Over the past 12 years, Spoolable Glass Reinforced Epoxy pipe (SGRE) has achieved widespread preference for in-field gathering and injection applications over welded steel and stick fiberglass (rigid GRE) pipelines. It is now in broad use in oil and gas fields throughout North America, and is now being installed for a major operator in Australia.

To date, over 15,000 km of high pressure SGRE pipe has been installed in North America for more than 450 operators. Faster and safer installation, lower capital and operating costs, immunity from corrosion and low maintenance in service are the drivers for this rapid success.

Technology Overview

SGRE is a patented product offered by a single manufacturer, Fiberspar. Trademarked as LinePipe™, it was initially developed by Fiberspar and Conoco in the early 1990’s, and subsequently commercialized with the assistance of Weatherford International and Halliburton.

Fiberspar’s design uses a filament-wound glass-reinforced structural layer with the addition of a thermoplastic liner, which acts as both the manufacturing mandrel and fluid barrier. The entire structure is bonded together. The internal liner is HDPE Fluid Barrier, Glass Reinforced Epoxy Laminate, and Thermoplastic Wear Resistant Jacket.
normally made of high-density polyethylene (HDPE), but other thermoplastics have also been used. An external thermoplastic jacket is extruded on the finished, tested pipe to provide additional impact protection.

Simple installation, small crew size, and no need for welding is the trademark of installing Fiberspar pipe. Normally, crew size is one supervisor from the pipe manufacturer along with the on-site ditching crew.

After the trench is dug, the spoolable pipe is deployed from a hydraulically powered spooling frame and is pulled into the trench by heavy equipment such as a backhoe. The process of installing the pipe in the ditch is very swift. A full reel can usually be deployed within one hour. Some example reel lengths are as follows:

- 2.5” pipe = 2,743 m per reel
- 4.5” pipe = 1,372 m per reel

Because the fiberglass spoolable pipe is flexible, a less precise, faster to make and lower-cost trench can be used without padding or expensive preparation.

Metallic end fittings, or pipe-to-pipe joints for longer lines, are affixed to the pipe with simple hand tools by the manufacturer’s technician or an installer certified by the manufacturer. The pipe fittings are made from alloy steel, and nickel coated for corrosion protection. Specialised fittings such as stainless, arctic grade and other types are available on request. No resins or bonding are required to make-up the mechanical fittings used on Fiberspar spoolable pipe, and makeup time per fitting is typically less than 30 minutes. The pipe fittings do not leak or fail when used in Burst certification tests.

**Fiberspar Linepipe in Corrosive Service**

One of the main drivers behind companies installing SGRE is its immunity to corrosion. This includes resistance to substances such as:

**Aromatic Hydrocarbons:** In Australia a large number of oil and gas pipelines contain aromatic hydrocarbons. The design of Fiberspar LinePipe means that it is well suited to these applications. The HDPE acts as a barrier layer to contain the fluid inside the pipe, and does not contribute structurally. The GRE layer is where LinePipe derives its pressure retaining ability, and it is this layer that provides the product strength. This is in contrast to other composites or Reinforced Thermoplastics (RTPs) where the internal and external layers are loaded as part of the pipe body construction and connector interface.

**CO₂:** Fiberspar LinePipe has a long history of use in the transportation of carbon dioxide (CO₂). The majority of these lines have been when the CO₂ is in a gas phase, but there are also numerous lines in operation with high pressure dense phase CO₂. This dense phase fluid can be problematic for rigid GRE
pipe as it attacks the resin and causes bruising, which in turn can cause failure. The HDPE layer on SGRE prevents this problem from occurring.

**H₂S**: Sour oilfield streams are incredibly common in some parts of the world, and SGRE has a long service history operating with high concentrations of H₂S.

### Fiberspar Spoolable Pipe

<table>
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<tr>
<th>Specification</th>
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<tr>
<td>Standard Pipe Pressure Ratings</td>
<td>750, 1500 and 2500 psi</td>
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<tr>
<td>Standard Nominal Pipe Size</td>
<td>2.5” – 6.5”</td>
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<tr>
<td>Temperature Ratings</td>
<td>60°C and 82°C (95°C product undergoing final testing)</td>
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<td>Common Fluids Carried</td>
<td>Oil, Gas, Water, CO₂, H₂S, Aromatic streams etc.</td>
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<td>Certification and Design per</td>
<td>API 15HR, API 15S, CSA Z662</td>
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<td>Certification Manufacturing</td>
<td>ISO-9001</td>
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<td>Installation Rate</td>
<td>4 to 5 reels/day (e.g., 4.5” pipe at 5 km/day)</td>
</tr>
<tr>
<td>Installation Methods</td>
<td>Trench, Pull through (rehabilitation), Bore, Plough</td>
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</table>

The widespread conversion of field lines to SGRE by operators in North America is based on clear cost savings and quality assurance at every step of the manufacturing, installation and operations process.

In Australia, the first 50-km Fiberspar line has just been installed for a customer in the Cooper Basin. This flowline will be operating at 75°C and contain 25% aromatic hydrocarbons. It is likely that there will be additional benefits due to the remote nature of many installations and the shortage of skilled resources and equipment. These additional benefits include:

- **No welding required**: Scarcity of skilled welding personnel, especially in remote regions, is a significant drawback to steel pipes in Australia. Fiberspar requires no welding. Fittings, which are typically few in number, are completed with simple hand tools.

- **Cost competitive for all 8-in. pipe or smaller**: Dual lines often laid for 8-in. equivalent.

- **Remote access**: Minimal use of heavy equipment required.

- **Faster installation**: Days/weeks instead of months; two to three times faster installation than stick fiberglass or steel.
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