CI-LV FS

Fast-Setting Low-Viscosity Structural Injection Epoxy

SIMPSON Strong-Tie®

CSI Specification: 03 01 00 Maintenance of Concrete

DESCRIPTION

CI-LV FS Fast-Setting Low-Viscosity Structural Injection Epoxy is a two-component, high-solids, moisture-tolerant epoxy specially designed for pressure injection, gravity feeding and flood coat filling of concrete cracks; and for increasing the bond between freshly placed repair mortars or concrete mixes and existing concrete; and as a repair mortar.

SPECIFICATION COMPLIANCE

- Meets the requirements of: ASTM C881 and AASHTO M235, Type I/II, Grade 1, Class B
  ASTM C881 and AASHTO M235, Type I/IV and II/V, Grade 1, Class C

ASSESSMENT

WHERE TO USE

- Pressure-injection of cracks in structural concrete
- Gravity-feed and flood coat of cracks in horizontal concrete
- As a low-viscosity epoxy (600 cP) for repair of fine- to medium-width cracks 1⁄64"–1⁄4" (0.4–6 mm) in width
- For structural repairs
- To bond new concrete or repair mortars to existing concrete
- For use as a repair mortar

FEATURES

- Chemically bonds with the concrete to provide a structural repair. CI-LV FS seals the crack from moisture, protecting rebar in the concrete from corrosion.
- Moisture-tolerant, can be used on dry and damp surfaces
- Low surface tension allows the material to effectively penetrate narrow cracks
- Formulated for maximum penetration under pressure
- Suitable for pressure injection or gravity-feed applications
- Non-shrink and resistant to oils, salts and mild chemicals
- Can be used with metered pressure-injection equipment
- Freeze-thaw resistant

PRODUCT DATA

Generic Description
Epoxy resin

Packaging
32 fl. oz. (946 mL) dual cartridge (CILVFS32), 5/carton;

3 US gallon (11.4 L) bulk kit (CILVFS3KT) contains:

- (2) 1 US gallon (3.8 L) cans of Component "A" (CILV1A)
- 1 US gallon (3.8 L) can of Component "B" (CILVFS1B)

Cured Color
Amber

Shelf Life
2 years in unopened packaging

Storage
Store dry between 45°–90°F (7°–32°C)

VOC
13 g/L (mixed)

MADE IN USA with GLOBAL MATERIALS

APPLICATION DATA

Mixing Ratio (By Volume)	2:1
Yield	231 in.^{3}/US gal. (0.001 m^3/L)
For Flood-Coat Applications	150–200 ft.^{2}/US gal. (3.7–4.9 m^2/L) depending on surface profile and porosity
Pot Life, 1 Quart (0.95 L)	10 minutes at 72°F (22°C) 28 minutes at 50°F (10°C)
Thin Film (5 mil) Cure Time at 72°F (22°C), ASTM D5895	Set to Touch: 1:45 hours Dry Through: 4:00 hours

APPLICATION DATA — MORTAR

Maximum Mixing Ratio (By Volume)	1 part CI-LV FS: 5 Parts FX-702
Pot Life, 1 Quart (0.95 L)	40 minutes at 72°F (22°C)
Yield, 1 gallon (3.8 L) CI-LV with 5 gallons (19 L) of dry, loose sand	3.7 gallons (14 L) of mortar

TECHNICAL INFORMATION

Compressive Strength

	23°F (-5°C) psi (MPa)	40°F (4°C) psi (MPa)	60°F (16°C) psi (MPa)	72°F (22°C) psi (MPa)	Test Standard
1-hour cure	—	—	—	9,500 (65.5)	ASTM D695
2-hour cure	—	—	—	11,250 (77.6)	
4-hour cure	—	—	—	11,600 (80.0)	
8-hour cure	—	—	—	11,700 (80.7)	
16-hour cure	—	—	7,150 (49.3)	11,800 (81.4)	
24-hour cure	—	—	8,350 (57.6)	11,800 (81.4)	
3-day cure	—	6,600 (45.5)	12,800 (88.3)	12,800 (88.3)	
7-day cure	2,250 (15.5)	12,600 (86.9)	13,700 (94.5)	13,500 (93.1)	
14-day cure	2,850 (19.7)	13,700 (94.5)	14,500 (100.0)	13,600 (93.8)	
28-day cure	2,900 (20.0)	14,500 (100.0)	15,200 (104.8)	13,600 (93.8)	

Temperature Range	Class B 40°–60°F (4°C–16°C)	Class C >60°F (16°C)	Test Standard
Epoxy Classification	Types I, II Grade I (LV)	Types I, II, IV, V Grade I (LV)	ASTM C881
Viscosity, Mixed[1]	2,000 cP	600 cP	ASTM D2556
Gel Time, 60 gram mass[1]	55 minutes	12 minutes	ASTM C881
Bond Strength, Slant Shear:			ASTM C882
Hardened to Hardened Concrete, 2-day cure[2]	1,700 psi (11.7 MPa)	3,650 psi (25.2)	
Hardened to Hardened Concrete, 14-day cure[2]	3,850 psi (26.5 MPa)	4,000 psi (27.6 MPa)	
Fresh to Hardened Concrete, 14-day cure[3]	2,150 psi (14.8 MPa)	2,150 psi (14.8 MPa)	
Tensile Strength, 7-day cure[2]	5,300 psi (36.5 MPa)	7,900 psi (54.5 MPa)	ASTM D638
Elongation at Break, 7-day cure[2]	1.06%	1.91%	ASTM D638
Flexural Strength, 7-day cure[2]	5,700 psi (39.3 MPa)	9,350 psi (64.5 MPa)	ASTM D790
Modulus of Elasticity in Compression, 7-day cure[2]	442,000 psi (3,050 MPa)	439,000 psi (3,030 MPa)	ASTM D695

Heat Deflection Temperature, 7-day cure[3]	122°F (50°C)	ASTM D648
Glass Transition Temperature, 7-day cure[3]	132°F (56° C)	ASTM E1356
Water Absorption, 7-day cure[4]	0.23%	ASTM D570
Linear Coefficient of Shrinkage[3]	0.004 in./in. (0.004 cm/cm)	ASTM D2566
Coefficient of Thermal Expansion[3]	8.48 x 10^{-5} cm/(cm C) in./(in.°F)	ASTM C531
Shore D Hardness, 24-hour cure[3]	80	ASTM D2240
Shore D Hardness, 7-day cure[3]	82	ASTM D2240
Adhesion to Concrete, 24-hour cure[3]	1,100 psi (7.6 MPa)	ASTM D7234

1. Class B tested at 50°F (10°C), Class C tested at 72°F (22°C)
2. Class B cured at 40°F (4°C), Class C cured at 60°F (16°C)
3. Cured at 72°F (22°C)
4. Cured at 72°F (22°C), immersed in water 24 hours

TECHNICAL INFORMATION

TECHNICAL INFORMATION — WHEN USED AS A MORTAR

Tests performed at 1 part by volume of mixed CI-LV FS to 5 parts by volume of FX-702

Compressive Strength

	40°F (4°C) psi (MPa)	60°F (16°F) psi (MPa)	72°F (22°F) psi (MPa)	Test Standard
1-day cure	3,500 (24.1)	7,800 (53.8)	9,150 (63.1)	ASTM C579
7-day cure	7,600 (52.4)	8,850 (61.0)	10,000 (68.9)	
28-day cure	7,700 (53.1)	8,950 (61.7)	10,150 (70.0)	

	72°F (22°C) psi (MPa)	Test Standard
Flexural Strength, 7-day cure	1,900 (13.1)	ASTM C580
Tensile Strength, 7-day cure	1,350 (9.3)	ASTM C307
Bond Strength, Slant Shear Hardened to Fresh Mortar, 7-day cure	1,800 (12.4)	ASTM C882

PLANNING

LIMITATIONS

- For optimal product performance, do not apply to surfaces below 40°F (4°C) or above 90°F (32°C)
- Material is a vapor barrier after cure
- Not for use on exterior slab on-grade coating applications
- For use in non-moving cracks only
- Product may discolor if exposed to direct sunlight
- Not for use in actively leaking or seeping cracks
- Remove active hydrostatic pressure before attempting injection
- For cracks wider than ¼ in. (6 mm), consult a qualified engineer
- When used as a bonding agent, repair mortars and concrete mixes must be applied while CI-LV FS is still tacky

PREPARATION

SURFACE PREPARATION

Gravity Feed Crack Repair: Crack and surrounding surface must be sound, clean and free of all contaminants that could impair product adhesion, bond or performance. If possible seal backside of crack. Open the crack with an abrasive or diamond blade to create a reservoir for the epoxy. Blow out the crack with minimum 80 psi (550 kPa) oil-free, compressed air to remove any visible debris.

General Concrete Repair: Concrete surface must be sound, clean and free of all contaminants that could impair product adhesion, bond or performance. Concrete should be a minimum of 28 days old or substantially cured to the equivalent design strength prior to CI-LV FS installation. Prepare concrete in accordance with ICRI Guideline 310.2 CSP 5-9, taking care to avoid microcracking. Remove all loose or deteriorated concrete by chipping hammer, water jetting or other mechanical means to achieve an open pore structure and sound concrete surface. Remove all cleaning media and debris by vacuum or blowing with high-pressure, oil-free air.

Pressure Injection: Prepare surface area around crack by abrasive blasting or other mechanical means, taking care not to impact any debris into the crack. Blow out the crack with minimum 80 psi (550 kPa) oil-free, compressed air to remove any visible debris. For surface mounted ports, use a suitable paste-over material such as CIP-LO, CIP-F, ETR, or FX-764 (Underwater Applications) to adhere the ports to concrete surface. For drill-in ports, drill the appropriate sized hole and set. Paste over and seal the entire crack, and port bases using a putty knife. Apply the paste-over material at a minimum thickness of 3⁄16 in. (5 mm) and 1 in. (25 mm) wide. Cover port bases with a minimum thickness of ¼ in. (6 mm) and extend the paste-over at least 1 in. (25 mm) beyond the base of the port. If possible, seal the backside of the crack. Allow paste-over material to fully cure before injecting.

Flood Coat: All surfaces must be sound, clean, dry, and free of all contaminants that could impair product adhesion or performance. All cracks, spalls, and voids must be repaired prior to coating installation. Concrete should be a minimum of 28 days old and fully cured prior to coating application. Prepare surface by abrasive blasting, water blasting or other mechanical means per SSPC-SP13/NACE No. 6, ICRI Guideline 310.2R CSP 1-3.

PREPARATION

Bonding Agent: Concrete surface must be sound, clean and free of all contaminants that could impair product adhesion, bond or performance. Concrete should be a minimum of 28 days old or substantially cured to the equivalent design strength prior to CI-LV FS installation. Prepare concrete in accordance with ICRI Guideline 310.2R CSP 5-9, taking care to avoid micro-cracking. Remove all loose or deteriorated concrete by chipping hammer, water jetting, or other mechanical means to achieve an open pore structure and sound concrete surface. Remove all cleaning media and debris by vacuum or blowing with high-pressure, oil-free air.

Repair Mortar: Prepare the surface by abrasive blasting or other mechanical means to achieve an open pore structure and profile per ICRI Guideline 310.2 CSP3-6. Prepare the repair area in accordance with ICRI Guideline No. 310.1R, taking care to avoid microcracking. Prime exposed reinforcing steel with a zinc-rich primer such as FX-406.

MIXING

For Neat Resin: Proportion components at a 2A:1B ratio by volume in a clean pail or use calibrated mixing equipment. Mix thoroughly with a low-speed (300–600 rpm) drill and mixing paddle for 2–3 minutes, scraping unmixed material from sides and bottom of mixing container as needed to achieve a uniform consistency. Avoid entrapping air into mixture.

Dual Cartridges: Hold cartridge upright, unscrew retaining nut and remove plugs. Attach Simpson Strong-Tie EMNO22 mixing nozzle (included) to the top of cartridge and secure with retaining nut. Insert cartridge into dispensing tool. When using a pneumatic dispensing tool, regulate air pressure to 80–100psi (550–690 kPa). IMPORTANT: Cartridge must be equalized prior to use. Failure to follow these instructions can result in product not properly curing. To ensure proper mixing ratio, orient the cartridge and tool in an upward direction so any entrapped air can escape into the mixing nozzle. Begin by squeezing the trigger on the tool until the mixing nozzle is completely full. Once full, re-orient the cartridge and tool to the side and dispense 3 full trigger pulls and ensure all air bubbles are out of the cartridge before beginning the injection process. Repeat if necessary. Dispose of unmixed adhesive in accordance with local regulations. When properly mixed, CI-LV FS will be a uniform amber color. Modification or improper use of mixing nozzle may impair adhesive performance. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle. Adhesive will start to gel in the nozzle if allowed to stand beyond the listed pot life. Adhesive will gel faster at higher temperatures. Material under pressure can blow out the back of the cartridge if the adhesive in the nozzle hardens.

Repair Mortar: Mix neat resin as stated above, then slowly add up to 5 parts by volume of FX-702 oven dried rounded silica filler for every 1 part by volume of mixed CI-LV FS, to avoid clumping, while continuing to mix for approximately 2–3 minutes or until a uniform consistency is achieved, scraping the pail as needed. For large batches, mix neat resin as stated above, then transfer the mixed liquid to a mortar mixer and add FX-702, and continue mixing for 2–3 minutes or until a uniform consistency is achieved. Do not thin CI-LV FS.

EXECUTION

APPLICATION

Gravity Feed Crack Repair: Slowly pour or dispense epoxy into the crack/reservoir. Continue pouring until completely filled. Monitor and maintain fill level as epoxy penetrates the substrate.

For Pressure Injection: With all ports open, begin injecting CI-LV FS at the lowest port and work your way up. For horizontal applications, choose one end of the affected site and work your way to the other end. Begin pumping CI-LV FS into the first port to establish flow. If the next port shows material, close that port and continue pumping until the first port refuses material. If the first port refuses material prior to showing at the next port, close the first port and re-establish flow at the second port. Repeat until all ports refuse material. When injection is complete, and following initial set time, remove installation ports. If desired, remove cured paste-over epoxy by mechanical means.

For Flood-Coat/Gravity-Feed Applications: Remove all standing water by vacuum or blowing with oil-free, compressed air prior to installation. CI-LV FS can be installed on damp or dry surfaces. Do not install through standing water. Avoid applying in direct sunlight. Pour properly mixed CI-LV FS onto surface to be treated and spread evenly with a squeegee, roller, or brush. Continue to work material to ensure all voids and cracks are filled, taking care not to leave puddles. Immediately broadcast approximately 12 lb. (5.4 kg) of FX-702 oven dried rounded silica filler per 100 sq. ft. (9.3 m^2) to create a non-slip surface. Allow to cure, then sweep off any excess sand.

EXECUTION

As a Bonding Agent: Remove all standing water by vacuum or blowing with oil-free, compressed air prior to installation. CI-LV FS can be installed on damp or dry surfaces. Do not install through standing water. Avoid applying in direct sunlight. Apply CI-LV FS by brush, roller, or squeegee at a rate of 60–100 ft.^{2}/US gal. (1.5–2.5 m^2/L), depending on surface profile and porosity. Immediately install repair materials or concrete mix into wet CI-LV FS. Do not allow CI-LV FS to dry or become tack-free before concrete or mortar installation. If CI-LV FS does dry or becomes tack-free, abrade surface and recoat. Do not apply more bonding agent than can be effectively covered with repair mortars or concrete mixes while remaining tacky. Care should be taken to prevent pooling of the bonding agent.

For Repair Mortar: Prior to applying repair mortar, apply neat resin as a bonding agent as stated above. Pour mixed repair mortar material into repair area. Screed and vibrate if necessary. Finish with wood float or steel trowel. Allow CI-LV FS to fully cure to its design strength prior to placing into service. CI-LV FS repair mortar can be applied to dry or damp surfaces. Do not apply to wet surfaces or through standing water.

SAFETY

WARNING

Resin: WARNING! Causes skin irritation. Causes serious eye irritation. May cause an allergic skin reaction.

Hardener: DANGER! Harmful if swallowed. Harmful in contact with skin. Causes severe skin burns and eye damage. May cause an allergic skin reaction.

Protective Measures: The use of chemical splash goggles or safety glasses with side shields and chemical-resistant gloves is recommended. Use appropriate clothing to minimize skin contact. The use of a NIOSH-approved respirator is required to protect respiratory tract when ventilation is not adequate to limit exposure below the PEL. Refer to Safety Data Sheets (SDS) available at **strongtie.com/sds** for detailed information.

FIRST AID

Eye Contact: Hold open eyes under running water for 15 minutes. Seek medical advice.

Skin Contact: Wash skin with soap and water. Seek medical advice if irritation develops.

Inhalation: Remove victim to fresh air. If necessary, use artificial respiration. Seek medical advice.

Ingestion: If product is swallowed, call physician or poison control center. Do not induce vomiting, or give diluents to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice.

CLEAN-UP

Spills: Construct a dike to prevent spreading. Soak up with absorbent material such as clay, sand, or other non-reactive material. Place in leak-proof containers. Keep out of sewers, storm drains, surface waters, and soils.

Surface Area: Wipe up uncured material with cotton cloths. If desired, scrub area with abrasive, water-based cleaner and flush with water. If approved, solvents such as ketones (MEK, acetone, etc.), or adhesive remover can be used. Cured material can only be removed by mechanical means.

Tools and Equipment: Wipe up uncured material with cotton cloths. If desired, scrub area with abrasive, water-based cleaner and flush with water. If approved, solvents such as ketones (MEK, acetone, etc.), or adhesive remover can be used. Cured material can only be removed by mechanical means.

Skin: Use a non-toxic pumice-based soap, citrus-based hand cleaner or waterless hand-cleaner towel. Never use solvents to remove product from skin.

Disposal: Dispose of container and unused contents in accordance with federal, state, and local requirements. Containers may be recycled; consult local regulations for exceptions.

LIMITED WARRANTY

This product is covered by the Simpson Strong-Tie RPS Product One-Year Limited Warranty, which is available at **strongtie.com/limited-warranties** or by calling Simpson Strong-Tie at (800) 999-5099.

Distributor