

FLOWTITE ORANGE

EXTREME WEAR RESISTANT GRP PIPE



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FLOWTITE ORANGE is a new Flowtite pipe – developed by researchers and scientists at Flowtite Technology. Years of research and development have culminated in an extremely wear resistant pipe – tested and approved according to relevant international pipe standards.

Flowtite Orange is the third pressure pipe in the Flowtite pressure pipe portfolio. Compared to Flowtite Grey, Flowtite Orange is designed for more extreme wear exposure.

Flowtite Orange enables transport of fluids containing highly abrasive materials such as slurries from the mining industry, storm water containing extreme

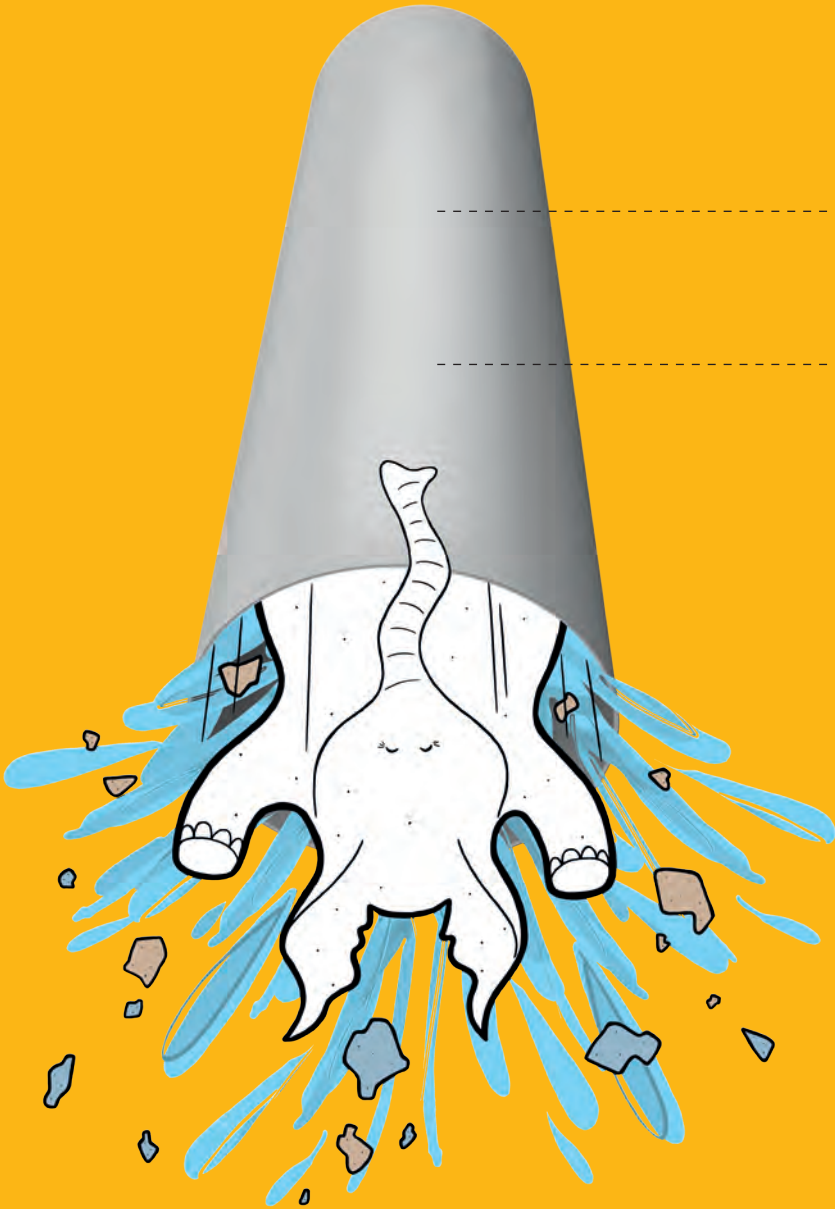
volumes of sand and gravel, and other applications with extreme wear exposure. Continuously wound GRP, invented by Flowtite pioneers in the late 1960s, is a flexible technology enabling engineers to apply new materials as well as developing new design and process technology. With this new pipe, Flowtite Orange, Flowtite takes yet another step ahead.

Flowtite Orange is available in Flowtite's standard pressure, stiffness and diameter range. Please see the brochure "First Choice of Engineers" for details on pipe properties and dimensions.



THE FIRST CHOICE OF ENGINEERS WORLDWIDE

WHY FLOWTITE ORANGE?



Extreme Abrasion Resistance

Extreme Erosion Resistance +

Longer Service Life =






EXTREME PERFORMANCE FOR EXTREME WEAR EXPOSURE

WATER WITH SAND AND STONES

Some penstocks are built where it is difficult to avoid sharp riverbed stones and large quantities of sand entering the pipeline. Flowtite Orange increases lifetime when water contains extremely abrasive and erosive materials.



MINING SLURRY WATER

Flowtite Orange is designed to endure the continuous wear of slurry water used in the mining industry. The extreme wear of slurry water wears down practically all types of material. Flowtite Orange is a more durable alternative!



WATER WITH STORM WATER DEBRIS

With global warming, storm water pipelines have in recent years received far more sizable debris than earlier years. Sharp stones, timber, and other material often pass through gratings and end up tubing down the storm water pipelines.



OTHER FLUIDS WITH HARD SUBSTANCES

Special needs arise all the time. No pipeline is facing the same challenges - and for all those that can suffer damage from extreme wear - Flowtite Orange can be a more sustainable alternative.

EXTREMELY **WEAR** RESISTANT

FLOWTITE ORANGE OFFERS highly improved wear resistance. This means that the Flowtite Orange pipe can cope with extremely abrasive particles sliding on or impacting the interior surface. A pipe with a hard inner surface material will offer excellent resistance toward the abrasion mode, but will be reduced in the erosion resistant capability. Vice versa, a pipe with a flexible inner surface is excellent toward the erosion mode, but less capable of handling the abrasion mode. Flowtite Orange is a new pipe developed to minimize wear, no matter the mode. Orange is not a compromise, but a technology that tackles both extreme erosion and extreme abrasion simultaneously.

HIGHER WEAR RESISTANCE allows engineers to transport water with of extremely abrasive and erosive substances. Typical uses of Flowtite Orange would be slurry pipelines, penstocks stormwater with unpredictable types and shapes of contaminations, and others. The modes of wear in one pipeline will constantly be changing depending on a series of variables:

COMMON WEAR VARIABLES

- Flow velocity
- Particle loading
- Particle mass (particle size and particle density)
- Particle nature (Shape, chemical composition)



Flowtite Orange technology was used in Laxa River in Iceland.

WHAT IS WEAR RESISTANCE?

Erosion and abrasion are two phenomena that are prone to cause wear. The difference of these two is seen in the figure. Where flow is laminar the abrasion mode will be pronounced, while a turbulent flow will result in particles bumping against the liner – thereby erosion. The two together, erosion and abrasion, are prone to cause wear.

ABRASION RESISTANCE

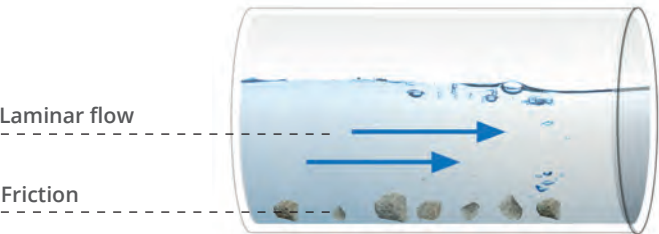
EROSION RESISTANCE

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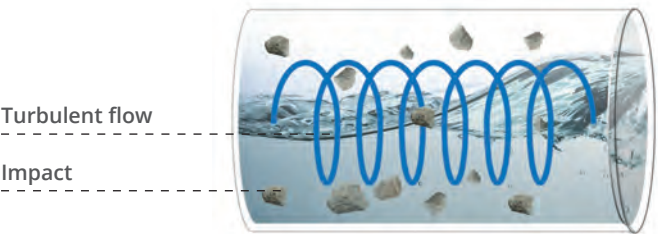
WEAR RESISTANCE

=

ABRASION



EROSION



FLOWTITE ORANGE IS **EROSION** RESISTANT

EROSION RESISTANCE is a concern for many pipe installations when water contaminated with extreme quantities of sand, silt and gravel must be transported in the pipe at higher flow velocity. Erosion occur when particles impact the liner from an angle, as opposed to abrasion, which is the occurence of particles sliding on the internal surface (liner). A liner exposed to erosion should be softer in order to handle impact over time.

The suspended solids can cause erosion and, when severe, result in structural integrity issues and may even eventually require repair or rehabilitation.

Tests conducted at the Flowtite Technology Laboratory in Norway show that Flowtite Orange has excellent erosion resistance.

Flowtite Orange's new pipe design offers better resistance to erosion for most applications with extreme wear issues.

DUCTILE EROSION



BRITTLE EROSION



WHY IS **HIGHER EROSION RESISTANCE** IMPORTANT TO ENGINEERS?

Erosion dramatically affects service life of pipelines. High erosion, such as can be found in slurries, can wear down a pipeline within few years, even months.

TESTING EROSION RESISTANCE

Slurry jet erosion at different impact angles are among the tests Flowtite Orange is subject to. Slurry Jet Erosion (22.5 ° at 10 m/s for 60 minutes

with 10 wt % volcanic sand) showed a reduction of liner thickness of only 0.07 mm of the Flowtite Orange. Slurry Jet Erosion (45 ° at 10 m/s for 60 minutes with 10 wt % volcanic sand) showed a reduction of liner thickness of mere 0.18 mm of Flowtite Orange. An extremely wear resistant pipe like Flowtite Orange can extend pipeline service life significantly.

Mining Water Processing plant. Flowtite Orange pipes are designed for extremely erosive slurry water.



EXTREMELY **ABRASION** RESISTANT

TESTS CONDUCTED at the Flowtite Technology Laboratory in Norway show that Flowtite Orange has excellent abrasion resistance.

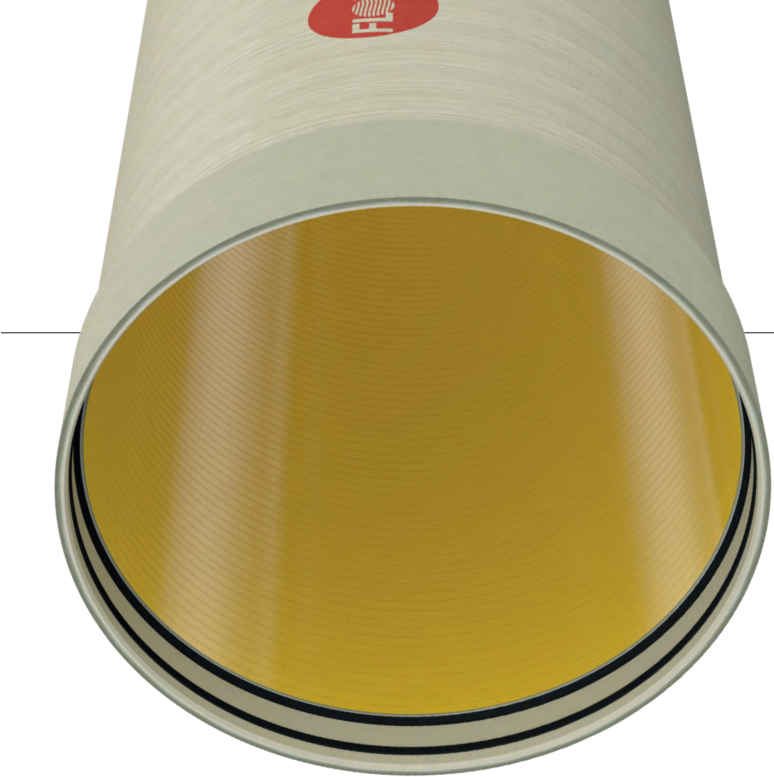
Flowtite Orange's new pipe design offers better resistance to abrasion in most applications.

The Darmstadt abrasion test showed <0.03 mm liner thickness reduction after 200,000 cycles on Flowtite Orange.

WHAT IS ABRASION RESISTANCE?
Abrasion resistance is the resistance to internal damage on the pipe liner by suspended solids. The extent of the abrasion depends on flow velocity, concentration of the particles, chemical composition and shape of the particles.



Abrasion testing at the Flowtite Technology laboratory in Sandefjord, Norway.



ABRASION RESISTANCE
Gravel abrasion to 200 000 cycles estimated
< 0.03 mm
loss in liner thickness.

WHAT DOES **HIGHER ABRASION RESISTANCE** MEAN TO ENGINEERS?

HIGHER ABRASION RESISTANCE permits engineers to employ Flowtite pipes in applications with heavier loads of suspended solids. Higher resistance to abrasion reduces

the frequency for costly shut downs for inspection and longer periods in operation are permitted. Better abrasion resistance can mean longer operating life for the pipeline.

Wear damages on a steel pipe. Location: Iceland

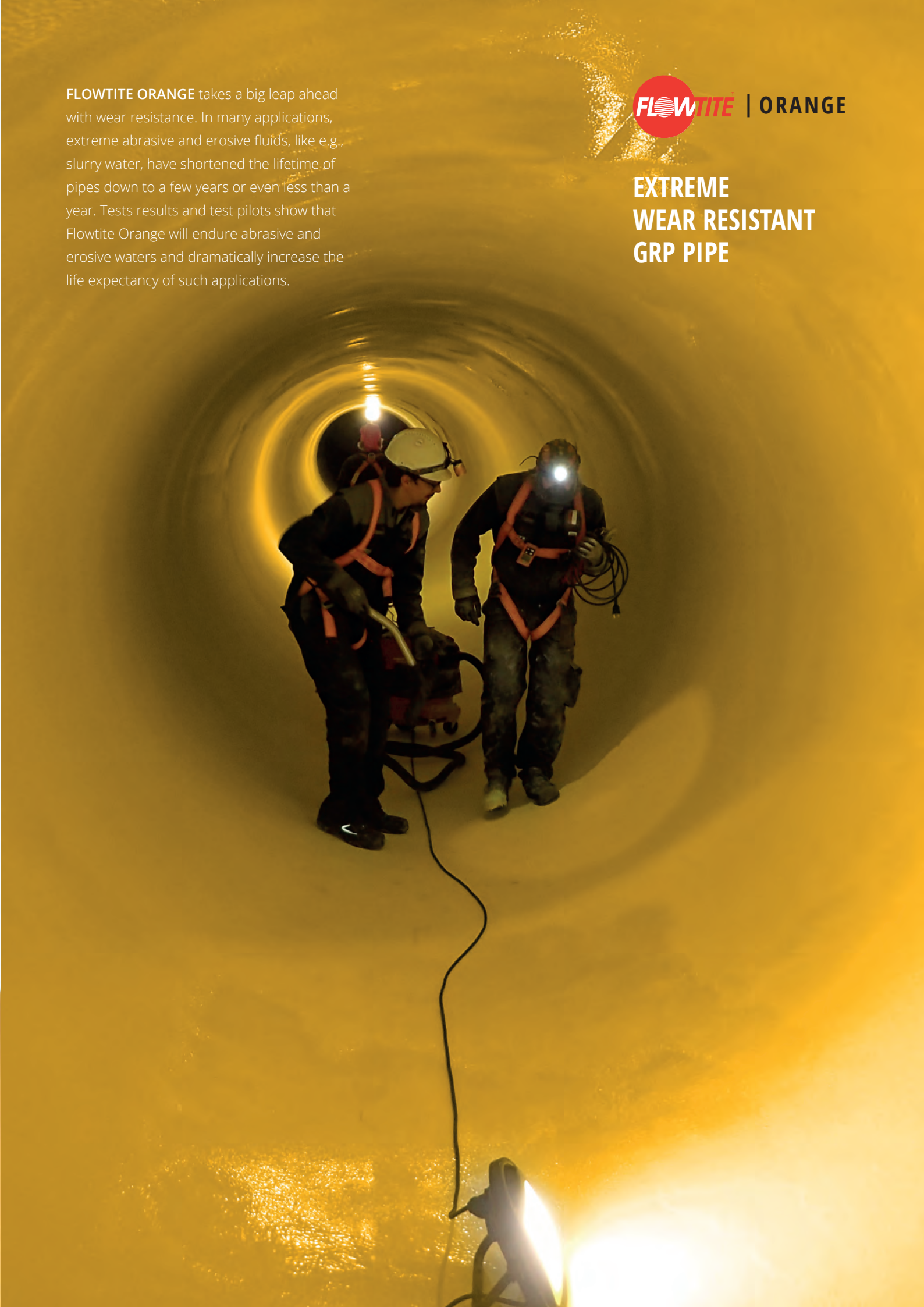


THE ORANGE STANDARD

FLOWTITE ORANGE takes a big leap ahead with wear resistance. In many applications, extreme abrasive and erosive fluids, like e.g., slurry water, have shortened the lifetime of pipes down to a few years or even less than a year. Tests results and test pilots show that Flowtite Orange will endure abrasive and erosive waters and dramatically increase the life expectancy of such applications.



**EXTREME
WEAR RESISTANT
GRP PIPE**



INVENTING THE ORANGE TECHNOLOGY

FLOWTITE ORANGE has been made possible by elastomeric thermoset chemistry and a novel way of reacting the material with GRP during the continuous winding process. This offers an integrated highly flexible liner, that does not peel under harsh conditions.

Kinera has been one of Flowtite's research partners in the process of developing the Orange technology.



COMPARING **ORANGE** TO **STANDARD** FLOWTITE



STANDARD FLOWTITE PROPERTIES

Flowtite pressure pipe is the most commonly used pipe for pressure and gravity applications, with a 50 year long proven track record. It is compliant with all international performance standards.

FLOWTITE ORANGE PROPERTIES

Flowtite Orange is a new pipe, developed for extreme wear resistance that occur in e.g., slurry pipelines, storm water and other applications where extreme wear may occur.



Wear Resistance

Good wear resistance for most applications.

Abrasion Resistance

Good resistance in most pressure and gravity applications.

Erosion Resistance

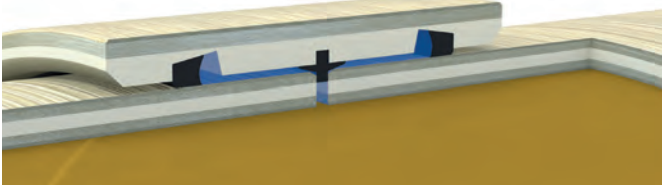
Good erosion resistance.

Expected Service Life in Extreme Wear Environments

If exposed to extreme wear, Flowtite standard pressure pipes will have not as long service life as Flowtite Orange.

Flow Velocity

Flowtite pipelines sustain intermittent velocities up to 8 m/s if the water is clean and contains no abrasive material.



Wear Resistance

Extremely high wear resistance in applications where most pipe materials give up.

Abrasion Resistance

Gravel abrasion to 200 000 cycles <0.03 mm loss in liner thickness.

Erosion Resistance

Exceptional erosion resistance.

Expected Service Life in Extreme Wear Environments

Flowtite Orange significantly increases pipeline service life.

Flow Velocity

Flowtite Orange is expected to sustain high intermittent flow velocities, maybe as high as 15 m/s, even for water with abrasive materials. Testing is still in progress, and applications with extreme flow velocities should be evaluated by Flowtite Technology before installation.

LIGHTWEIGHT DESIGN
MAKES HANDLING EASY



STANDARDS



Flowtite Technology has the world’s largest certified GRP pipe laboratory. Location: Norway

FLOWTITE PIPE HAS BEEN RIGOROUSLY TESTED TO VERIFY CONFORMANCE
TO THE FOLLOWING INTERNATIONAL PERFORMANCE STANDARDS:

STANDARD	PURPOSE
AWWA C950	Water supply
AWWA M45	Design manual
ISO 10639	Water supply
ISO 10467	Sewer and drainage
ISO 14692	Industrial piping
EN 1796	Water supply
EN 14364	Sewer and drainage
ASTM D3262	Sewer
ASTM D3517	Water supply
ASTM D3574	Pressure sewer

Flowtite pipes are additionally approved by most national standards

ALL YOU NEED TO KNOW

All you need to know about installation, couplings and fittings can be found in Flowtite company literature. This literature can be found in the brochures section at www.flowtite.com

The environmental impact of Flowtite pipes has been thoroughly documented by Flowtite, and has been certified and approved by an external body. Flowtite Orange is covered by the findings in the Flowtite Environmental Product Declaration (EPD).



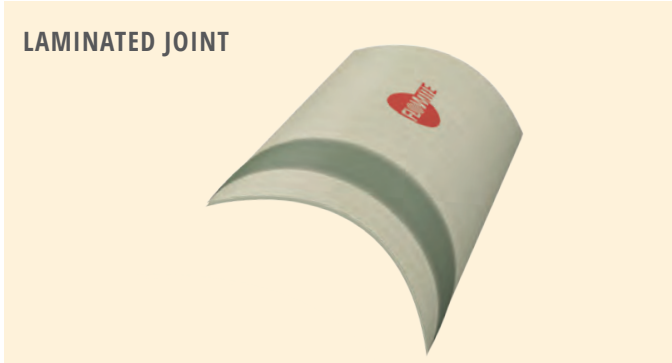
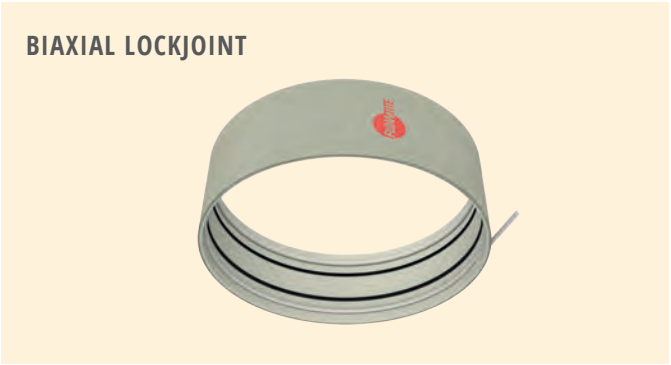
COUPLINGS & FITTINGS

COUPLINGS

Contact your local Flowtite supplier for advice on choosing suitable couplings for Flowtite Orange. Below are options that may be considered. For more detailed information on Flowtite couplings, please see "The First Choice of Engineers" brochure at www.flowtite.com.

Fittings are also manufactured and delivered according to the principles for ordinary Flowtite pipelines. For more information on Flowtite fittings, please see "The First Choice of Engineers" brochure at www.flowtite.com.

SUGGESTED JOINTS





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.

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