

Product Data Sheet
Edition 7.26.2005
Identification no.
Sikadur Pier Restoration System

Sikadur Pile Restoration System

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| Description | The Sikadur Pile Restoration System is a multi-component system primarily comprised of Sikadur 35, Hi-Mod LV LPL mixed with a specified aggregate to create an epoxy mortar, placed or injected into a Fiberglass Reinforced Plastic (FRP) Pile Repair Sleeve. Products are used to wrap, encapsulate and protect damaged or deteriorated timber or concrete load-bearing piles. |
| Where to Use | <ul style="list-style-type: none"> • Use for the repair and structural strengthening of load-bearing timber and concrete piles that support elevated structures over wet (marine) or dry environments. • Use where it has been professionally determined that encapsulation of existing timber or concrete piles in epoxy mortar, is the appropriate method for restoring structural integrity. |
| Advantages | <ul style="list-style-type: none"> • System engineered to significantly reduce costs as compared to traditional removal and / or replacement of timber or concrete piles. • Lightweight system as compared to traditional concrete repair methods. • Viable method for protecting older pier structures, which support large superstructures. • Increases marine pile's resistance to tidal current, changes in sea level, and contact or collisions with floating debris, ice and sea-faring vessels. • Restores and protects timber piles that have been damaged by the proliferation and / or infestation of marine boring organisms (e.g. limnoria, teredo). • Seals timber and concrete piles, preventing further deterioration and / or corrosion of pile material components. • One-piece FRP Pile Repair Sleeves remain in place as permanent forms to protect the repaired pile. |
| Coverage | 3-gal (11.5 liter) unit when mixed with 100 lbs (45.5 kg) of specified aggregate; epoxy mortar yields approximately 1.4 cu. ft (0.04m ³) = 2,425 cu. in. (39,738 cm ³). |

Technical Data [Material and Curing Conditions @ 73° F (23°C) and 50% R.H.]

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| Shelf Life (Sikadur epoxy products) | 2 years in original, unopened containers | |
| Storage Conditions | Store dry at 40 - 95°F (4 - 35°C). Condition materials to 65 - 75°F (18 - 24°C) | |
| Color | Sikadur 35, Hi-Mod LV LPL neat – clear, amber Sikadur 35, Hi-Mod LV LPL epoxy mortar – light brown Sikadur Injection Gel / Sikadur AnchorFix-3 / Sikadur AnchorFix-4 (mixed) – gray | |
| Pot Life | Sikadur 35, Hi-Mod LV LPL neat or epoxy mortar (250 gram mass) - Approx. 65 minutes / (800 gram mass) – Approx. 60 minutes Sikadur Injection Gel / AnchorFix-4 (60 gram mass) – Approx. 30 – 35 minutes Sikadur AnchorFix-3 (60 gram mass) – Approx. 15 minutes | |

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| Compressive Strength (ASTM C-109) | | |
| Sikadur 35, Hi-Mod LV LPL (epoxy mortar) | dry cure @ 28 days, 73°F (23°C) | 13,500 psi (93 MPa) |
| | submerged cure @ 28 days, 45-60°F (7-15°C) | 9,000 psi (62 MPa) |

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| Tensile Strength (ASTM C-307) | ≥ 1,200 psi (8.3 MPa) |
| Flexural Strength (ASTM C-580) | ≥ 3,000 psi (20.7 MPa) |
| Hardness (ASTM D-2240) | ≥ 90 |

FRP Pile Repair Sleeve – Materials

Manufactured from general purpose, commercial grade, polyester thermosetting resin, containing no fillers and Type "E" glass with silane finish and styrene-soluble binder, minimum 30% glass content by weight

FRP Pile Repair Sleeve – Physical Properties

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| Barcol Hardness (ASTM D-2583) | 46 |
| Tensile Strength (ASTM D-638) | 20,700 psi (143 MPa) |
| Flexural Properties (ASTM D-790) | |
| Flexural Strength | 27,000 psi (186 MPa) |
| Flexural Modulus of Elasticity | 940 ksi (6,486 MPa) |
| Izod Impact Strength (ASTM D-4812) | 23 ft-lbs/in (1.3 N-m/mm) |
| Specific Gravity (ASTM D-792) | 1.47 |
| Water Absorption (ASTM D-570) | 1% maximum |
| Accelerated Weathering (ASTM D-4329) | |
| Alternating conditions: Fluorescent UV and Condensation | No change in gloss, no chipping, |
| Cycle under each condition for 4 hours each, total = 500 hours | flaking, cracking or oxidation |

Specify FRP Pile Repair Sleeves by Diameter, Length (Width, if sleeve is rectangular) and Wall Thickness



Packaging

- FRP Pile Repair Sleeves [by MFG Construction Products Company of Independence, KS at (800) 225-5634] are custom manufactured (i.e. diameters, lengths, thickness, etc.) per unique application requirements. When possible, FRP Pile Repair Sleeves are nested for convenient shipping and handling.
- Sikadur 35, Hi-Mod LV LPL – 3-gal (11.5 liter) units (mixed with specified aggregate to create epoxy mortar).
- 50 lb (22.7 kg) bags of specified aggregate (supplied by others, contact Sika Technical Services for further information).
- Sikadur Injection Gel – 4-gal (15.4 liter) units
- Sikadur AnchorFix-3 / Sikadur AnchorFix-4 (alternates to Sikadur Injection Gel) – 10.1 fl. oz. (300 ml) single-tube caulk-style cartridges with static mixers [carton of 12 cartridges (AnchorFix-3 only)], 22 fl. oz. (600 ml) side-by-side dual cartridges with static mixers (carton of 12 cartridges), 55 fl. oz. (1,625 ml) side-by-side dual cartridges, Hi-Flow static mixers sold separately (carton of 6 cartridges).
- CarboDur Rods (optional) – 1/4" (6 mm) available by the foot / 3/8" (9 mm) available in 20 ft. (6m) lengths
- Sikadur Pump-Aid (optional) – 5-gal units.

How to Use

Surface Preparation

Pile substrate surface must be clean and sound. Remove dust, laitance, grease, oil, tar, curing compounds, impregnations, waxes, foreign particles, disintegrated materials, loose unsound fragments, contaminated portions of substrate and any bond breaking materials prior to repair.

Timber Pile / Concrete Pile in Wet (Marine) Environment – Should be cleaned and prepared thoroughly to achieve a laitance and contaminant-free, open textured, sound surface by water-blasting, wire brushing or other equivalent mechanical means.

Timber Pile / Concrete Pile in Dry Environment – Should be cleaned and prepared thoroughly to achieve a laitance and contaminant-free, open textured, sound surface by blastcleaning (e.g. sand blasting, water-blasting), wire brushing or other equivalent mechanical means. Pile surface should be dust-free and dry prior to priming, positioning of FRP Pile Repair Sleeve and epoxy mortar placement. Prime prepared, dry surface of timber or concrete pile with neat Sikadur 35, Hi-Mod LV LPL.

FRP Pile Repair Sleeve

Preparation

FRP Pile Repair Sleeves are delivered with a peel-away, protective film that lines the interior walls of the sleeve. This protective film needs to be removed prior to sleeve preparation and positioning. Removal of protective film reveals a clean, textured surface that enhances the epoxy materials' ability to bond to the repair sleeve. After removal of the protective film, the interior walls of the repair sleeve should be kept clean and contaminant-free prior to positioning around pile and placement of epoxy mortar. If interior wall of FRP Pile Repair Sleeve becomes contaminated, a light, non-damaging mechanical preparation and / or solvent-wipe should be performed prior to positioning the repair sleeve around the pile.

Special FRP Pile Repair Sleeve Instructions

1. Prior to placement around pile, the attachment / installation of corrosion-resistant standoffs (e.g. spacers) are recommended to ensure that the FRP Pile Repair Sleeve is correctly centered on the pile. Corrosion-resistant standoffs also ensure the correct thickness of epoxy mortar is maintained within the annular space between pile and FRP Pile Repair Sleeve during placement (standoff hardware supplied by others).
2. Installation of optional foam gaskets (supplied by others) to create a tight seal at the bottom of a repair sleeve is performed prior to placement around the pile. Foam gaskets are adhered to the bottom inside perimeter at their contact points by applying a generous bead of mixed epoxy gel. Choice of either Sikadur Injection Gel, Sikadur AnchorFix-3 or Sikadur AnchorFix-4 may be used depending on contractor's required cure times, packaging and installation preferences.
3. The unique "Slip Joint Closure" feature of FRP Pile Repair Sleeves makes placement and positioning around pile easier for the installer, especially in marine environments where divers perform underwater work. Immediately prior to positioning repair sleeves around pile, a generous bead of mixed epoxy gel is applied along the length of the vertical "slip joint closure" seam. Choice of either mixed Sikadur Injection Gel, Sikadur AnchorFix-3 or Sikadur AnchorFix-4 may be used. This will provide a watertight seal at the seam and prevent epoxy grout leakage during placement. During actual positioning of the repair sleeve, the unique "slip joint closure" seam will also be mechanically fastened. Depending on the choice of sealing product, refer to application instructions for Sikadur Injection Gel / Sikadur AnchorFix-3 / Sikadur AnchorFix-4.

4. Position prepared FRP Pile Repair Sleeve around pile. FRP Pile Repair Sleeves are designed with a unique “slip joint closure” for ease of installation. It is recommended that the slip joint closure is sealed with an epoxy gel and mechanically fastened staggered pattern, using corrosion-resistant, # 14 x 1-1/2 in. stainless steel self-drilling screws (supplied by others). Screws are typically installed 3 in. (76 mm) on center. Epoxy gel used to seal vertical seam is allowed to cure prior to epoxy mortar placement.
5. Secure a sufficient number of 2 in. (50 mm) nylon reinforcing bands (supplied by others) around FRP Pile Repair Sleeve prior to placing mixed epoxy mortar. Reinforcing bands are installed at any height on the repair sleeve to accommodate pressures developed during epoxy mortar placement. Do not over-tighten! Over-tightening may cause distortion to the shape of the repair sleeve, potentially opening the seam and allowing epoxy mortar leakage. Reinforcing bands must remain in place during placement and until after the epoxy mortar cures.
5. When length of pile repair requires vertical stacking of more than one FRP Pile Repair Sleeve, sleeves should be ordered with a female, bell-type connection molded into one end. FRP Pile Repair Sleeves with optional splicing collar can also be ordered. Using mixed epoxy gel at the male / female bell connection will help affix the sections together and provide a seal to prevent epoxy mortar leakage during placement. Either mixed Sikadur Injection Gel, Sikadur AnchorFix-3 or Sikadur AnchorFix-4 may be used. This seal is supplemented by # 14 x 1-1/2” stainless steel self-drilling screws (supplied by others) installed around the perimeter of the repair sleeve.

Mixing General

For Sikadur epoxy products packaged in 3-gal or 4-gal units, pre-mix each component prior to mixing components together.

For cartridges of Sikadur AnchorFix-3 / Sikadur AnchorFix-4, appropriate and compatible static mixing nozzles are required. Ensure that a uniform blend of mixed epoxy components is achieved prior to applying adhesive to substrate. For additional information, refer to Technical Data Sheets for proper mixing recommendations of individual Sikadur epoxy products.

To prepare Sikadur 35, Hi-Mod LV LPL as a primer neat (Repairs in Dry Environment) – Premix each component. Proportion 1 part Component ‘B’ to 2 parts Component ‘A’ by volume into a clean pail. Mix thoroughly for 3 minutes with a low speed (400 – 600 rpm) rotary drill using a Sika paddle, “jiffy” paddle or caged mixing paddle until uniformly blended. Mix only that quantity that can be used within its Pot Life.

To prepare Sikadur 35, Hi-Mod LV LPL epoxy mortar – Pre-mix each component. Mix full 3-gal units in a clean vessel thoroughly for 3 minutes with a low-speed (400 – 600 rpm) rotary drill using a Sika paddle, “jiffy” paddle or caged mixing paddle until uniformly blended. Place mixed unit of Sikadur 35, Hi-Mod LV LPL into a mortar mixer. Begin blending mixed epoxy while slowly adding 100 lbs of specified, oven-dried aggregate for every mixed 3 gallons of Sikadur 35, Hi-Mod LV LPL. Continue to mix epoxy and aggregate together thoroughly for 3 to 5 minutes to achieve a uniformly blended epoxy mortar. Mix only that quantity that can be used within its Pot Life. Contact Sika Technical Services at (800) 933-7452 for further information on specified, oven-dried aggregate.

Application General

The procedures described herein are general suggestions and recommendations. The installer / contractor must refer to the appropriate contract specifications and documents for specific project requirements. It is the installer’s / contractor’s responsibility to integrate the suggested procedures outlined below consistently with specific project requirements. If additional information or assistance is needed, contact Sika’s Technical Services Department at (800) 933-7452.

Primer for pile repairs in dry environments – Apply Sikadur 35, Hi-Mod LV LPL neat over clean, dry, properly prepared pile surface with rollers or brushes. Allow penetration. Remove excess to prevent surface film.

There are two methods of epoxy mortar placement inside the positioned FRP Pile Repair Sleeve to consider. A “tremie” method or “bottom pumping” method can be used to place the epoxy mortar, depending on job site conditions and contractor’s preference or experience.

Tremie Method - in accordance with normally accepted industry standards and specifications, epoxy mortar is not usually allowed to drop to the bottom of the positioned and bottom-sealed repair sleeve from the top. Instead, the epoxy mortar is allowed to flow through a “tremie” hose or pipe [2 in. (50 mm) diameter typ.] extending down to the lowest point of the repair sleeve. As the epoxy mortar fills the annular space between pile and repair sleeve, the “tremie” hose or pipe is gradually extracted, while keeping the nozzle end submerged below the epoxy mortar’s surface. If this method is used in wet (marine) environments, the amount of water that gets mixed into the epoxy grout will be limited.

Bottom Pumping Method - prior to positioning around the pile, appropriately dimensioned hole(s) should be drilled into the wall of the FRP Pile Repair Sleeve to accommodate epoxy mortar injection port(s). At least one injection port is required at the bottom of the FRP Pile Repair

Sleeve, located at least 9 in. (229 mm) up from the bottom edge. Depending on length of FRP Pile Repair Sleeve, additional injection ports may be required, spaced a minimum 9" on center (injection ports supplied by others). Injection ports should be located 180° away from vertical slip joint closure seam.

Pressures exerted during epoxy mortar pumping will vary depending upon the height of the pour, weight and / or density of the epoxy mortar, conditioning temperature of the epoxy components prior to mixing the mortar, restricted and / or varying annular space between pile and repair sleeve, and the surge of the pump to push epoxy mortar and displaced liquid (e.g. sea water) up to the next injection port or top of the repair sleeve. The type of epoxy mortar pump recommended is a peristaltic pump that is in good mechanical working condition, with valves in proper adjustment (epoxy mortar pump supplied by others). Test shots should be made prior to placement of epoxy mortar into the repair sleeve. Refer to pump manufacturer's instructions and specifications for further information. The operation of the pump should deliver a steady, continuous stream of epoxy mortar without air pockets. To minimize friction, the pump hose must be as straight as possible, or have gentle radii bends to prevent the build up of excessive pressure. When jobsite conditions prevent proper conditioning of Sikadur 35, Hi-Mod LV LPL epoxy components to recommended temperatures, use Sikadur Pump-Aid to improve ability to pump epoxy mortar. See Technical Data Sheet for Sikadur Pump-Aid for dosage recommendations and more information.

Whether using the "tremie" or "bottom pumping" method, continue to pump epoxy mortar until undiluted epoxy mortar is overflowing from the top of the repair sleeve. Clean away excess epoxy mortar to a depth 4 – 6 in. (102 – 152 mm) below the top of the sleeve and allow epoxy mortar to cure. After sufficient cure time has elapsed, top off this area with epoxy mortar. Tool, finish and bevel top epoxy mortar surface to permit water drainage from the top edge of the repair.

Repair Methods

Method 1 – "Tidal Zone Only" [Pile Repair in Wet (Marine) Environments]

The assembly of a temporary platform is recommended as a temporary bottom closure and work surface for the bottom of the FRP Pile Repair Sleeve. The platform can be installed and supported by use of friction-type clamps around the existing pile. Implementation of a platform is the responsibility of the installer / contractor. A polyethylene plastic film (e.g. visqueen) cover should be placed over the portion of the temporary platform that will come in direct contact with the bottom epoxy mortar seal of the FRP Pile Repair Sleeve. Use of a plastic film will help make stripping and removal of the temporary platform after completion of the pile repair easier.

Method 2 – "Repair Extending Below Mudline" [Pile Repair in Wet (Marine) Environments]

Excavate and clean out the mud at the base of the pile (underwater - use water blaster at 6,000 psi typ.) to a depth of approximately 3 ft. (1 m) to reach firm ground and solid pile material. A supporting "starter sleeve" will be required to withstand the weight of the repair sleeve filled with epoxy mortar. A "starter sleeve" is simply a larger FRP Pile Repair Sleeve oversized by 6 – 8 in (152 – 203 mm) in diameter and a minimum 18 in. (457 mm) in length. Position "starter sleeve" around pile, below the mudline in the excavated area. Install "starter sleeve" with recommended standoffs and accessories around pile as if it were a standard repair sleeve installation. Fill annular space between pile and starter sleeve with epoxy mortar to within 2 – 3 in. (50 – 76 mm) of the top. While epoxy mortar is still uncured, place typically dimensioned repair sleeve inside starter sleeve. It is recommended that vertical brackets (supplied by others) be pre-fabricated and attached to the exterior of the initially installed, typically dimensioned repair sleeve prior to positioning within the starter sleeve. Vertical brackets will allow the typically dimensioned repair sleeve to rest, independent of the starter sleeve, in the excavated area. Top off annular space between starter sleeve and repair sleeve with epoxy mortar and allow to fully cure. After epoxy mortar in "starter sleeve" is cured, fill typically dimensioned repair sleeve following the epoxy mortar placement procedures described above.

Limitations

- Only experienced and qualified contractors should perform pile restoration work.
- Epoxy mortar and epoxy sealant cure rates are dependent upon substrate temperature. In wet (marine) environments, water temperatures will typically govern.
- Use specified oven-dried aggregate only, prior to mixing epoxy mortar (contact Sika Technical Services for more information).
- Variations in lighting and / or UV exposure will change the appearance of the epoxy and the FRP Pile Repair Sleeve. FRP Pile Repair Sleeves can be ordered with optional ultra-violet (UV) resistance.
- Every job site is different and unique. The design professional in charge of the actual pier restoration should be consulted prior to installation.



Caution

FRP Pile Repair Sleeves are not designed to independently support the forces and pressures that occur during the placement and curing of epoxy mortar. A structural backup and support system to the jacket is required during epoxy mortar placement. All support bracing, alignment systems, reinforcing bands and hardware shall be the responsibility of the user. Failure to provide adequate support against the forces and pressures that occur during placement and curing of epoxy mortar could result in an epoxy mortar "blow out" subjecting installers to the risks of injury or death, and potentially causing work stoppages and / or costly rework. For additional "Cautions" regarding the chemical content of Sikadur epoxy products, refer to respective Technical Data Sheets and Material Safety Data Sheets for further information.

For First Aid and Cleanup recommendations pertaining to Sikadur epoxy products, refer to respective Technical Data Sheets and Material Safety Data Sheets for further information.

KEEP CONTAINERS TIGHTLY CLOSED
NOT FOR INTERNAL CONSUMPTION

KEEP OUT OF REACH OF CHILDREN
FOR INDUSTRIAL USE ONLY

CONSULT MATERIAL SAFETY DATA SHEETS FOR MORE INFORMATION

Sika warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current technical data sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

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