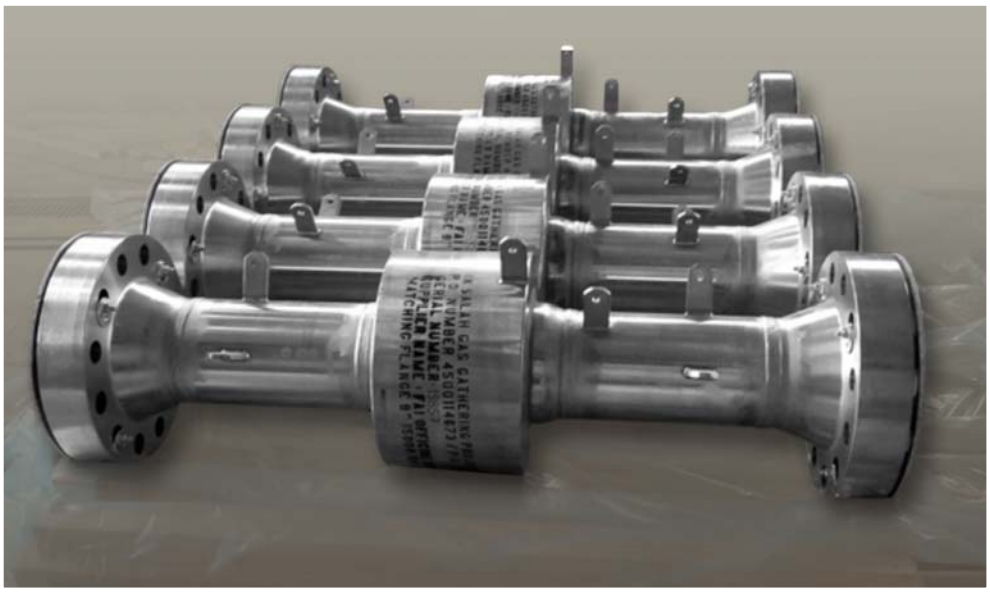
MONOLITHIC

ISOLATING JOINT



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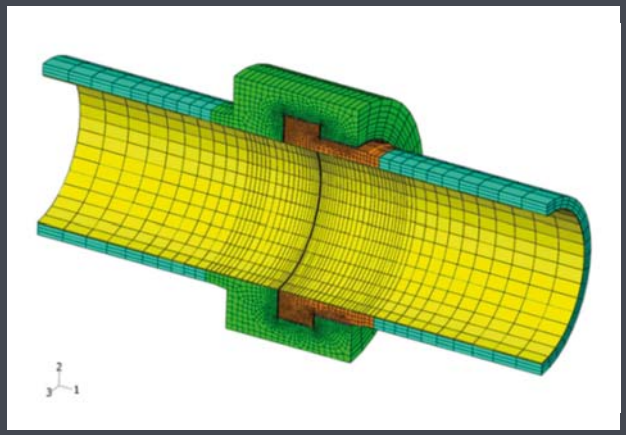
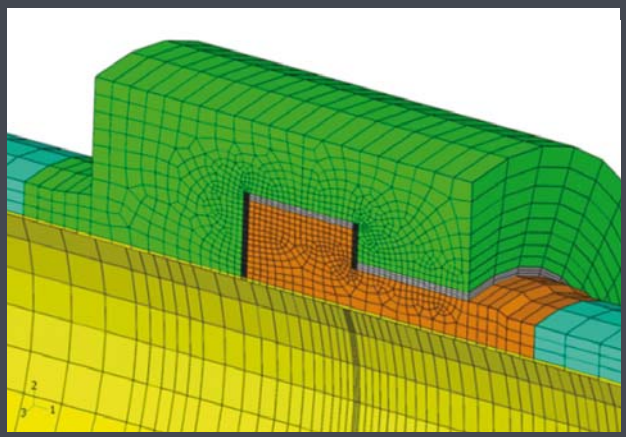
Isolating Joint

The project expectation to install an isolating joint for oil and gas pipeline is to secure the electrical separation between different pipeline sections from the main components, creating a barrier against the stray current and preventing the diffusion of a lightening discharge.

Therefore the purpose of the isolating joints is to prevent electrochemical corrosion caused by stray electrical currents or interference from other pipelines by an enhanced cathodic protection of the complete system, becoming an effective electrical barrier in service.

Originally the isolating joint was a plate disc made by of dielectric fiberglass bolted as a sandwich between two flanges.
The modern isolating joint is a monolithic compact design suitable to withstand the static and external loads to be supported by pipes and sized to **guarantee the pipeline design life**.

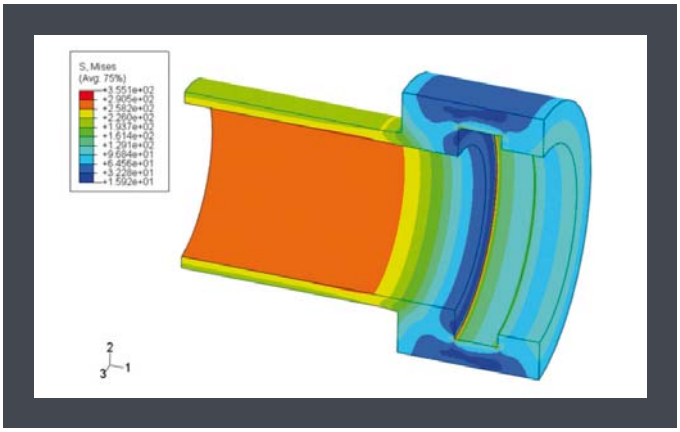




Code And Standard

The applicable codes are generally the pipelines codes which, whatever the country of installation is, always meet the requirements of ASME B31.3 / B31.4 / B31.8.DNV OSF101 and the Australian AS 2885 are usually also applied.

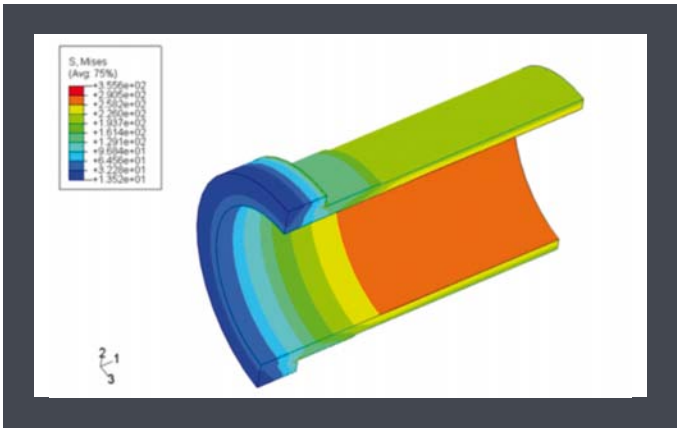
The sizing of the isolating joint's main components which hold in place the gaskets and the fiberglass dielectric disk is generally assumed as flange or reverse flange and therefore calculated to ASME VIII Div. 1 or 2.



Conceptual Design

Following today's market requirements and in addition to the pressure, the design is extended to the assessment of the external loads acting on the pipeline which involve bending and torsion on the monolithic isolating joint.

The conclusion is: the isolating joint cannot be weaker than the pipe to which it is connected, thus the evaluation of its design by finite element analysis is mandatory, but not only: the test is mandatory also for the other components, such as gaskets, dielectric disks and filler resin to verify the interaction of the composite materials with the base structure.



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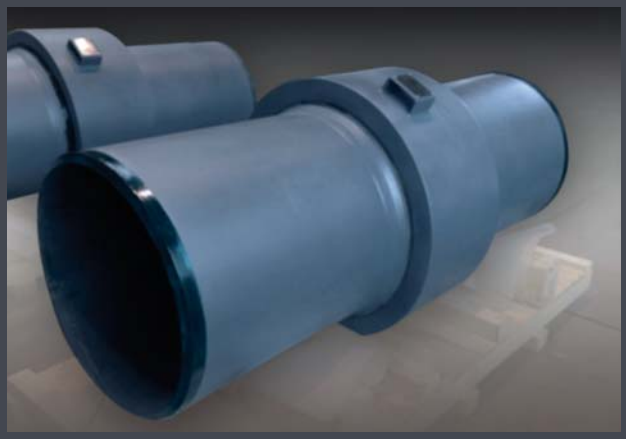


Design Assessment

Some assumptions need to be considered to do a correct design assessment, based on the main components suitability compared to the design conditions.

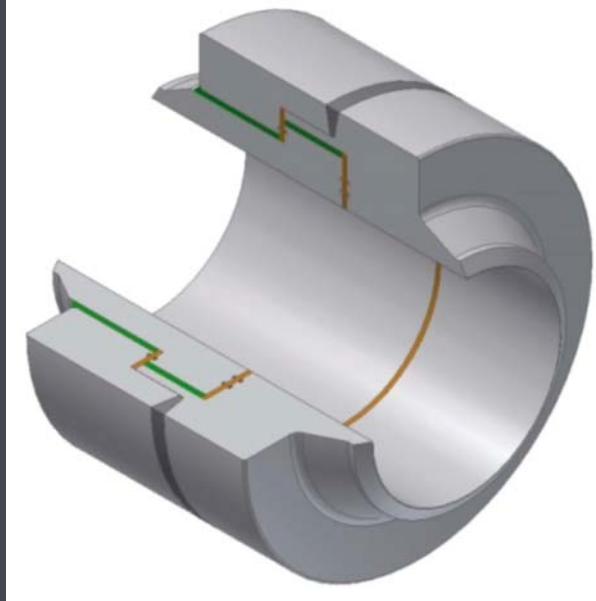
Monolithic isolating joint's main components are:

- Metallic parts : made by forging
- Girth welding to join the components
- Isolating disk : made of Fiberglass
- Gasket : made of Elastomer
- Filler resin : made of Epoxy bi-components

The metallic components and welding are commonly used in all pressure equipment and never create problems. The non-metallic components, although commonly used like the previous, in case of monolithic isolating joints are forced to be fitted as non-replaceable items. For this reason they create a problem for the whole design life of the joint.

FAI is aware about the extensive requirements related to the isolating and sealing system of the monolithic isolating joints and has carried out researches and tests with the aim to **meet** the **Costumer requirements and ensure the design life**.

The test, carried out in parallel with our non-metallic components suppliers and focused on the correct design implementation either under corrosion or static loads, has helped achieve our aim.



Sealing

The **FAI** monolithic isolating joint design can suit any type of elastomer such as HNBR, Viton, Aflas , Kemraz and Kalrez.

The elastomer features, quoted in the supplier data sheets, are tested in autoclave by independent laboratories to simulate the design condition, as verification of the requirement of the Project data sheets.

FAI has a record of how each elastomer reacts against the pipeline medium.

Static Loads Plus Bending & Torsion

FAI's design for metallic components is addressed to minimize the local stress and the elastic deformations of the monolithic isolating joint. The stresses assumed in the calculation are significantly lower than the permitted amount. The monolithic isolating joints result effectively redundant. The low arising elastic deformations ensure the negligible clearance between the sealing faces preventing the extrusion of the gaskets .

The selected gasket prototype is hydro tested in a bolted device at twice the design pressure to verify its suitability and the geometry of the grove.

The isolating disk is statically tested by a hydrotest in a bolted chamber to verify combined loads: pressure and compression.
The above mentioned tests, periodically performed on the components treated as single items, and the tests performed on the complete monolithic isolating joint, make **FAI** design a **proven design**.

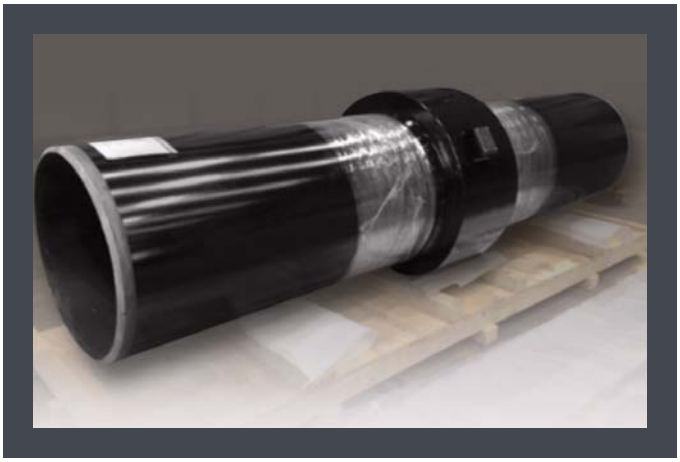
Material

FAI proposed material for metallic components are basically forgings to:

- Carbon steel ASTM A694 Gr. F65-F70
- Alloy steel ASTM A182 Gr. F11 –F22
- Duplex steel ASTM A 182 Gr. F51 –F53

Modified to suit Project requirements and costumer chemistry and mechanical limitations, FAI proposed non metallic components are:

- Gasket elastomer — NBR- HNBR- Viton-Aflas Kemraz - Kalrez
- Dielectric disk — ASTM D709 G10 –G11
- Filler resin — Epoxy bi-component



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Welding

The closing weld in the **FAI** monolithic isolating joint is located approximately in the center of the two main components. The weld is externally flush ground to make easier the ultrasonic and radiographic non destructive tests. The welding is performed with the welding parameters specified in the WPQR to keep the correct heat input and prevent any affect on non metallic component.

The two diametric girth welding, used to connect the monolithic isolating joint to the pipeline pipes, are both located outside the isolating joint body to make easier both the welding and the non destructive tests at site.

The welding of the free issue extension pipes is now a routine practice for **FAI** since our qualified personnel, together with our workshop capabilities, have the skill to weld all materials presently available on the market.

Welding of the extension pipes gives some benefit such as:

- On-site pipe to pipe welding, avoiding the necessity to provide new PQR for pipe to forging welding.
- Orbital welding as any other girth pipeline welds.
- Hydrotest with easier bending and torsion tests (where required), avoiding welding and removal of temporary pipes.

Tests

Our tests capabilities have been implemented to satisfy all applicable Code, pipeline and client's specifications, and include:

- Hydraulic test
- Dielectric strenght test (AC)
- Electric resistance megger test (DC)
- Dielectric continuity (Holiday) check for coating corrosion resistance

= Pressure leakage test performed with Helium or Nitrogen

= Fatigue Cycle strength Testing

= Combined impact of internal pressure and bending moment

= Combined impact of internal pressure and torque.

(=) Tests usually performed on prototype.

Our Joints are always supported by maechanical / FEA calculations and are always designed to withstand all the above mentioned tests.

Tests

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