



# Corrosion Resistant Fiberglass Piping Systems

For Oil & Gas Applications



## NOV Fiber Glass Systems

Headquartered in San Antonio, Texas, NOV Fiber Glass Systems is the leading worldwide manufacturer of fiberglass reinforced epoxy (GRE) products used for onshore and offshore corrosion control in a variety of low to high pressure oilfield applications. NOV Fiber Glass Systems brings over 60 years of experience in the oil and gas sector with its offering of the most highly recognized and respected brands in the industry. These brands include STAR™ and Fiberspar™ for high-pressure line pipe and downhole tubing and casing applications as well as Red Thread™ and Bondstrand™ for low-pressure applications.

### Line Pipe

STAR, Red Thread HP and Bondstrand

Jointed Line pipe for oil and gas production is manufactured in sizes ranging from 1½” through 42” (40 to 1050 mm) diameters and will handle pressures from 150 psi (1.0 MPa) to 3,500 psi (24.1 MPa) depending on size and temperatures up to 212°F (100°C).

The high pressure products are typically used to transport highly corrosive produced water and CO<sub>2</sub> gas from an oil field’s central station to injection wells. Additionally, line pipe is used in lower to medium pressure oil and gas flow lines where corrosive flows are encountered.

The epoxy resin systems offered include aliphatic amine, aromatic amine, and anhydride curing agents and each provides slightly different chemical and temperature resistance. Fiberglass reinforcement provides the structural strength. NOV Fiber Glass Systems line pipe is manufactured to a minimum design life of 20 years at rated temperature and pressure according to ASTM D2992 Procedure B and industry standards, such as API 15HR and 15LR.

### Benefits

Corrosion Control

Resists corrosion caused by CO<sub>2</sub>, H<sub>2</sub>S and saltwater. Requires no protective coating.

Reduced Line Pipe Installation Cost

Light and easy to handle. Less personnel and equipment needed during installation.

Improved Flow Capacity

Smoother interior pipe surface increases efficiency and resists scale/paraffin build-up.

### Fiberspar

Fiberspar LinePipe is a Spoolable product (LPS) that consists of an inner thermoplastic pressure barrier that is reinforced by high-strength glass fibers embedded in an epoxy matrix. LPS is intended for corrosive gathering and injection applications including general and sour produced fluids and gases. LPS is available with high-density polyethylene or high temperature polyethylene pressure barriers with temperature ratings to 140°F (60°C), 180°F (82°C) and 203°F (95°C), respectively. The result is high pressure pipe available in continuous lengths of up to 9,000 ft (2,743 m) immune to corrosion.

- Our products are designed with Service Factors for Water, Oil and Gas in full compliance with API RP 15S, API 15HR and CSA Z662. Fiberspar is the first spoolable offering to comply with all three standards.
- **Temperature:** Our new XT product line offers you the highest temperature rating available in the spoolable line pipe market, up to 203°F (95°C)
- **Pressure:** You can now expand your use of spoolable line pipe with our extended pressure ratings up to 3,500 psi (24.1 MPa).
- **Flow Rate:** We offer you the largest selection of size and flow rate capabilities of any spoolable line available, allowing precise, straightforward selection of the needed product, avoiding unnecessary extra cost for over-designed or the dangers of under-designed piping systems.

### Applications

- Flow Lines or Injection Lines
- Transfer Lines or Disposal Lines
- Tank Battery Piping
- Fire Water Lines
- Oil
- Natural Gas Production
- High Pressure CO<sub>2</sub> and Salt Water Injection
- Crude Oil, Salt Water, H<sub>2</sub>S
- Light Chemicals:
  - Salts
  - Solvents
  - pH 2-13 Solutions





## Downhole Tubing and Casing

### STAR

NOV Fiber Glass Systems is the leading downhole GRE producer in the industry due to its unique proprietary fiberglass layering sequence, which provides superior tensile performance. Tubing is offered in 1½” through 9½” diameters (40 mm to 250 mm) with pressure ratings from 1,000 to 3,500 psi (6.9 to 24.1 MPa). Casing products range in size from 1½” through 9½” diameter (40 mm to 250 mm) with pressure ratings from 1,000 to 3,250 psi (6.9 to 22.4 MPa). The STARWell design program will assist in selecting the correct product based on tensile and collapse conditions.

NOV Fiber Glass Systems offers GRE downhole tubing and casing products produced with three distinct curing agents that withstand temperatures up to 212°F (100°C). All products come in standard nominal joint lengths of 30 ft (9.1 m). The company’s downhole products are used in a variety of highly corrosive applications such as saltwater and CO<sub>2</sub> injection wells, for corrosion control, in observation wells for monitoring formations where steel can interfere with monitoring equipment and in producing wells where steel products corrode easily.

### STARWell

The NOV Fiber Glass Systems well simulation analysis program was developed to analyze actual well conditions so that the correct tubing products can be recommended to the customer. Often a series of conditions will be evaluated using the worst and best case scenarios, thereby assuring the customer that the product will give years of trouble-free service.

### Fiberspar

In 2011, NOV Fiber Glass Systems introduced a spoolable lift system for downhole applications up to 3,500 ft (1,067 m) depth. This revolutionary system is aimed at artificial lift operations, mainly the rapid and simple deployment of electrical submersible pumps. This system has the potential to eliminate the use of workover and drilling rigs, reduce the time required to deploy and replace pumps, and change the performance profile required from electrical submersible pumps while significantly lowering production and artificial lift installation and operating costs. The system utilizes SmartPipe which incorporates embedded power conductors into the body of the pipe, eliminating the need for externally banded cable, a major source of damage and failure.

#### Simple Design

- Tubing sizes from 1½” to 2” (40 mm to 50 mm)
- Pressures up to 3,500 psi (24.1 MPa)
- Horizontal well de-liquification with sequential lift technology
- High strength couplings for easy installation of pumps and fittings to standard tubing hangers
- Eliminates corrosion, tubing joints, and sucker rods

#### Benefits

- Safer installation due to less equipment and fewer people on location
- Significant increase in production
- Reduced installation and operating costs
- Rapid deployment from over 20 strategically located deployment centers.

## Improved Downhole Make & Break Performance ACT Tubing

The ACT connection provides superior downhole performance, tighter thread tolerances, less breakout torque, less thread wear, higher thread shear, and unique axial and balanced hoop reinforcement.

## Applications

- Disposal or Injection Tubing
- Production Tubing (ESP, Gas Lift or Rodd Pump)
- Casing Liners
- Chemical Waste Disposal
- Geothermal
- Slotted Production Liners
- Observation Well Casing
- Open Hole Casing, Zone or to Surface

## Line Pipe Products & Connections

Products	Connection	Size Range	Pressure*	Temperature
STAR High Pressure Line Pipe	Advanced Composite Thread (ACT) API 5B EUE 10rd or 8rd	1½"-8" (40-200 mm)	500-3,500 psi (3.5-24.1 MPa)	Up to 212°F (100°C)
	Precision Ground Thread (PGT) API 5B 8rd	2"-8" (50-200 mm)	500-3,000 psi (3.5-20.7 MPa)	Up to 212°F (100°C)
STAR Super Seal STAR Super Seal High Pressure	Mechanical O-Ring (SS) (2 threads per inch)	8"-12" (200-300 mm)	500-1,250 psi (3.5-8.6 MPa)	Up to 200°F (93.3°C)
	Mechanical O-Ring (SS HP) (2 threads per inch)	6"-12" (150-300 mm)	1000-3,000 psi (6.9-20.7 MPa)	Up to 212°F (100°C)
	Modified ACME O-Ring (CEN) (4 threads per inch)	2"-3" (50-80 mm)	500 psi (3.5 MPa)	Up to 212°F (100°C)
	Round Form O-Ring (SP) (4 threads per inch)	2"-4" (50-100 mm)	750-2,500 psi (5.2-17.2 MPa)	Up to 212°F (100°C)
	Buttress O-Ring (SPH) (4 threads per inch)	4"-6" (150-300 mm)	500-2,250 psi (3.5-15.5 MPa)	Up to 212°F (100°C)
Red Thread HP	Threaded and Bonded (T.A.B.) Bell & Spigot (Matched Taper)	2"-42" (60-1,050 mm)	232-435 psi (1.6-3.0 MPa)	Up to 210°F (99°C)
Bondstrand	Bell & Spigot (Matched Taper) Coil Lock and Key Lock	2"-40" (50-1,000 mm)	150-3,000 psi (1.0-20.7 MPa)	Up to 210°F (99°C)
Fiberspar	Spoolable LinePipe LPS	2"-6" (50-165 mm)	750-3,500 psi (5.2 - 24.1 MPa)	Up to 203°F (95°C)

\* Contact NOV Fiber Glass Systems if higher pressure are needed.

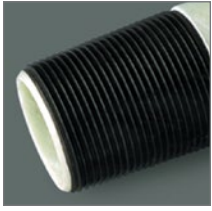
## Downhole Systems

Products	Size	Pressure	Temperature
STAR Tubing	1½"-9½" (40-250 mm)	3,500 psi (24.1 MPa)	Up to 212°F (100°C)
STAR Casing	1½"-9½" (40-250 mm)	3,250 psi (22.4 MPa)	Up to 212°F (100°C)
STAR Shallow Well Tubing	1½"-2½" (40-75 mm)	1,500 psi (10.3 MPa)	Up to 150°F (65.6°C)
Fiberspar Downhole Tubing	1½"-2" (40-50 mm)	3,500 psi (24.1 MPa)	Up to 180°F (82°C)

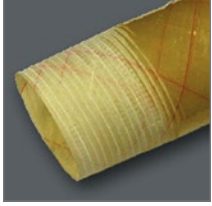


Awarded the FIRST API Q1 and API 15HR approval for the manufacture of high pressure fiberglass pipe.

## Connections



**Advanced Composite Thread (ACT)** connection is manufactured with a special composite consisting of epoxy, graphite, and ceramic. These materials with a Teflon® base lubricant or proprietary sealant, and the consistent tolerances of ACT, provide exceptional sealability to high pressure fluids and gases with excellent make-up and break-out performance. The molded ACT provides higher thread shear and chemical resistance and is preferred over cut or ground fiberglass threads for downhole tubing.



**Taper/Taper** adhesive bonded matched joints are the primary system used for Red Thread HP and Bondstrand piping systems. The pipe is supplied with one end belled and one end tapered. Epoxy adhesive is used to secure the joint. For 2"-6" diameter (50-150 mm) Red Thread HP pipe, factory supplied ends, have special profile double lead threads for quick reliable assembly.



**CEN** is a 4-thread per inch modified ACME thread (non-sealing) joint that seals with an O-ring seal fitted within a groove in the male end. It is used primarily in low pressure flow line or transfer applications in pressures from 500 psi (3.5 MPa) and temperatures up to 212°F (100°C).



**Fiberspar LinePipe** connectors seal on the interior of the pipe with elastomeric seals (3) and mechanically grip into the fiberglass laminate of the pipe wall for a permanent connection, not prone to loss of strength due to "creep" typically associated with joints attaching to a thermoplastic layer. Connectos are easy to install using common hand tools and can be reused since no crimping or swaging is done. Fiberspar connectors have a design safety factor of more than four times the pipe operating rating.



**SP/SPH** joints are 4 threads-per-inch with round form (SP) or buttress (SPH) profiled sealing threads. A secondary seal is provided by an o-ring gasket fitted within a groove in the male end. This exceptionally user friendly connection is used in high pressure applications up to 2,500 psi (17.2 MPa) and temperatures up to 212°F (100°C).



**Precision Ground Thread (PGT)** is produced with numerically controlled grinding equipment and the tolerances provided by PGT require only the use of Teflon base lubricant or proprietary sealant for make-up. The PGT connection is manufactured according to the industry standard EUE 8rd or OD 8rd thread, as is the case for the ACT thread described in the upper left



**STAR Super Seal (SS, SS HP)** is a fast, reliable, all-weather and self-restrained mechanical o-ring seal. O-rings are standard Nitrile for normal applications up to 212°F (100°C).

## Quality

The NOV Fiber Glass Systems commitment to quality extends throughout the company and supplier network. All products are closely monitored during production and thoroughly tested. Quality standards are strictly enforced and reinforced with production employee incentives and quality audits. Third party inspections are a normal occurrence at NOV Fiber Glass Systems. The API Q1 Quality Rating is a requirement for approval by API 15HR and API 15LR. The quality and performance requirements of API assure the customer that, not only do we have a quality system, but they also receive a product qualified and approved for performance standards. Our adherence to this internationally recognized quality system is another indication of our commitment to our global role as a manufacturer of the highest quality GRE products.

## Service

Field support during the installation of the product is an integral part to ensure the reliability and long-term, worry-free performance of your piping system. NOV Fiber Glass Systems offers complete training and inspection service for all products throughout the world. The availability of trained personnel at the job site leads to a more successful installation.

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