

QUALITY AND STANDARDS

SUBOR's approach to the quality concept is not limited to the production process and its product. SUBOR's management conception in all activities is an insight that considers the satisfaction of all stakeholders, especially the customers and it adopts occupational health and safety as the

fundamental policy.

Having established its management system upon such foundations, SUBOR has obtained certificates for ISO 9001 Quality, ISO 14001 Environment, and OHSAS 18001 Occupational Health and Safety Management Systems.

SUBOR manufacturing process has been designed to meet the requirements of the most fundamental and extensive international standards of the industry as given below:

AWWA C-950	Fiberglass Pressure Pipe
ASTM D 3754	Standard Specification for Sewer and Industrial Pressure Pipe
ASTM D 3517	Standard Specification for GRP Pressure Pipe
ASTM D 3262	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ISO 10639	Plastics piping systems for pressure and non-pressure water supply — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin
ISO 10467	Plastics piping systems for pressure and non-pressure drainage and sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin
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
EN 1796	Plastics piping systems for water supply with or without pressure - Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)
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
DIN 16868	Glass fibre reinforced unsaturated polyester resin (UP-GF) pipes

All relevant tests as required in the scopes of international standards as listed above are performed in SUBOR's laboratories, which are accredited with regards to conformity to ISO 17025: General Requirements for the Competence of Testing and Calibration laboratories.



PRODUCTION CONTROL TESTS

Tests are performed in order to inspect and measure performance of the product. The results of tests are recorded and they can be accessed easily. The conducted tests cover the entire process; from the entrance of raw materials to the shipment of the final products.

Raw materials are delivered with supplier certification demonstrating their compliance with SUBOR quality requirements; in addition, raw material samples are subjected to incoming control tests in SUBOR laboratories prior to their use.

All pipes are subjected to the following control checks in SUBOR laboratories and on production lines during production.

- Visual Inspection
- Barcol Hardness
- Dimensional Checks (Pipe Length, Diameter, Wall Thickness)
- Hydrostatic Leak Tightness Test (for pressure pipes)

On a sampling basis, the following control checks are performed.

- Determination of Pipe Stiffness
- Deflection without damage or structural failure
- Axial Tensile Strength Tests
- Circumferential Tensile Strength Tests
- Composition Test



QUALIFICATION TESTS

In addition to in-process product and performance tests, SUBOR also performs short and long term tests in order to determine qualification, pipe design criteria and monitor the long term material

condition. The long term monitoring is carried out for more than 10.000 hours in the "SUBOR Long Term Test Laboratory" and aim at reviewing the performance of pipes over 50 years.

SUBOR performs the following tests:

- Strain Corrosion Testing
- Hydrostatic Design Basis (HDB)
- Long Term Ring Bending Strain
- Long Term Specific Ring Stiffness
- Abrasion Resistance
- Joint Qualification Tests
- Water Jetting Resistance Testing





STRAIN CORROSION TEST

The method evaluates the effect of a chemical environment on the pipe when in a deflected condition. It has been found that the effects of chemical environments can be accelerated by

strain induced by deflection. This test is performed by applying sulphuric acid solution in accordance with ASTM D 3681 standard.



HYDROSTATIC DESIGN BASIS (HDB)

This practice is useful for establishing the hoop stress or internal pressure versus time-to-failure relationships, under selected internal and external environments which simulate actual anticipated

product end-use conditions, from which a design basis for specific piping products and materials can be obtained. This test is applied in accordance with ASTM D 2992 standard.



LONG TERM RING BENDING STRAIN TEST

Long term ring bending strain test method determines the long-term ring-bending strain of pipe when deflected under constant load and immersed in a chemical environment. It has been

found that effects of chemical environments can be accelerated by strain induced by deflection. This test is applied in accordance with ASTM D 5365 standard.



LONG TERM SPECIFIC RING STIFFNESS

The test is applied for determining the ring creep properties for glass-reinforced thermosetting plastics (GRP) pipes. Properties include the wet

creep factor and the long-term specific creep stiffness. This test is applied in accordance with ISO 10468 standard.



ABRASION RESISTANCE

The method for this test has been released by Darmstadt University. The test is carried out by adding a gravel mixture with water inside the pipe sample and cycling it within certain times to determine abrasion level of liner layer of pipe.



JOINT QUALIFICATION TESTS

Various joint qualification tests are applied according to international standards such as EN 1119 and ASTM D 4161, to find out the performance of the joint.

WATER JETTING RESISTANCE TESTING

During the service life, the sewer lines need to be cleaned with high pressurized water. Therefore the pipe has to have strength against high pressurized water jetting cleaning applications. This test is applied in accordance with DIN 19523 standard.