with pipeline design or installation. Our technical assistance and consulting services are available worldwide.

FLOWTITE GRP TRANSITION PIPE

Flowtite GRP transition pipe allows direct jointing of standard trenched pipe to jacking pipe eliminating the requirement for a maintenance structure. The customized pipe’s internal and external diameters can be accommodated.

FLOWTITE SPECIALLY-TAILORED FITTINGS & MANHOLES

In some situations a Flowtite pipeline needs to be connected to an existing underground pipeline or a manhole, often made of other pipe materials, than GRP. In such cases, it is most crucial to be able to adjust both dimensions and junction angles to achieve the desired result.

The specially tailored fittings and manholes are then designed and produced for each individual connection. The design of each such fitting is unique and depends on the requirements of a particular project.

FLOWTITE SERVICE TEAM WORLDWIDE

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www.amiantit.eu
Years of experience and research have provided Flowtite experts with profound knowledge of designing pipelines. Below are the most important factors to be taken into consideration when designing jacking pipes.

**INTERNAL PRESSURE**

The pressure capacity of Flowtite Jacking Pipe is defined by the joint capacity for each diameter. The lowest pressure class, PN1, is available for all diameters using the GR sleeve and an EPDM rubber gasket. The GR sleeve is qualified for pressures up to PN6, while the SE sleeve can be used to PN10. For higher pressure classes the standard Flowtite pressure coupling can be used.

Note that with increasing pressure, the allowable jacking force decreases, because of the greater coupling thickness. Note also that the SE sleeve builds less thickness, and therefore less reduction in jacking force.

**EXTERNAL PRESSURE**

The EPDM rubber gasket is designed for external pressure, with its special V-notch shape. As the external water pressure goes up the sealing pressure increases, until the limit of the rubber material is reached.

This makes the system especially suited for resisting grouting pressures, and for deep burials.

**ALLOWABLE JACKING FORCE**

The allowable jacking force depends on diameter and pressure class, as well as thickness ratio. During the jacking process the angle between the axes of the pipes determines the allowable jacking force. According to ISO25780 the allowable jacking force is computed for maximum eccentricity with closed joint (i.e. full contact at one edge of the pipe, dropping to zero at the other edge), using the minimum declared compressive strength of the pipe. The ISO25780 assumes a safety factor of 1.75 (3.5 - for a full contact in straight alignment).

**THICKNESS RATIO**

The thickness ratio, TR, is the ratio between the thickness of the pipe and the outer diameter, expressed in per mille. It varies between 23 for the lightest pipes, and 94 for the heaviest pipes. The allowable jacking force is proportional to the thickness ratio.

\[ TR = \frac{e}{OD} \]

The thickness in mm equals TR times OD, with the OD expressed in meters.

**STIFFNESS**

The stiffness of the jacking pipe can be computed from outer diameter and thickness ratio, together with the apparent E-modulus in bending. The highest stiffness SN 1000 000 corresponds to a TR = 93, and the lowest stiffness SN 20 000 corresponds to TR = 23.

\[ SN = \frac{E_{be} e^4}{12(OD - e)^3} \]

The stiffness is expressed in Pascals.
EASY TO HANDLE & INSTALL

FLOWTITE® GRP JACKINGPIPES are easy to handle and install. They are significantly lighter than concrete pipes with the same capacity. Flowtite jacking pipes are easier to manoeuvre. Their flexible length allows fewer joints and, consequently, reduced efforts of pipe loading, which results in time and costs efficiency.

FLOWTITE GRP J ACKING PIPES are suitable for the construction of new pipelines and rehabilitation of old pipelines, road culverts in transport engineering and relining using trenchless methods of construction. Flowtite jacking pipes can be produced adjusted to the installation equipment, which speeds up the installation process and helps to reduce costs.

FLOWTITE GRP J ACKING PIPES CAN BE INSTALLED IN:

• Straight or curved alignments
• Cohesive and non-cohesive soils
• Dry or high water table conditions

FLOWTITE GRP J ACKING PIPES are lighter and, therefore, easier to handle. The weight reduction makes them safer to the operators and friendlier to the lifting gear. In addition, due to material properties, the pipes are more resistant to impact and abrasion, than concrete pipes with the same capacity, which contributes to the efficiency of installation process.

For more information on handling and installation of the Flowtite jacking pipes, please contact your local Flowtite supplier.
RELINING
Due to highly adjustable dimensions of Flowtite GRP jacking pipes, they can be used for trenchless rehabilitation of existing pipelines to repair damages or restore structural stability of a pipeline without disruptive excavations.

TRANSPORTATION OF WATER
Flowtite GRP jacking pipes can be used in pipeline constructions for the transportation of water, including rainwater, sewage and industrial wastewater, both with and without pressure.
Where the jacking force is likely to exceed the capacity of the jacking pipe, intermediate jacking stations are generally used. A typical intermediate jacking station is illustrated below.

Intermediate jacking station assembly includes Leading and Trailing pipes. Leading pipe comes first in the assembly and accommodates intermediate jacking station and a trailing pipe. Trailing pipes are produced with a long rebate on the front spigot end, allowing extension and retraction of the intermediate jacking station during installation.

Angular deflection in accordance with ISO 25780 Flowtite GRP Jacking Pipes achieve a minimum allowable joint deflection (in accordance with ISO25780) as shown.

<table>
<thead>
<tr>
<th>EXTERNAL DIAMETER OD (MM)</th>
<th>MAXIMUM ALLOWABLE INSTALLED DEFLECTION α (MM)</th>
<th>MAXIMUM ALLOWABLE INSTALLED DEFLECTION δ (DEGREES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 &lt; OD ≤ 500</td>
<td>15</td>
<td>0.8594</td>
</tr>
<tr>
<td>500 &lt; OD ≤ 1,000</td>
<td>10</td>
<td>0.5729</td>
</tr>
<tr>
<td>100 &lt; OD</td>
<td>α = 10000/OD</td>
<td>Derive from α</td>
</tr>
</tbody>
</table>

Angular deflection

\[ b = \text{Maximum angular deflection in degrees} (°) \]

\[ A = \text{Maximum angular deflection in millimeters per metre} (\text{mm/m}) \]

Compressive stress distribution

\[ A = \text{Compression angle in the pipe, } \delta, \text{ expressed in degrees} (°) \]

\[ \delta = \text{Elastic compressive strain at the circumference of the jacking pipe, expressed in millimeters} (\text{mm}) \]

\[ \sigma_{\text{max}} = \text{Maximum stress, expressed in newtons per square millimetre} (\text{N/mm}^2) \]

\[ \delta = \text{Diametrical extent of compression in the joint segments, expressed in millimeters} (\text{mm}) \]
STANDARDS AND QUALITY
OF FLOWTITE GRP JACKING PIPES

FLOWTITE® GRP JACKING PIPE are manufactured to the following relevant standards under third party accredited quality assurance programs complying with ISO 9001 Quality Management System.

- ISO 25780 “Plastics piping systems for pressure and non-pressure water supply, irrigation, drainage or sewerage - Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin — Pipes with flexible joints intended to be installed using jacking techniques”
- ISO 10467 “Plastics piping systems — Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin Part 1: Pressure and non-pressure drainage and sewerage”
- ISO 10639 “Plastics piping systems — Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin Part 2: Pressure and non-pressure water supply”
- EN 1796 “Plastics piping systems for water supply with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)”
- NS-EN 14364 “Plastics piping systems for drainage and sewerage with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP) - Specifications for pipes, fittings and joints”
- ASTM D3262 “Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe”

MANUFACTURE
OF THE FLOWTITE GRP JACKING PIPES

FLOWTITE® GRP JACKING PIPES are manufactured worldwide: in Europe, North America, South America, Asia, Oceania and Africa. This ensures that the product is readily available to improve supply times and assist with tight construction programs.

A continuous winding and advancing mandrel process is used to produce a dense laminate that maximises the contribution from the raw materials. The process allows for high production outputs compared with other manufacturing processes.

The pipes are manufactured with polyester or vinyl ester resin, glass fibre, and silica sand. The technology enables the production of a desired pipe size, length and wall thicknesses, resulting in an optimal pipe selection. Pipe spigots are machined to the required dimensions and tolerances and assembled with either GRP or stainless steel couplings, depending on the application.

All pipes are quality inspected after manufacture to ensure their compliance with the relevant national and international standards.

This is the reason why we say that our customers can have their pipes the way they want them.
The Flowtite filament wound GRP Pipe was chosen for both the trenchless and the open-cut installations during construction of the Paradise Whitney Interceptor (PWI) pipeline in 2016. Flowtite was able to handle the unique issues at hand, as well as offer unique advantages in corrosion resistance, superior hydraulic characteristics and ease of installation.

As utility owners and municipal authorities look for ways to meet the increasing need to expand or replace existing water systems and infrastructures, the PWI serves as a good example for future pipe installation projects. Not only has the use of trenchless technology minimized surface disruptions and the impact to the public, but the use of Flowtite for direct bury, slipline and jacking pipes has shown to be extremely effective, offering contractors and owners alike many opportunities to save, both short- and long-term.

| Total length of pipeline (package 2 of 3) | 27,073 lf 8252 m |
| Trenchless Portion | 13,592 lf 4143 m |
| Direct Bury Portion | 13,592 lf 4143 m |
| Diameter | 30, 38, 60, 66 and 72 in. 800, 950, 1500 and 1800 mm |
| Pipe Stiffness (psi) | 72, 154 and 220 psi 5000, 10000, 20000 N/m² |
| Installation method | Microtunneling / Jacking, Slipline, Open Cut |
| Engineer | Carolle |
| Installer | Las Vegas Paving |
THE BEST SOLUTION FOR THE ENVIRONMENT

Studies show that due to material efficiency, GRP has a minimal negative environmental impact compared to other materials. Flowtite strongly focuses on the reduction of the environmental footprint of its GRP pipes. The ongoing efforts to find state-of-the-art solutions for the environment have contributed to the innovation and optimization of the processes, including sustainable recycling methods for the composite industry.

MATERIAL EFFICIENCY
An independent study conducted at the Norwegian University of Life Sciences in 2012 concludes that GRP pipes have a minimal negative environmental impact compared to other pipe materials. The main reason for this is the material efficiency.

NON-HARMFUL AND RECYCLABLE
Flowtite GRP pipes are not produced to be recycled - but to be in use decade after decade. However, when the time is up, they can be recycled in a cement production plant, or even left in the ground as they are not harmful for the environment.

TRANSPORTATION EFFICIENCY
That a pipe that is significantly lighter than a concrete pipe is easier to transport is almost needless to say - it is obvious. Moreover, it saves fuel - and therefore the environment, too!

EXCELLENT HYDRAULICS
Smooother bore of the pipe means that less energy is needed to pump the fluids through them. That saves the environment even more!
TODAY AND EVERYDAY MAKING THE WORLD A LITTLE BIT BETTER. Flowtite believes that the world’s need for infrastructure can be solved with innovation, research and excellence. At Flowtite we want to contribute to a more sustainable world. We do so by cutting edge technology through better research.

Distributed by

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