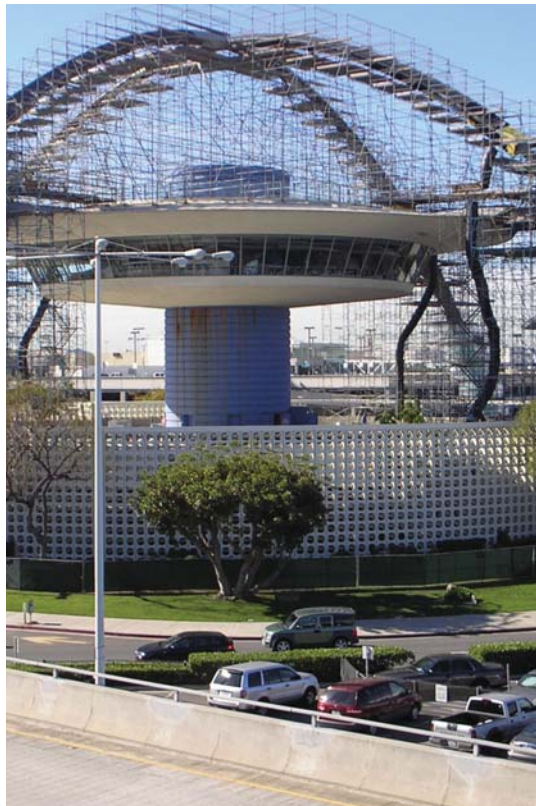


# TYFO<sup>®</sup> FIBRWRAP<sup>®</sup> SYSTEMS

*Specialized carbon, glass, aramid and hybrid fabrics combined with polymers for use in strengthening pipelines, structures and infrastructure*





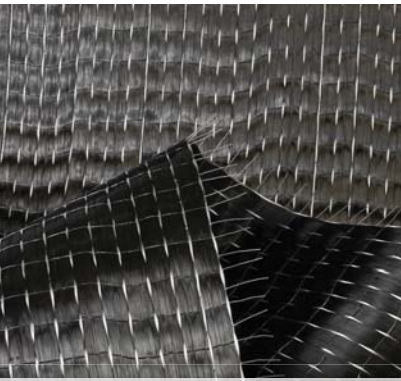
The primary products within the Tyfo® Fibrwrap® systems are:



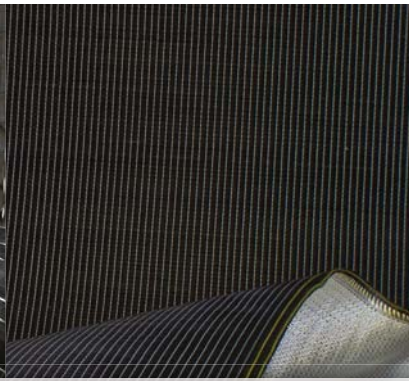
Tyfo® BC system  
Bi-directional glass composite ( $\pm 45^\circ$ )



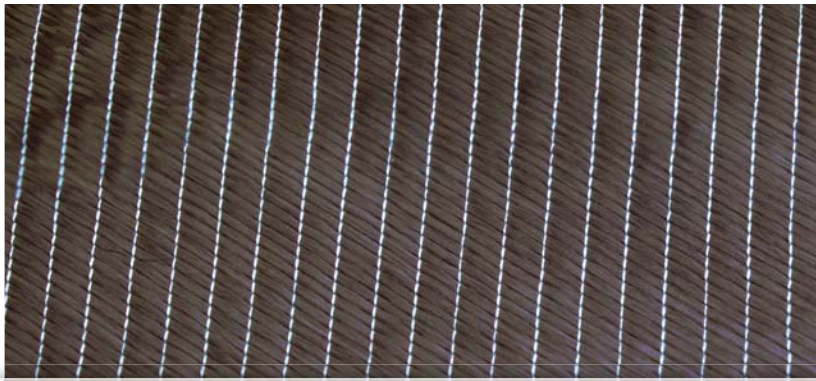
Tyfo® SEH systems (including Tyfo® SEH-51A and Tyfo® SEH-25A)  
Glass composite systems



Tyfo® SCH systems  
(Tyfo SCH-41, Tyfo® SCH-41-2x)



Tyfo® SCH systems  
(Tyfo® SCH-Mark IV and Tyfo® SCH-Mark V)



Tyfo® BCC system  
Bi-directional carbon composite ( $\pm 45^\circ$ )



Tyfo® WEB system  
Bi-directional glass composite ( $0^\circ/90^\circ$ )



Tyfo® UC Strip (pre-formed) systems  
FRP laminate strips

## The Tyfo® Fibrwrap® system restores the integrity of aging pipelines, structures and infrastructure.

Over time, the stresses of daily wear take their toll on pipelines, bridges, tanks, buildings and other structures. Fyfe Company develops and designs materials that strengthen, repair and restore these deteriorating structures—sometimes to better-than-new condition.

Founded in 1988 to strengthen failing bridge columns using aerospace materials, Fyfe was a pioneer in the fiber-reinforced polymer (FRP) structural strengthening industry. We are today a world leader in designing and manufacturing Tyfo® Fibrwrap®, a system of specialized carbon, glass, aramid and hybrid fabrics, which we combine with polymers to strengthen a wide range of masonry, concrete, steel and wooden structures. The Tyfo® Fibrwrap® system may also be used to rehabilitate piping systems.

Our staff includes engineers, designers, material specialists, material manufacturers and project support personnel who work together to develop and design turnkey solutions for structural problems and provide technical support to engineers, contractors and owners in the following markets:

- Pipelines
- Structures
- Infrastructure

### **We are an Aegion company**

Fyfe is part of Aegion Corporation, a global leader in infrastructure protection and maintenance that provides proprietary technologies and services to protect against the corrosion of industrial pipelines. The company also rehabilitates and strengthens water, wastewater, oil, gas and mining piping systems, as well as buildings, bridges, tunnels and waterfront structures. Aegion utilizes integrated professional services in engineering, procurement, construction, maintenance and turnaround services for a broad range of energy-related industries.



# PIPELINES



Installation and completion of the Tyfo® Fibrwrap® system

## Pipeline markets served:

- Municipal
- Industrial
- Nuclear/fossil fuel/power generation
- Oil and gas



## PIPE REHABILITATION

When a large-diameter pre-stressed concrete cylinder pipe (PCCP, LCP and ECP), reinforced concrete pipe (RCP), steel, ductile iron, cast iron, FRP or other types of pipe suffer from corrosion or another form of decay, they can experience significant structural loss. The Tyfo® Fibrwrap® system strengthens structurally deficient pipes and enables them to accommodate all internal loads (i.e. operating, transient, thrust and vacuum pressures) and all external loads (i.e. traffic, soil, groundwater and temperature).

The Tyfo® Fibrwrap® system is a fiber-reinforced polymer (FRP) that can be bonded to either the inside or outside of pipes. Designed to resist all internal and external pressure, the Tyfo® Fibrwrap® system meets NSF/ANSI Standard 61 certification requirements, has a design life of 50 to 100 years, and is an accepted structural rehabilitation method in the municipal, oil and gas and power industries.

The use of the Tyfo® Fibrwrap® system for structural renewal of buried pipe is a widely accepted repair technology due to its structural performance and many construction benefits, including point repairs, power piping system repairs, trenchless application, NSF certification, low impact to community, improved flow characteristics, watertightness, design life, small construction footprint and cost competitiveness.

### The Tyfo® Fibrwrap® system provides solutions for:

- Structural strengthening/ pipeline renewal
- Leak repair
- Joint rebuilding and repair
- Operating pressure increase
- Corrosion mitigation

We complete turnkey repairs **quickly**, **with limited service disruption** even during emergency shutdowns.



# STRUCTURES



## STRUCTURAL STRENGTHENING

Whether a structure has lost its original design strength, must be reinforced to support new loads or guard against earthquakes and other natural disasters, solution to provide the necessary structural strength.

The Tyfo® Fibrwrap® system has been successfully tested and applied to circular and rectangular columns as well as to a wide range of reinforced concrete, masonry, wood and steel structural elements.

### Today, our system is used for:

- Seismic retrofit
- Non-intrusive/rapid repair
- Concrete restoration
- Adaptive reuse
- Increased load capacity

## Commercial and Industrial Applications

When the activity inside a factory or other industrial building changes, so can its structural support needs. Our solutions can be used to add strength to existing walls, beams, slabs and columns to support the addition of everything from high-capacity filing systems, computer servers and topping slab material to HVAC equipment or heavy machinery. We can also provide the structural reinforcement needed when bays are removed to allow for the addition of new openings or when residential buildings are retrofitted for commercial use.

The Tyfo® Fibrwrap® system can be used to strengthen structures that no longer have their original design strength due to construction errors, corrosion or increased loading. Specialized Tyfo® composite anchors can also be designed to address specific project requirements. In addition, our Tyfo® product line includes fire-rated finishes for both Class 1/Class A flame and smoke as well as for a 2-hour to 4-hour rating (UL listings available).





Prefabricated blast walls for new air traffic control tower





#### Our blast mitigation solutions can be used for:

- Progressive collapse (tie-force method and alternate load path)
- Overpressure mitigation
- Close-in blast resistance
- Wind-blown object resistant overlay (tornado missile protection)
- Fire protection

The Tyfo® Fibrwrap® system may be used for blast mitigation on the following structural elements: walls, columns, beams, slabs and beam-column connections. Prefabricated blast panels for new construction are also available.

### BLAST MITIGATION

Sometimes it is necessary to install blast systems that protect structures from the effects of industrial or other blast scenarios. We have performed structural retrofits that included the design and installation of the Tyfo® Fibrwrap® system and other Tyfo® solutions to provide force protection for both governmental (i.e. courthouses, airports, army barracks, embassies and military bases) and industrial (i.e. control rooms, manufacturing, refining and power generation) facilities.

The Tyfo® Fibrwrap® system can be used to **protect buildings** from the effects of industrial or other types of blasts.



## SEISMIC RETROFIT

When bridges, buildings, columns and other infrastructure fail in an earthquake, many lives can be endangered. To help mitigate these risks, the Tyfo® Fibrwrap® system is designed to provide the additional strengthening necessary to these structures.

### Our FRP solutions can be used for strengthening:

- Diaphragm shear
- Rectangular and circular columns
- Beam and slabs, including both shear and flexure strengthening
- Reinforced concrete and unreinforced masonry walls
- Beam/column joints
- Drag struts and collectors

We have used these solutions to successfully complete **more than 3,000 seismic retrofits and general strengthening projects.**



## HIGH-PERFORMANCE COATINGS

Aging structures sometimes need more than structural reinforcement. We offer high-performance coatings for fire protection, blast mitigation, UV protection, corrosion prevention, chemical exposure protection and aesthetic coatings that provide post-repair architectural finishes.

The Tyfo® Fibrwrap® system can be used in conjunction with these coatings to meet the requirements of each individual project.

### Our solutions include:

**Flame and smoke coating** – Tyfo® RR can be used alone or as a coating for the Tyfo® Fibrwrap® system to achieve a Class 1/Class A flame and smoke rating per ASTM E84.

**Fire protection** – FRP strengthening for additional gravity loads often require a 2- to 4-hour fire rating for the FRP system. The UL listed Tyfo® AFP and CFP products satisfy these requirements. See next page for more information on fire protection coatings.

**Drinking water applications** – Tyfo® PWC is an NSF Standard 61 listed coating for use in potable water applications.

**UV protection** – Tyfo® U is a urethane coating with low VOC content to give excellent UV protection and durability. Tyfo® A provides structures with an acrylic coating finish.

**Architectural finishes** – Tyfo® RR, a UL-approved, Class 1 ASTM E84 flame and smoke spread coating, is available in limestone, sandstone and a variety of artistic finishes. Tyfo® HS is a final coating that can be tailored to match the existing concrete for historic and other structures.

## INDUSTRIAL FACILITIES

Because of its high strength-to-weight ratio and ease of installation, the Tyfo® Fibrwrap® system is ideal for strengthening industrial structures. As it can be easily installed around existing equipment and instrumentation, construction of time-sensitive repairs can be completed with minimal impact to operations, significantly shortening shutdown times.

### Our FRP and other solutions meet a wide range of industrial needs:

- Structural upgrades
- Seismic strengthening
- Blast mitigation
- Corrosion repair
- High performance coatings
- Concrete repair
- Rapid shutdown turnaround



## FIRE PROTECTION

We offer a variety of coatings for our Tyfo® Fibrwrap® systems:

**Tyfo® CFP** – Tyfo® CFP is one of the lowest profile fireproofing systems available for application over FRP. The thin and environmentally durable application is spray-applied and can be installed for up to a 4-hour rating on vertical and overhead assemblies. Used to provide an hourly structural rating for the Tyfo® Fibrwrap® system during a fire, the system calls for a layer of VG Primer and Dash Coat to be applied to the installed Tyfo® Fibrwrap® system. The required thickness of Tyfo® WR-AFP is then applied to meet the UL/ULC design requirements.

**Tyfo® AFP** – Tyfo® Advanced Fire Protection (AFP) is used to provide an hourly structural rating for the Tyfo® Fibrwrap® system during a fire. Like Tyfo® CFP, the system requires a layer of VG primer and dash coat to be applied to the installed Tyfo® Fibrwrap® system. The required thickness of Tyfo® VG is then applied to meet the UL/ULC design requirements. Tyfo® EI-R is a unique coating which is spray-applied over the VG to complete the assembly.

**Tyfo® FC/F Fire-Resistant System** – The Tyfo® FC/F fire-resistant system is applied in combination with the Tyfo® Fibrwrap® system. Tyfo® FC/F is an ambient cure, two-part system comprised of the Tyfo® FC base coat and Tyfo® F top coating, which provides a 2-hour rated system per ASTM E119 and a Class 1/Class A flame and smoke per ASTM E84.

**Tyfo® 4HFL Fire-Resistant System** – Tyfo® CR, FC base coat and IM systems are applied in combination with the Tyfo® Fibrwrap® system to create a 4-hour fire-resistant system. The 4HFL system is typically less than ¼" thick.

**Tyfo® RR System** – Tyfo® RR system can be used in combination with the Tyfo® Fibrwrap® system as an assembly to provide a Class 1 /Class A flame and smoke spread rating as per ASTM E84.



# INFRASTRUCTURE

## BRIDGE STRENGTHENING

Initially developed for seismic strengthening of bridge columns, the Tyfo® Fibrwrap® system has since been used to strengthen bridges all over the world. It has undergone rigorous structural and durability testing to gain acceptance for use by transportation departments and ministries worldwide.

**The Tyfo® Fibrwrap® system has been used on bridges to:**

- Increase load rating
- Complete seismic retrofit
- Repair impact damage
- Extend service life

**Completed installations include:**

- Historic arch bridges
- Pedestrian flyovers
- Construction error remediation
- Corrosion repair and protection



## COASTAL AND MARINE PROJECTS

The corrosive nature of seawater can damage marine and waterfront structures, destroy their aesthetics or render them unable to support the machinery, equipment and other loads they were designed to carry.

We are leaders in retrofitting these types of reinforced concrete, wood and steel structures using our Tyfo® Fibrwrap® advanced composites, which rehabilitate and preserve existing structural elements.

We employ innovative, state-of-the-art techniques with solutions for installing structural upgrades both above and below the surface of the water. Our solutions include the versatile prefabricated Tyfo® PR jacket, which is used to encase caissons and other waterfront structures using our underwater curing epoxies.

Corrosion protection is essential for waterfront structures, especially those located near saltwater. We not only repair existing damage, but also protect these structures against future exposure to corrosive elements. Our solutions for erosion and scour protection, seismic upgrades and live load enhancements can be used to extend the life of:

- Piers and ports
- Wharfs
- Timber, concrete and steel piles
- Coastal residences
- Splash zone structures







# INNOVATION

Our Tyfo® Fibrwrap® system and other products have been tested and proven at hundreds of independent universities and accredited private labs throughout the world. These tests include structural, durability, corrosion, blast mitigation and fire-resistance studies. Environmental durability research, simulating 50 to 100 years of service life, has also been conducted on the Tyfo® Fibrwrap® system and other products. In addition to these extensive laboratory tests, the Tyfo® Fibrwrap® system has performed as designed in major urban earthquakes in Taipei, Los Angeles, Seattle, San Salvador and China. The result is reliable composite strengthening systems that have demonstrated intended design performances time and time again.

Both destructive and non-destructive in nature, tests included full-scale structural testing for a variety of design goals, long-term environmental durability and insitu testing of actual installations.

Fyfe Company continues to innovate and develop products to meet the needs of the markets and clients we serve. Our in-house research and development team is committed to leading and improving the structural strengthening market.



Fyfe Company's focus on innovation has led to the sophisticated Tyfo® Fibrwrap® system, a specialized and unique combination of fabrics and resins that create tested and proven composites. Our Tyfo® Fibrwrap system has a successful performance record with more than 25 years of use. Extensive testing as well as successful performance during seismic events on three continents prove the reliability of the Tyfo® Fibrwrap® system.

Since 1985, the Tyfo® Fibrwrap® system has undergone **more than 500 structural and material tests** to prove its effectiveness and durability.





# CERTIFIED INSTALLERS

Fyfe Company partners with certified specialty contractors to install the Tyfo® Fibrwrap® system. Fibrwrap Construction, Inc., Fyfe's preferred contractor, provides training and certification to other installers throughout the world. Our certification program requires contractors to identify the individuals in their company who will be trained, and who will also receive the certificates from Fyfe Company. These certificates must be renewed annually.

Fibrwrap Construction professionals are experienced at working in industrial environments, including refineries, water treatment plants, mills, nuclear power plants and manufacturing sites. Our stringent safety plan surpasses the toughest governmental and industrial standards. With the protection of our team's health and safety at the forefront, we maintain one of the best safety records in the industry, according to OSHA standards.

Our Fibrwrap Construction crews are experienced in both plural component spray-applied and trowel-applied systems. They are also highly trained and certified to apply high-performance coatings.

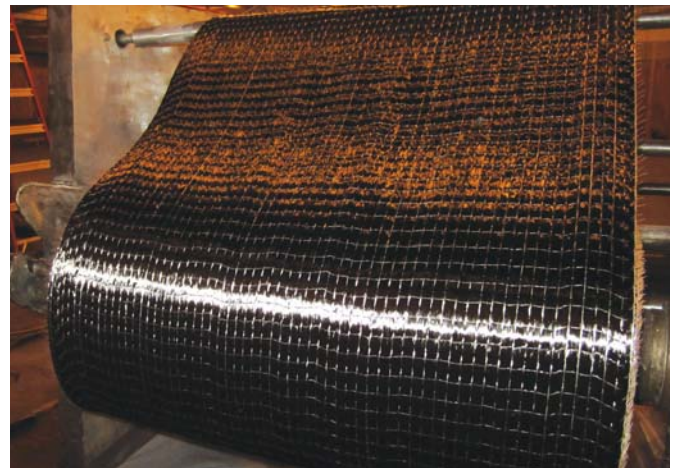
## COMMERCIAL AND INSTITUTIONAL

We have performed structural repairs to many commercial and institutional facilities, including some of the most prestigious universities and commercial structures worldwide. Our use of cutting-edge installation techniques and materials result in rapid project completion and minimal disruption to students, faculty, tenants and owners. Whether we are working at a university library or a popular theater, our goal is always to complete the required task while remaining as minimally disruptive as possible.

### Our preferred solutions:

- Can be installed without a facility shutdown
- Are lightweight and have limited effect on facility operations
- Have minimal impact on building aesthetics

Over the past decade, our certified applicators have **completed structural retrofits and repairs on more than 3,000 government projects**, including work at military bases, hospitals, office buildings, schools, courthouses, stadiums and embassies.





Stronger. Safer. Infrastructure.™

Aegion protects against the corrosion of industrial pipelines, rehabilitates wastewater and water pipelines and maintains and constructs mission-critical equipment and facilities in the oil and gas industry.

Aegion's three business platforms are dedicated to pipe and infrastructure protection.

### INFRASTRUCTURE SOLUTIONS

Our proven technologies provide a superior alternative for the rehabilitation and strengthening of municipal and industrial pipelines, as well as public and commercial infrastructure worldwide.

### CORROSION PROTECTION

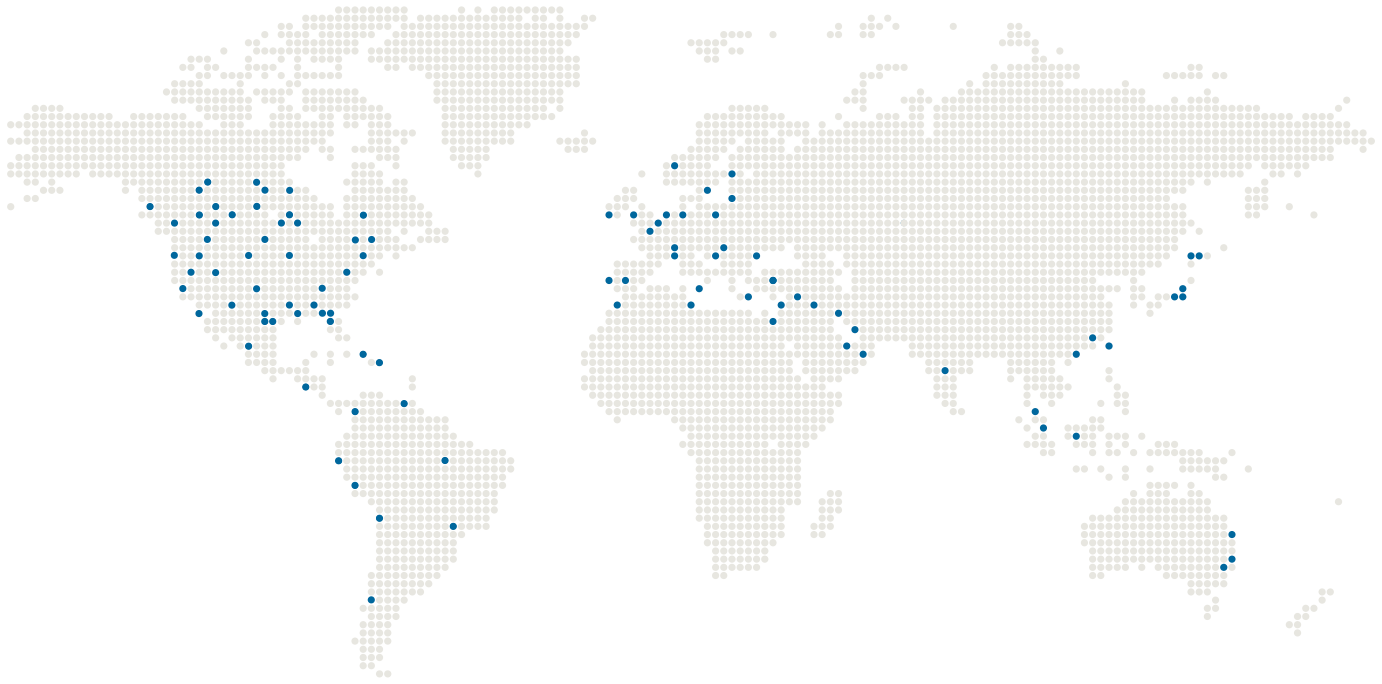
We safeguard the world's oil, gas and mining resources, including the integrity of the pipelines and other structures that transport and store them.

### ENERGY SERVICES

With a best-in-class safety culture, we deliver engineering, procurement, construction maintenance and turnaround services to oil and gas facilities.







## Aegion companies operate across the world.

The Aegion family of companies can be found where we are most needed, onshore and offshore, in big cities and remote locations throughout the world. With operations across the United States, Canada, South America, Europe, Australia, the Middle East and Asia-Pacific, we work in geographic markets where demand for our products and services is strong.

**AEGION HEADQUARTERS**  
 World Headquarters  
 United States  
 Missouri – St. Louis  
 636.530.8000

**INFRASTRUCTURE SOLUTIONS**

**FIBRWRAP**

**HEADQUARTERS**  
 1400 E. Orangethorpe Ave.  
 Fullerton, CA 92831  
 909.390.4363

**AREA HEADQUARTERS**

**Fibrwrap Canada**  
 81 Golden Drive, Unit 110A  
 Coquitlam, British Columbia  
 Canada, V3K 6R2  
 604.945.5429

**FYFE**

**HEADQUARTERS**  
 3940 Ruffin Road, Suite C  
 San Diego, CA 92123  
 858.642.0694

**AREA HEADQUARTERS**

**Canada**  
 81 Golden Drive, Unit 110A  
 Coquitlam, British Columbia  
 Canada, V3K 6R2  
 604.945.5429

Fyfe Asia  
 Singapore  
 6 Clementi Loop  
 #04-00  
 Singapore 129814  
 65.6898.5248

Fyfe Latin America  
 Calle Los Bambues No. 16 Col.  
 San Francisco, San Salvador  
 El Salvador, C.A.  
 503.2223.6098

**INSITUFORM**

**HEADQUARTERS**  
 Missouri – St. Louis  
 636.530.8000

**CORROSION PROTECTION**

**BAYOU**

**HEADQUARTERS**  
 Louisiana – New Iberia  
 337.369.3761

**CCSI**

**HEADQUARTERS**  
 Texas – Conroe  
 936.539.3294

**CORRPRO**

**HEADQUARTERS**  
 Texas – Houston  
 800.422.7878

**CRTS**

**HEADQUARTERS**  
 Oklahoma – Tulsa  
 917.877.5210

**UNITED PIPELINE SYSTEMS**

**HEADQUARTERS**  
 Colorado – Durango  
 970.259.0354

**ENERGY SERVICES**

**BRINDERSON**

**HEADQUARTERS**  
 California – Los Angeles  
 (Costa Mesa)  
 714.466.7100

# Aegion Corporation

Aegion Corporation is a global leader in infrastructure protection and maintenance, providing proprietary technologies and services to protect against the corrosion of industrial pipelines, to rehabilitate and strengthen water, wastewater, energy and mining piping systems and buildings, bridges, tunnels and waterfront structures and to utilize integrated professional services in engineering, procurement, construction, maintenance and turnaround services for a broad range of energy-related industries.

*For more information please contact:*



Fyfe Co. LLC  
United States  
3940 Ruffin Road, Suite C  
San Diego, CA 92123  
858.642.0694  
[www.fyfeco.com](http://www.fyfeco.com)



**Stronger. Safer. Infrastructure.™**

Aegion Corporation

17988 Edison Avenue  
St. Louis, MO 63005

[www.aegion.com](http://www.aegion.com)

636.530.8000