

**ICC-ES PMG Listing****PMG-1040**

Effective Date: March 1, 2011

*This listing is subject to re-examination in one year.*

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CSI: DIVISION: 22—PLUMBING  
Section: 22 13 16 Sanitary Waste and Vent Piping  
Section: 22 11 16 Domestic Water Piping  
DIVISION: 03—CONCRETE  
Section: 03 01 00—Maintenance of Concrete

Product: Tyfo® Pipe System

Listee: Fyfe Company LLC  
8380 Miralani Drive  
San Diego, California 92126  
[www.fyfeco.com](http://www.fyfeco.com)

Compliance with the following codes:

2009 *International Plumbing Code*® (IPC)  
2009 IAPMO *Uniform Plumbing Code* (IAPMO UPC)\*  
1997 *Uniform Plumbing Code* (UPC)

\**Uniform Plumbing Code* is a copyrighted publication of the International Association of Plumbing and Mechanical Officials.

Compliance with the following standards:

NSF/ANSI 61  
AC 125

Identification:

This listing applies to Tyfo® Pipe System components satisfying ICC-ES evaluation report number ESR-2103 which must be labeled, in accordance with the evaluation report and the approved quality control manual, with the Fyfe Company LLC name and address, product name, expiration date and the name of the inspection agency (Underwriters Laboratories Inc.). The ICC-ES evaluation report number (ESR-2103) must be placed on the listed product's packaging, and the ICC-ES PMG listing number (PMG-1040) must be placed on the installation instructions for the Tyfo® Pipe System.

Installation:

Installation must comply with ICC-ES evaluation report ESR-2103, the manufacturer's published installation instructions and the applicable codes. The finish coat must be Tyfo® PWC.

The Tyfo® Pipe System is an internally bonded carbon fiber reinforced composite (FRC) repair system with protective coatings used to rehabilitate prestressed concrete cylinder pipe (PCCP), reinforced concrete pipe and steel pipe with diameters of 30 inches (762 mm) or greater, in accordance with the manufacturer's proprietary process. The systems must be installed by installers trained and certified by the manufacturer.

**Models:** **Tyfo<sup>®</sup> Pipe System:** The system consists of one or more of the components listed below in accordance with the Fyfe Company quality control manual and the design manual, the installation instructions and the applicable code.

**Fabrics:** The SEH, SCH, WEB and BC fabrics are composed of either carbon or glass fibers.

**Tyfo<sup>®</sup> S Epoxy Matrix:** The Tyfo<sup>®</sup> S Epoxy Matrix is an ambient cure epoxy resin mix used to bind the fibers. Components A and B of the matrix are shipped in separate containers and must be mixed, at either the jobsite or the facility of the approved fabricator, at a volumetric ratio of 100:42 (A:B) for five minutes in a low-speed (400-600 rpm) mixer prior to application.

**Tyfo<sup>®</sup> SEH-51 (A) Composite:** In the primary direction (0°), the carbon fiber composite has a minimum ultimate tensile strength of 66 ksi (460 MPa), a minimum tensile modulus of 3036 ksi (20.9 GPa), and a corresponding elongation of 1.7 to 4.0 percent. Layer thickness is 0.05 inch (1.30 mm).

**Tyfo<sup>®</sup> SCH 41S(1) Composite:** In the primary direction (0°), the carbon fiber composite has a minimum ultimate tensile strength of 107 ksi (745 MPa), a minimum tensile modulus of 8900 ksi (61.5 GPa), and a corresponding elongation of 0.8 to 1.7 percent. Layer thickness is 0.04 inch (1.04 mm).

**Tyfo<sup>®</sup> SCH-41(2X) Composite:** In the primary direction (0°), the carbon fiber composite has a minimum ultimate tensile strength of 121 ksi (835 MPa), a minimum tensile modulus of 11,900 ksi (82 GPa), and a corresponding elongation of 0.8 to 1.7 percent. Layer thickness is 0.08 inch (2 mm).

**WEB Composite:** In both directions (0°/90°), the glass fiber composite has a minimum ultimate tensile strength of 35 ksi (247 MPa), a minimum tensile modulus of 2,240 ksi (15.4 GPa), and a corresponding elongation of 1.2 to 4.0 percent. Layer thickness is 0.01 inch (0.25 mm).

**Tyfo<sup>®</sup> BC Composite:** In both directions (±45°), the glass fiber composite has a minimum ultimate tensile strength of 32 ksi (223 MPa), a minimum tensile modulus of 2160 ksi (15.2 GPa), and a corresponding elongation of 1.2 to 4.0 percent. Layer thickness is 0.034 inch (0.86 mm).

**Tyfo<sup>®</sup> FC Base Coat:** The Tyfo<sup>®</sup> FC Base Coat is a two-component epoxy-based material. The components must be mixed at a volumetric ratio of 100:26 (A:B).

**Tyfo<sup>®</sup> F:** The Tyfo<sup>®</sup> F is a specifically formulated acrylic paint.

**Tyfo<sup>®</sup> PWC:** The Tyfo<sup>®</sup> PWC finish coat is a two-component epoxy-based material. The components must be mixed at a volumetric ratio of 100:44.4 (A:B) for five minutes in a low-speed (400-600 rpm) mixer prior to application. Tyfo<sup>®</sup> PWC epoxy is formulated for potable water contact and complies with Section 605 of the IPC, based on ANSI/NSF 61 for cold water applications 73.4°F (23°C). The material must be applied in two coats to a total dry-film thickness ranging from 10 mils to 19 mils (0.25 to 0.50 mm). Surfaces include concrete, masonry, steel or cured composites. All surfaces must be clean, dry and free of contaminants. Concrete, masonry and steel surfaces must be prepared by water-blasting, sandblasting or shot-blasting. Composite surfaces must be prepared by hand-sanding the surface to remove the gloss of the cured composite and then cleaning with water to remove residues. The cure interval between coats must be 24 hours. Final curing must be 24 hours at 40°F to 72°F (4°C to 22°C).

**Tyfo<sup>®</sup> RR:** Tyfo<sup>®</sup> RR is an acrylic-based liquid material with natural stone.

**Conditions of Listing:**

1. Installation must be performed by applicators or approved fabricators certified by Fyfe Company LLC.
2. Design and installation must be in accordance with this listing, the approved quality control manual, the design manual, and the applicable code. Copies of the quality control manual and the design manual must be submitted to the code official for each project using the system.
3. Special inspection must be conducted in accordance with the ICC-ES Acceptance Criteria for Inspection and Verification of Concrete and Unreinforced Masonry Strengthening Using Fiber-reinforced Polymer (FRP) Composite Systems (AC178), Appendix A of the approved quality control manual, and the applicable code.
4. Final coatings must be the Tyfo<sup>®</sup> PWC finish coat which NSF has certified as complying with ANSI/NSF 61 and this listing.
5. Tyfo<sup>®</sup> materials are manufactured by Fyfe Company LLC in San Diego, California, under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668) (Quarterly inspections must be carried out under the evaluation report program).