



Fiberglass Structural Engineering, Inc.



FRP SPECIALIST



Serving international industry with consulting engineering and inspection in composite materials applications since 1976 ❖

Fiberglass Reinforced Plastic

- ❖ Large Dia. Seawater & Cooling Water Piping
- ❖ Underground Firewater Pipe
- ❖ Storage Tanks
- ❖ Chemical Piping
- ❖ Process Vessels and Scrubbers
- ❖ Gravity Chemical Drains (PAD's, etc.)
- ❖ Circulation Water Piping
- ❖ FGD Chimney Liners, Ducting, Slurry Piping

Fiberglass Structural Engineering, Inc. (FSE) is an internationally known consulting engineering inspection and testing firm, specializing exclusively in corrosion resistant **fiberglass reinforced plastic (FRP)** equipment and piping for industrial applications. Based in the United States, FSE serves end-user owners and EPCM companies on domestic and international industrial projects. FSE increases Owner value and confidence, and enhances EPCM technical assurance. Operating independently from vendors and fabricators, FSE provides the Owner's Project Team with unbiased FRP engineering and third party inspection. FSE is qualified and experienced in the specialized requirements of composite materials – both in structural design, and in third-party quality assurance inspection.

FSE specializes in FRP structural design engineering, inspection and testing. We do not provide general discipline engineering or inspection services. FSE is the largest known FRP Specialist consulting firm in North America. We have been providing integrated technical assurance support services to the international industrial community since 1976.

When structural reliability and corrosion resistance are important for mission critical piping and tanks, fiberglass-reinforced plastics will continue to be the material of choice.

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- ❖ FRP Specifications
 - ❖ Constructability/ Feasibility Review
 - ❖ Descriptive Design
 - ❖ FRP Technical Bid Evaluation Assistance
 - ❖ Design Submittal Review
 - ❖ Pipe Stress Analysis
 - ❖ QA Inspection (fab shop & site)

Industrial projects are increasingly selecting FRP for their corrosion resistant equipment and piping needs. When structural reliability and corrosion resistance are important for mission critical piping and tanks, fiberglass-reinforced plastics will continue to be the material of choice. FRP is a specialized material made with specialized manufacturing processes, encompassing both commodity and custom products. Fiberglass Structural Engineering provides the expertise and experience necessary to assure Owners and Project Teams that their FRP products are produced with appropriate quality and are compliant with project specifications and requirements. FSE technical assurance results in least cost, technically acceptable FRP equipment and piping that is fit for the intended service and will provide years of reliable performance.

Avoid the cost and schedule risks of trusting your project to FRP vendor designs and quality – Add Fiberglass Structural Engineering to your Project Team's technical assurance today!

FRP EQUIPMENT AND PIPING EXPERIENCE FOR INDUSTRIAL APPLICATIONS

- Petrochemical Complexes and Process Units
 - ◆ Large diameter seawater and cooling water piping (aboveground and underground)
 - ◆ Underground firewater piping
 - ◆ Chemical piping and drains
 - ◆ Process Area Drains (PAD systems)
- Refineries
 - ◆ Process Area Drains (PAD systems) and other chemical and utilities piping
 - ◆ Underground firewater systems
 - ◆ Calciner off-gas ducting, scrubbers and stacks
 - ◆ Reverse Osmosis / Demineralized, boiler-feed water piping systems
- Oil/Gas Offshore Production:
 - ◆ Seawater ballast and cooling water lines
 - ◆ Process area drains and sewers
 - ◆ Firewater lines (special resin systems used)
- Electric Power Generation Plants (coal-fired, natural gas combined cycle, and nuclear)
 - ◆ Large volume cooling/circulation water piping (underground and above ground)
 - ◆ FGD (flue gas desulfurization) ducting, scrubbers, JBR's, stack liners and breeching
 - ◆ Electrostatic Precipitator Bodies (ECP's)
- LNG (Regasification, and Gas-to-Liquids)
 - ◆ Re-Gas ORV (Open Rack Vaporizer) seawater piping and headers
 - ◆ Large diameter seawater and cooling water piping (aboveground and underground)
 - ◆ Underground firewater piping
 - ◆ Process Area Drains and other utilities piping
- Oil Field Production
 - ◆ CO₂ gas gathering systems
 - ◆ Brackish water injection piping, produced water piping, and down-hole tubing
- Refined Petroleum Product Marketing
 - ◆ Underground gasoline storage tanks (UST)
 - ◆ Gasoline delivery piping
 - ◆ Vapor recovery systems in terminals
- Pulp and Paper Mills
 - ◆ Chemical process piping (stock and filtrate lines), and chemical waste sewers
 - ◆ Chlorine dioxide solution storage tanks, absorber and scrubber columns
 - ◆ Filtrate tanks
 - ◆ Stock towers
- Chemical Plants
 - ◆ Process piping
 - ◆ Chlorine headers
 - ◆ Chemical storage tanks
- Municipal Wastewater Treatment Plants
 - ◆ Sodium hypochlorite and sodium hydroxide storage tanks
 - ◆ Foul air ducting
 - ◆ Air scrubbers and carbon-filled odor removal towers (ORT's)
- Metals Processing Plants
 - ◆ Chemical storage and acid dump tanks
 - ◆ Electrolytic reaction cell liners
- Semiconductor Chip Fabrication Plants
 - ◆ Air scrubbers and chemical storage tanks
 - ◆ Ducting



Fiberglass Structural Engineering, Inc.

COMPANY PROFILE

SECTION 1: ORGANIZATION

Contact Information:

Fiberglass Structural Engineering, Inc.
316 E. McLeod Rd.
Bellingham, WA 98226
360.734.7040
1.800.800.7040
360.733.7905 fax
email: fse@FSE.com
website: www.FSE.com

Office locations:

Main Office – Bellingham, WA, USA (near Seattle, WA)
'FSE Arabia' Joint Venture Office: Dammam, Saudi Arabia

Staffing (variable):

Eleven (11) engineers (including principal engineers)
Twenty (20) inspectors and field operations personnel
Five (5) support personnel (Business Development, Accounting, Administration)

Company Ownership/ Management:

Privately owned United States Corporation, sole proprietor
Christopher J. Renoud, Owner and CEO
Winston J. Renoud, President

Established:

FSE was established in 1976 in Bellingham WA

Location providing deliverable FRP engineering, inspection, and materials testing services:

FSE Main Office and Testing Laboratory -- Bellingham, WA USA

Locations providing field-based inspection and engineering services:

FSE Main Office and Testing Laboratory -- Bellingham, WA USA
FSE Joint Venture Inspection Office – Kingdom of Saudi Arabia

SECTIONS 2: EXPERIENCE AND REFERENCES

BENEFITS OF USING FRP-SPECIALIZED SERVICES FROM FIBERGLASS STRUCTURAL ENGINEERING

Since 1976, FSE has provided specialized composites engineering and inspection support for mission critical FRP process equipment and piping throughout North American and international industry. FSE has added increased Owner value and confidence to FRP equipment fabricator designs by identifying errors, omissions, low safety factors, and non-conservative assumptions used for FRP physical properties. Fabrication and installation methods and procedures are examined for compliance with the latest and best industry standards and practices. An FSE-originated design or design adequacy review ensures that the equipment is designed for long-term, low risk service in actual operating conditions. Adding third-party FSE quality assurance inspections to the equipment shop fabrication and field installation ensures qualified independent verification of specifications and design conformance, and quality workmanship throughout the process. Regularly assessing the condition of existing FRP equipment, using experienced FSE preventive maintenance inspection, reduces maintenance and replacement costs and the threat to safety and reliability caused by unexpected equipment failure. Properly conducted and applied PM in conjunction with FSE PM inspection, will result in cost effective and reliable repair decisions, based on an accurate assessment of the equipment's actual condition and the rate at which that condition is changing.

- ◆ Professional references and FSE project case histories are available upon request.

Sections 3: Specialized FRP Consulting Services Available from FSE

- ◆ FSE-originated Detailed Descriptive Design Engineering
- ◆ Design Submittal Review Engineering
- ◆ Design Adequacy Review Engineering
- ◆ FRP Equipment and Piping Project Specifications (Descriptive, Performance, Line Class)
- ◆ FRP Pipe System Stress Analysis Engineering
- ◆ Finite Element Analysis (FEA/ FEM) and Design Engineering
- ◆ Third-Party Quality Assurance Inspection Services (fabrication & installation)
- ◆ Field Engineering and FRP Construction Management Services
- ◆ Fabricator and Field Joiner Pre-Qualification
- ◆ Preventive Maintenance Inspection & Evaluation
- ◆ Non-Destructive Testing & Evaluation
- ◆ Failure Investigation and Forensic Testing
- ◆ Corporate Guidelines & Specifications
- ◆ Technical Seminars
- ◆ Product Testing & Evaluation