TYFO® SCH-41 COMPOSITE

using Tyfo® SW-1S Underwater Epoxy

DESCRIPTION

Tyfo® SCH-41 composite reinforcing fabric combined with SW-1S epoxy. Tyfo® SCH-41 is a custom weave, uni-directional carbon fabric. The carbon material is orientated in the 0° direction. Tyfo® SW-1S is a hydrophobic, underwater curing epoxy.

USE

Tyfo® SCH-41 Fabric is combined with Tyfo® epoxy material to add strength and ductility to bridges, buildings, and other structures, mainly for areas of moisture and underwater applications.

ADVANTAGES

- Excellent for underwater applications
- Good high & low temperature properties
- High elongation
- Ambient cure
- Rolls can be cut to desired widths prior to shipping

COVERAGE

Approximately 600 sq. ft. surface area with 3 to 4 units of SW-1S epoxy and 1 roll of Tyfo® SCH-41 Fabric when used with the Tyfo® Saturator.

PACKAGING

Order SW-1S epoxy in 4-gallon pre-measured units in 5-gallon (19L) containers. Order Tyfo® SCH-41 Fabric in 24" x 300 lineal foot (0.6 m x 91.4 m) rolls. Typically ships in 12" x 13" x 64" (305mm x 330mm x 1626mm) boxes.

EPOXY MIX RATIO

Tyfo® SW-1S 100.0 component A to 56.0 component B by weight. Tyfo® SW-1S 100.0 component A to 66.7 component B by volume.

SHELF LIFE

Epoxy – two years in original, unopened and properly stored containers.
Fabric – ten years in proper storage conditions.

STORAGE CONDITIONS

Store at 50° to 100° F (10° to 38° C). Avoid freezing. Store rolls flat, not on ends, at temperatures below 100° F (38° C). Avoid moisture and water contamination.

CERTIFICATE OF COMPLIANCE

- Will be supplied upon request, complete with state and federal packaging laws with copy of labels used.
- Material safety data sheets will be supplied upon request.

Typical Dry Fiber Properties

Property	Typical Test Value
Tensile Strength	550,000 psi (3.79 GPa)
Tensile Modulus	33.4 x 10^6 psi (230 GPa)
Ultimate Elongation	1.7%
Density	0.063 lbs./in.^{3} (1.74 g/cm^3)
Weight per sq. yd.	19 oz. (644 g/m^2)

Composite Gross Laminate Properties – Cured Dry

Property	ASTM Method	ACI 440.2R Properties[1]	Design Value[3]
Ultimate tensile strength in primary fiber direction, ksi	D3039	108	108
Elongation at Break	D3039	1%	1%
Tensile Modulus, ksi	D3039	13,790	10,020
Ultimate tensile strength 90 degrees to primary fiber, psi	D3039	0	0
Nominal Laminate Thickness	D1777	0.04 in. (1.0mm)	0.04 in. (1.0mm)

Composite Gross Laminate Properties – Cured Below Water

Property	ASTM Method	ACI 440.2R Properties[1]	Design Value[3]
Ultimate tensile strength in primary fiber direction, ksi	D3039	74	74
Elongation at Break	D3039	0.75%	0.75%
Tensile Modulus[2], ksi	D3039	13,410	10,000
Ultimate tensile strength 90 degrees to primary fiber, psi	D3039	0	0
Nominal Laminate Thickness	D1777	0.04 in. (1.0mm)	0.04 in. (1.0mm)

[1] Strength is defined as the mean strength (Cured Dry 143 ksi / Cured below water 130 ksi) minus 3 standard deviations. Modulus is defined as the reported mean modulus, and elongation is defined as the calculated strain from the design strength and modulus.
[2] Tensile modulus is defined as the 5th percentile value representing the 80% lower confidence bound of a 2 parameter Weibull distribution (ASTM D7290).
[3] Design values may require additional reduction factors based on expected exposure conditions, type of application, and design life assumptions.

Epoxy Material Properties at 75° F

Property	Tyfo® SW-1S
Mixing ratio, by wt.	100:56
Specific Gravity	1.1
Viscosity A & B mixed, cps	9,000 - 11,000
Gel Time, 65° F, hours	2.5 - 3.5
ASTM D695, 7 day compressive strength, psi	7,000 - 8,000
ASTM D695, 7 day compressive strength, mortar, psi 8,000 - 9,000 (Tyfo® SW-1: sand – 1:1 by volume)	8,000 - 9,000
ASTM D2240 Shore D hardness	80-85

Values presented are typical laboratory data.

HOW TO USE THE TYFO® SCH-41 WITH SW-1S COMPOSITE SYSTEM

DESIGN
The Tyfo® System shall be designed to meet specific design criteria. The criteria for each project is dictated by the engineer of record and any relevant building codes and/or guidelines. The design should be based on the allowable strain for each type of application and the design modulus of the material. The FyfeFRP LLC engineering staff will provide preliminary design at no obligation.

INSTALLATION
Tyfo® System to be installed by FyfeFRP LLC trained and certified applicators. Installation shall be in strict compliance with the FyfeFRP LLC Quality Control Manual.

SURFACE PREPARATION
The required surface preparation is largely dependent on the type of element being strengthened. In general, the surface must be clean, dry and free of protrusions or cavities, which may cause voids behind the Tyfo® composite. Column surfaces that will receive continuous wraps typically require only a broom cleaning. Discontinuous wrapping surfaces (walls, beams, slabs, etc.) typically require a minimum concrete surface profile (CSP-3) surface roughness to prepare for bonding. Sharp and chamfered corners will be rounded off by grinding or using an approved repair mortar. Tyfo® Composite Anchors are incorporated in some designs. The FyfeFRP LLC engineering staff will provide the proper specifications and details based on the project requirements.

MIXING
For pre-measured units in 5-gallon (19L) containers, pour the contents of component B into the pail of component A. For drums, premix each component: 100.0 parts of component A to 56.0 parts of component B by weight; Tyfo® SW-1S 100.0 component A to 66.7 component B by volume. Mix thoroughly for five minutes with a low speed mixer at 400-600 RPM until uniformly blended.

APPLICATION
Apply one prime coat of Tyfo® SW-1S epoxy on the substrate by using a roller. Saturate the fabric by feeding it through the Tyfo® Saturator or by approved hand methods (See the Tyfo® Saturator Manual). Prior to the application of the saturated fabric, fill any uneven surface. Saturate and apply subsequent layers of the fabric according to the Specifications and the Design Requirements. With the use of a roller or hand pressure, ensure proper orientation of fibers. Release or roll out entrapped air and ensure that each individual layer is firmly bedded and adhered to the preceding layer or substrate. Apply a final coat of Tyfo® SW-1(S) epoxy and detail all fabric edges, including butt splice, termination points and jacket edges.

PROTECTIVE COATINGS
In case of paint final coating, paint between 24 and 72 hours after final application of epoxy. If more than 72 hours after application, prepare the surface of the final coat of epoxy by light sandblast or hand sanding to slightly etch the surface.

LIMITATIONS
Minimum application temperature of the epoxy is 40° F (4° C). DO NOT THIN, solvents will prevent proper cure.

QUALITY CONTROL

PREPARATION
Visit site to ensure that all patch work is completed and cured. Review project specifications in details. Verify ambient and concrete temperatures. No work shall proceed if the temperature of the concrete surface being repaired is less than 40ºF (4ºC) or greater than 100ºF (38ºC). In case of discontinuous wrapping surfaces such as walls, beams, slabs, etc, the bonding strength to substrate (concrete or repair mortar) should be greater than 200 psi (1.38 MPa) (this shall be verified by pull-off strength tests according to ASTM D4541-95).

FIELD QUALITY CONTROL
Record batch numbers for fabric and epoxy used each day and note locations of installations. Measure square feet of fabric and volume of epoxy used each day.

SAMPLE PREPARATION
From a standard epoxy mix, saturate fabric according to specified fiber-resin ratio. On a smooth, flat, level surface covered with polyethylene sheeting, prime with epoxy resin. Prepare sample by placing two layers of saturated fabric with primary fibers oriented in the same direction. Apply additional topping of epoxy. Cover with plastic film and squeeze out all bubbles. Samples shall be stored in a sample box and not moved for a minimum of 48 hours after casting. A minimum of two samples shall be made daily. The two sample batches will be taken at appropriate times during the day.

LABORATORY TESTING
The samples shall be given to pre-approved testing laboratory. Samples are to be post-cured for 48 hours at 140ºF (60ºC) before testing. Testing shall be in accordance with ASTM D3039 and FyfeFRP LLC sample preparation and testing procedures.

CAUTION!

Do not thin or dilute Tyfo® SW-1S. Do not mix or apply below 40ºF (4ºC). Use only clean, oven dry aggregate to produce mortar. Tyfo® SW-1S is not designed to resist hydrostatic pressure from the negative side. Agitation of the product once under water should be minimized. When applying in a splash zone, protection should be provided from wave action until the product has reached initial cure (8-10 hours). Due to the many variables which can exist in underwater applications, a test application under job site conditions is recommended prior to the start of every project to evaluate both application techniques and adhesion properties.

COMPONENT A - Irritant:
Prolonged contact to the skin may cause irritation. Avoid eye contact.

COMPONENT B - Irritant:
Contact with skin may cause severe burns. Avoid eye contact. Product is a strong sensitizer. Use of safety goggles and chemical resistant gloves recommended. Remove contaminated clothing. Avoid breathing vapors. Use adequate ventilation. Use of an organic vapor respirator recommended.

SAFETY PRECAUTIONS
Use of an approved particle mask is recommended for possible airborne particles. Gloves are recommended when handling fabrics to avoid skin irritation. Safety glasses are recommended to prevent eye irritation.

FIRST AID
In case of skin contact, wash thoroughly with soap and water. For eye contact, flush immediately. For respiratory problems, remove to fresh air. Wash clothing before reuse.

CLEANUP
Collect with absorbent material, flush with water. Dispose of in accordance with local disposal regulations. Uncured material can be removed with approved solvent. Cured materials can only be removed mechanically.

TECHNICAL SERVICE
For application procedures or surface conditions not specified above, please contact FyfeFRP LLC.

SHIPPING LABELS CONTAIN
- State specification number with modifications, if applicable
- Component designation
- Type, if applicable
- Manufacturer's name
- Date of manufacture
- Batch name
- State lot number, if applicable
- Directions for use
- Warnings or precautions by law

KEEP CONTAINER TIGHTLY CLOSED. NOT FOR INTERNAL CONSUMPTION. CONSULT MATERIAL SAFETY DATA SHEET (MSDS) FOR MORE INFORMATION. KEEP OUT OF REACH OF CHILDREN. FOR INDUSTRIAL USE ONLY.

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V: 01.17.2024