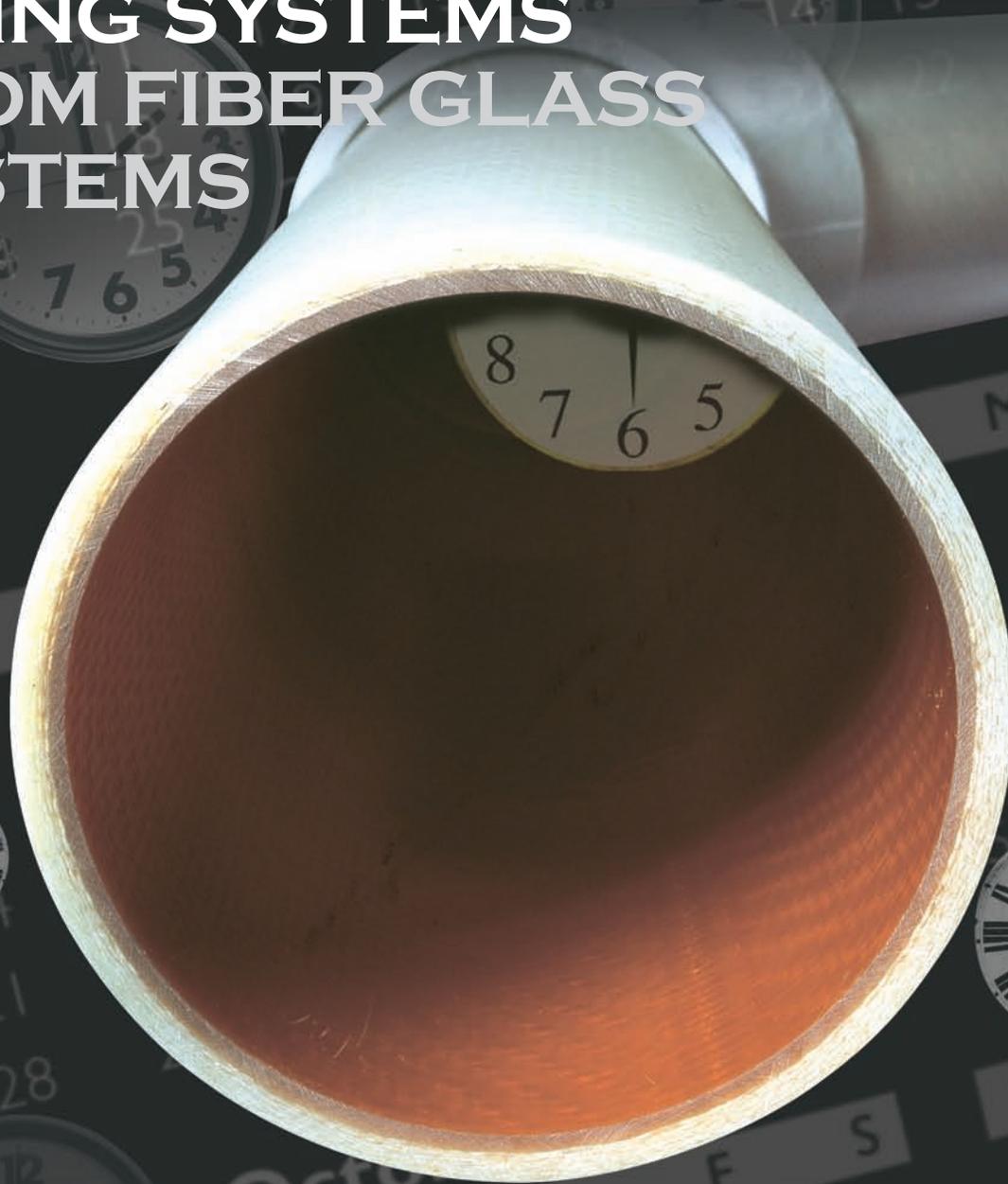


TIME-TESTED FIBERGLASS PIPING SYSTEMS FROM FIBER GLASS SYSTEMS



NOV Fiber Glass Systems™

FIBER GLASS SYSTEMS

Worldwide Leader in Composite Piping

We call our Fiber Glass Systems (FGS) reinforced piping systems “time tested” because they have been proving their durability and value in harsh environments and unforgiving applications for decades. In fact, we’re closing in on our 60th anniversary, and some of our buried fuel-handling installations have been in the ground for almost 40 years.

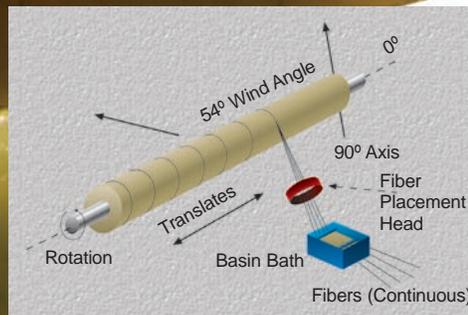
In addition to extensive experience in designing, engineering, manufacturing, fabricating, and installing piping systems for caustic chemicals, abrasive slurries, hot temperatures, and high pressures - as well as less abusive forms of service - we offer these credentials:

- ▶ A long list of “firsts,” including world’s first composite pipe manufacturer; first North American pipe manufacturer to earn ISO 9001 certification; first U.S. pipe manufacturer to achieve API Q1 status; first listed non-metallic pipe for fuel handling.
- ▶ ISO 9001:2000 quality assurance at both of our production facilities - in Little Rock, Arkansas, and Sand Springs, Oklahoma, featuring nearly 400,000 square feet of combined manufacturing space.
- ▶ The broadest, most comprehensive product selection available (we’re the only manufacturer producing both filament wound and centrifugally cast piping) and a worldwide network of stocking distributors.
- ▶ A wide range of products meeting performance standards established by the principal maritime, industrial, governmental, military, and independent testing authorities (see back cover).
- ▶ Fiber Glass Systems, L.P. (FGS) combines the resources of Star Fiberglass and Smith Fibercast. With five manufacturing facilities in North America and two in the Far East, FGS offers a wide range of products to meet most piping needs.
- ▶ The multibillion-dollar global resources of our parent company, National Oilwell Varco - the leader in high-performance oilfield equipment and advanced drilling and well-servicing technologies, with more than 20,000 employees in 40 countries.

Resins, Compositions, and Sizes for All Applications

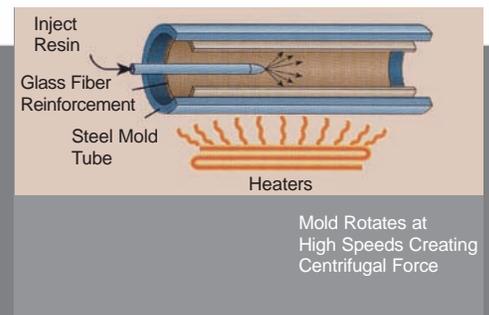
As the pages that follow will reveal, FGS piping systems employ a variety of epoxy and polyester resins and, where necessary, corrosion barriers to achieve the optimum performance characteristics for virtually any application. Temperature capabilities to 275 degrees Fahrenheit. Pressure capabilities of up to 4,000 pounds per square inch or more. Diameters from 1 inch to 72 inches. And our unique ability to produce pipe by either filament winding or centrifugal casting allows us to best match pipe to the requirements of your specific application.

Six joining systems (page 7) and a wider selection of fittings than you'll find available for any other piping material, including steel, ensure precision installation, optimum system performance, and unbeatable ease of assembly.



Filament Winding Process

Resin-impregnated glass fibers are wound onto a mandrel in a predetermined pattern under controlled tension. Repeated passes create a strong layered wall of the desired thickness. This process results in a pipe that is at least 75% glass-reinforced for optimum internal pressure capability.



Centrifugal Casting Process

Woven glass fiber (or fabric) in a motor-driven steel tube is saturated with resin while the tube rotates at high speed. Centrifugal force displaces air from the resin and glass, producing a dense, void-free laminate. Fiber reinforcement in both the hoop and axial directions affords excellent thermal expansion and beam-bending properties.

Epoxy Piping Systems

When selecting a fiberglass piping system, operating temperature and chemical resistance usually dictate the appropriate resin system. Epoxy resins perform best in the presence of caustics, solvents, brines, petroleum products, and certain acids. Proprietary epoxies offer the highest temperature ratings, 275 degrees. Aromatic-amine cured epoxies offer ratings up to 250 degrees Fahrenheit. Aliphatic-amine cured epoxies have temperature ratings up to 200 degrees.

Visit www.fgspipe.com or contact your distributor to obtain our Chemical Resistance Guide (E5615). For applications not listed in the guide, or for those involving multiple chemicals, contact Fiber Glass Systems for assistance.



Z-Core®

Capable of handling high concentrations of corrosive acids, alkalis, and solvents; exceeds the corrosion resistance of lined steel and alloys.

Centricast Plus® RB-2530

Recommended for most caustics, salts, solvents, and many acids and chemical process solutions; can also handle many abrasive slurries.

Centricast® RB-1520

Primary uses include chemical process solutions, solvents, acids, caustics, and salt solutions.

Green Thread®

Especially suitable for dilute acids and caustics; hot-water and condensate return.

Red Thread® II

Extensively used for water and saltwater handling, CO₂, crude oil, natural gas, and light chemical services including salts, solvents, and pH 2-13 solutions that corrode traditional metallic piping systems.

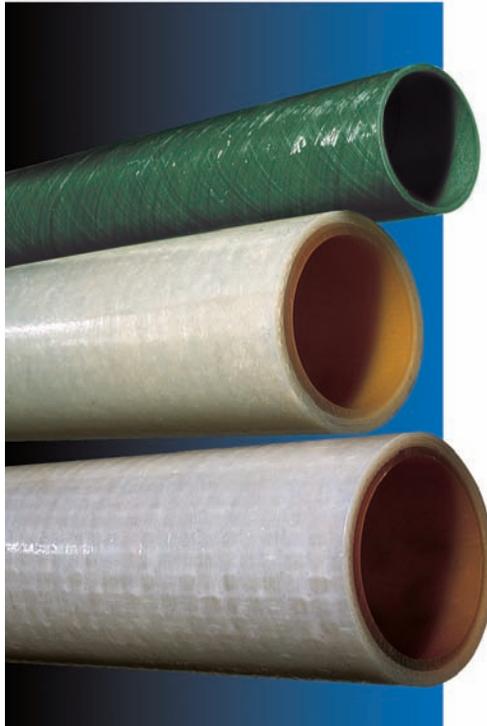
Red Thread® IIA

UL 971 Listed primary and secondary piping systems for all UL identified fuels, including 100% ethanol or methanol; compatible with bio-diesel and E85.

Pipe	Size Range (in.)	Resin	Pressure Rating (psig)	Inner Corrosion Barrier Thickness (in.)	Temperature Rating	Joint Types	RTRP Classification (ASTM D2310)	Product/Installation Manuals
Centricast Z-Core	1 - 8	Premium Epoxy	150 - 275	.100	275F/135C	Socket	RTRP-21CO	A2115/F6080
Centricast Plus RB-2530	1 - 14 Epoxy	Aromatic Amine	125 - 300	.100	250F/121C	Socket	RTRP-21CW	A1380/F6080
Centricast RB-1520	1½ - 14 Epoxy	Aromatic Amine	125 - 300	.050	250F/121C	Socket	RTRP-21CW	A1280/F6080
Green Thread	1 - 36	Aromatic Amine Epoxy	225 - 450	.015 - .030	225F/107C	Bell & Spigot	RTRP-11FF	A1300/F6000
Red Thread II	2 - 3 4 - 24	Aromatic Amine Epoxy	225 - 450	Resin Rich	210F/100C	T.A.B.™ or Bell & Spigot	RTRP-11AF RTRP-11AH	A1200/F6000
Red Thread IIA	2 - 4	Aromatic Amine Epoxy	125 - 250	Resin Rich	150F/65C	T.A.B.™	UL971	B2101/B2160

Vinyl Ester Piping Systems

Vinyl ester resin systems provide outstanding performance in mineral acid, chlorine, and oxidizing-agent applications. Premium vinyl ester systems handle temperatures as high as 225 degrees Fahrenheit.



F-Chem®

Custom piping - ideal for strong mineral acids and bleaching solutions and many chemical waste streams. Premium and fire retardant resins available.

Centricast Plus® CL-2030

Recommended for strong acids, chlorine, oxidizing agents, and chemical mixtures.

Centricast® CL-1520

Used extensively for a wide range of process solutions including acids, chlorine, and oxidizing agents.

Pipe	Size Range (in.)	Resin	Pressure Rating (psig)	Inner Corrosion Barrier Thickness (in.)	Temperature Rating	Joint Types	RTRP Classification (ASTM D2310)	Product/Installation Manuals
F-Chem	14 - 72	Polyester Vinyl Ester	50-150	.020 - .250	250F/121C	Spigot, O-Ring Flanged Butt & Wrap	RTRP-12EU	A1515/F6080
Centricast Plus CL-2030	1 - 14	Vinyl Ester	125 - 300	.100	200F/93C	Socket	RTRP-22BS	A1580/F6080
Centricast CL-1520	1½ - 14	Vinyl Ester	125 - 300	.050	200F/93C	Socket	RTRP-22BT	A1480/F6080

Secondary Containment

Fiber Glass Systems offers several solutions for handling environmentally sensitive chemical applications.



Two piece secondary containment fittings are available in 3"-16" for primary pipe sizes up to 14". The system is designed for maximum field flexibility, ease of installation and the ability to use one size larger containment.

When higher pressure, larger diameter or severe temperature changes are required, Fiber Glass Systems can provide special fittings to handle the added requirements.

Specialty Piping Systems

Fiber Glass Systems completes the gamut of piping requirements with a variety of special-purpose systems offering unsurpassed performance, longevity, and cost-saving value.

Visit www.fgspipe.com or contact your distributor to obtain our Chemical Resistance Guide (E5615). For applications not listed in the guide, or for those involving multiple chemicals, contact FGS Smith Fibercast for assistance.



Ceram Core®

For applications requiring heavy-duty abrasion resistance, including bottom ash, dredge lines, wet process slurries, heavy salt slurries, and more.

Silver Streak®

Provides medium-duty abrasive resistance for flue-gas desulfurization scrubber applications such as limestone and gypsum slurries, and similar uses.

Marine/Offshore

Green Thread products for the gamut of applications, including firewater systems, cooling systems, drain lines, dry-deluge fire piping, column piping, process water, potable water, ballast piping, sounding tubes, and vent lines.

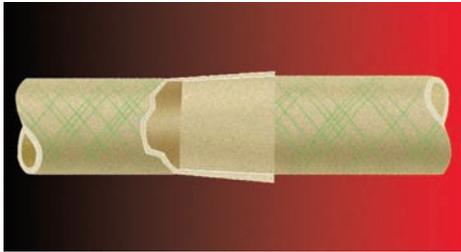
Star High Pressure

Up to 4,000 psi internal pressure capability for injection, flow, and gathering lines in crude-oil, natural gas, saltwater, and freshwater applications; and corrosive oil field service including CO₂ and H₂S.

Pipe	Size Range (in.)	Resin	Pressure Rating (psig)	Inner Corrosion/ Abrasion Barrier Thickness (in.)	Temperature Rating	Joint Types	RTRP Classification (ASTM D2310)	Product/ Installation Manuals
Ceram Core	6 - 16	Epoxy	100 - 225	.130	200F/93C	Flange	RTRP-11CF	A1700/F6460
Silver Streak	2 - 48	Epoxy	150	.070	225F/107C	Bell & Spigot, Flanged	RTRP-11FF	A2000/F6000
Marine/Offshore								
Green Thread 175	2 - 24	Epoxy	175	.020	200F/110C	Socket, Bell & Spigot	RTRP-11FW	C3800/F6300
Green Thread 250	1 - 24	Epoxy	250					
Green Thread 250F	2 - 24	Epoxy with Intumescent Coating	250					
Star High Pressure*	1½ - 8	Anhydride, Aliphatic Amine, or Aromatic Amine Cured Epoxy	500 - 4,000	Resin Rich	200F/100C	8-Round, SFT, Mechanical O-Ring, Star Super Seal	RTRP-11AF @ 200F	Call Factory*

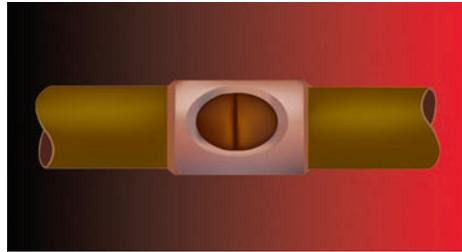
* Available through Fiber Glass Systems, A National Oilwell Varco Company, San Antonio, Texas, www.starfiberglass.com.

Joining Systems



Bell & Spigot

A matched-taper joint secured with epoxy adhesive. Stronger than the pipe itself, in both internal-pressure and axial-tension capability. Resists movement, facilitating joining long runs of pipe without waiting for the adhesive to cure. Can be used with 1-inch to 24-inch pipe diameters.



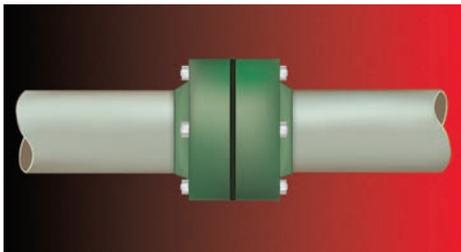
Socket

Positive stop lands simplify precise makeup of complex piping configurations. For pipe diameters of 1 inch to 14 inches.



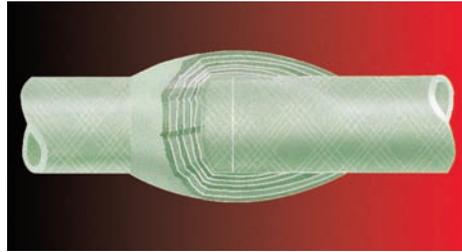
T.A.B.™

The ultra-reliable FGS threaded and bonded joining system. Double-lead threading ensures an extra secure adhesive connection during installation. Available for 2-inch through 6-inch pipe diameters (larger sizes available by special quotation).



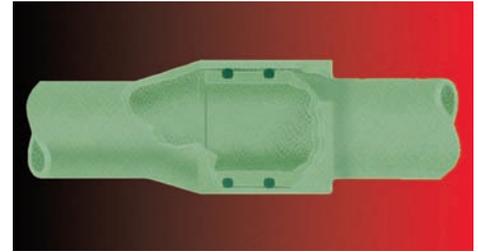
Flanged

Available for all piping systems and diameters; factory assembled or shipped loose for assembly in the field. Self-aligning flanges for Ceram Core systems ensure proper alignment of inside diameters for optimum wear resistance.



Butt & Wrap

Plain-end pipes or pipe and fittings butted together and wrapped with multiple layers of resin-saturated mat or woven roving. Can be used with all piping systems and diameters.



O-Ring Bell & Spigot

Mechanical, O-ring sealed joint, especially useful for buried installations. Available for 10-inch through 72-inch diameters, with the choice of either single or double O-rings in most sizes.

Fiber Glass Systems Support

To help ensure timely, trouble-free, and above all economical installations of time-tested Fiber Glass Systems piping systems, we offer unrivaled customer support to go with our unrivaled product lineup. Call FGS for full information about all of the following and more:

- Turn-key design and engineering assistance
- On-site installation training by Fiber Glass Systems field technicians
- Free FGS piping-design CD-ROM programs for the Chemical & Industrial, Marine-Offshore, and UL-Listed Fuel Piping markets; including the *Success by Design* engineering program, complete with pipe specifications and chemical guidelines (also available for download from our Web site)
- Factory fabrication services to reduce field joints and installation costs
- The worldwide network of FGS stocking distributors and certified fabricators



Product Certifications

Fiber Glass Systems offers a wide range of products to meet the specifications of these and other distinguished regulatory entities.

Call for information about the time-tested piping products available to fulfill your project's compliance requirements.

- Achilles Joint Qualification Systems
- American Bureau of Shipping (ABS)
- Alberta Boilers Safety Association (ABSA)
- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Water Works Association (AWWA)
- ANSI/NSF Standard 61 Listed (UL)
- ASTM International
- Det Norske Veritas (DNV)
- Factory Mutual (FM)
- Germanischer Lloyd
- Korean Register
- Lloyd's Register
- Technical Standards & Safety Authority (TSSA)
- Underwriters Laboratories (UL/ULC)
- United States Coast Guard (USCG)
- United States Department of Defense (Military Specifications)
- United States Food & Drug Administration (FDA)



ANSI/NSF 61
Drinking Water System
Components 35GH
Water Contact Temp: 23C

WATER QUALITY



15LR-0004
LICENSEE
Contact
Fiber Glass
Systems for
licensed products.



Germanischer Lloyd



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 **Fiber Glass Systems™**

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