

CRACKBOND[®] LR-321

Crack Injection Epoxyes



Product Description

CRACKBOND[®] LR-321 adhesive products are two-component, high modulus epoxy resin formulations designed for high performance structural crack repair applications, including those which require ASTM C881. The adhesive product's application temperature range is between 50 °F - 100 °F (10 °C - 38 °C).

General Uses & Applications

- **LR-321 LV** (formerly LR-321) - Low viscosity, hi-mod epoxy for the majority of crack injection requirements and may also be used as a mortar repair when mixed with dry silica sand 1/8 in. to < 1/4 in.
- **LR-321 SLV** - Super low viscosity, hi-mod epoxy injection for pressure injection of fine to very fine cracks and gravity fed fine cracks up to < 1/8 in.
- **LR-321 TXO** (formerly LR-321G) - A medium viscosity injection epoxy with unique thixotropic properties making it ideal for injection of blind sided cracks ≥ 1/4 in.
- Bonding fresh to hardened or hardened to hardened concrete
- May be used as an effective mortar repair when mixed with kiln dried silica sand, or to fill larger voids when used with dried pea gravel.

Advantages & Features

- UL Certified - Drinking Water System Components (NSF/ANSI 61) Joining and Sealing (LV)
- Acceptable for use in USDA inspected facilities (LV)
- High Modulus
- Non-shrink and moisture insensitive allowing for installation in damp applications

STANDARDS & APPROVALS

ASTM C881-15 / AASHTO M235

CRACKBOND LR-321 LV*
Type I, II, IV & V Grade 1 Class C

CRACKBOND LR-321 SLV
Type I, II, IV & V Grade 1 Class B** & C

(See ATC website for current Department of Transportation approvals throughout the United States)

*With exception of Gel Time

**Class B at temperatures ≥ 50 °F

Availability: Adhesives Technology Corp. (ATC) products are available online and through select distributors providing all your construction needs. Please contact ATC for a distributor near you or visit www.atcepoxy.com to search for a distributor by zip code.

Color & Ratio:

LR-321 LV - Part A (Resin): Clear, Part B (Hardener): Amber, Mix Ratio: 2:1 by volume, Mixed Color - Amber

LR-321 SLV - Part A (Resin): Clear, Part B (Hardener): Light Amber, Mix Ratio: 2:1 by volume, Mixed Color - Light Amber

LR-321 TXO - Part A (Resin): White, Part B (Hardener): Black, Mix Ratio: 2:1 by volume, Mixed Color - Gray

Storage & Shelf Life: For best results, store between 55 °F (13 °C) and 80 °F (27 °C). Shelf life is 24 months when stored in unopened containers in dry conditions.

Installation & Estimation: Installation Instructions are available within this Technical Data Sheet (TDS). Due to occasional updates and revisions, always verify the most current usage. In order to achieve maximum results, proper installation is imperative. An estimating guide for product usage may be found at www.atcepoxy.com.

Clean-Up: Always wear appropriate personal protective equipment such as safety glasses and gloves. Clean uncured materials from tools and equipment using a mild solvent, such as a citrus based product or denatured alcohol. Cured material can only be removed mechanically using a sander or grinder.

Limitations & Warnings:

- Do not thin with solvents, as this will prevent cure
- New concrete should be a minimum of 28 days old
- Not intended for repairing cracks subject to movement; repairs should be made to the cracked element to eliminate the cause of the cracking prior to usage
- Not for installation when seeping or flowing water is present, however may be applied in moist or damp environments as long as standing water is removed

Safety: Please refer to the Safety Data Sheet (SDS) for CRACKBOND products published on ATC's website or call for more information at 1-800-892-1880.

Low Viscosity Crack Injection

Advantages & Features

- Pressure injection or self-leveling low viscosity (LV) for structural repair of 1/8 in. to < 1/4 in. concrete cracks
- National Transportation Product Evaluation Program (NTPEP)
- Acceptable for use in USDA inspected facilities
- UL Certified - Drinking Water System Components (NSF/ANSI 61) Joining and Sealing
- Moisture insensitive
- Epoxy resin binder for mortar repair, patching and overlay of interior surfaces including aggregate
- Sealer for interior slabs and exterior above-ground slabs, decks, patios, driveways, parking garages and other structures
- Shear fracture repairs on interior and exterior concrete slabs

TABLE 1: CRACKBOND LR-321 LV Adhesive Packaging, Dispensing Tools and Mixing Nozzles¹

Package Size	6.1 fl. oz. (180 ml) Cartridge	15.9 fl. oz. (470 ml) Cartridge	102 fl. oz. (3.0 L) Kit	3 Gallon (11 L) Kit
Part #	A6-321LV	A16-321LV	BUG-321LV	B3G-321LV
Recommended Mixing Nozzle	T12CSREZ	T12LV	N/A	N/A
Manual Dispensing Tool	TM9HD	TM16HD		
Pneumatic Dispensing Tool	N/A	TA16HD-A		
Case Qty.	12	10	1	1
Pallet Qty.	1,116	720	75	50
Pallet Weight (lb.)	888	1,077	747	1,510

1. Each cartridge is packaged with one mixing nozzle.



T12CSREZ



T12LV



TM9HD



TM16HD



TA16HD-A



A6-321LV



A16-321LV



BUG-321LV



B3G-321LV

TABLE 2: CRACKBOND LR-321 LV performance to ASTM C881-15^{1,2,3}

Property	Cure Time	ASTM Standard	Units	Sample Conditioning Temperature
				60 °F (16 °C)
				Class C
Gel Time - 60 Gram Mass ⁴	----	C881	min	27
Viscosity			cP	500
Pot Life ^{5,6}		----	min	19
Compressive Yield Strength	7 day	D695	psi (MPa)	10,150 (70.0)
Compressive Modulus			psi (MPa)	300,000 (2,068)
Tensile Strength		D638	psi (MPa)	7,230 (49.8)
Tensile Elongation			%	4.4
Bond Strength Hardened to Hardened Concrete	2 day	C882	psi (MPa)	1,580 (10.9)
	14 day		psi (MPa)	2,950 (20.3)
Bond Strength Fresh to Hardened Concrete	14 day		psi (MPa)	1,720 (11.9)
Heat Deflection Temperature	7 day	D648	°F (°C)	120 (48.9)
Water Absorption	14 day	D570	%	0.3
Linear Coefficient of Shrinkage	48 hr	D2566		0.0003

1. Results based on testing conducted on a representative lot(s) of product. Average results will vary according to the tolerances of the given property.
2. Full cure time is listed above to obtain the given properties for each product characteristic.
3. Results may vary due to environmental factors such as temperature, moisture and type of substrate.
4. Gel time may be lower than the minimum required for ASTM C881.
5. Property not referenced in ASTM C881.
6. Pot life is measured as the workable and applicable time of 1.0 gallon (3.8 L) when mixed.

TABLE 3: CRACKBOND LR-321 LV NSF 61/ANSI Certification¹

Description	Application	Water Contact Temperature	Surface Area to Volume Ratio
Drinking Water System Components - Health Effects	Joining and Sealing Materials	Cold 73 ± 4 °F (23 ± 2 °C)	4 cm ² /L

1. CRACKBOND LR-321 LV is certified as a joining and sealing material. Mix Ratio: Part A (Resin): Part B (Hardener) = 2:1 by volume. Final cure: 7 days at 60 °F (16 °C).

Specification: The concrete repair adhesive shall be a two-component, 2:1 mix ratio epoxy system supplied in premeasured containers. When cured 7 days and at a minimum temperature of 60 °F (16 °C), shall have a minimum compressive yield strength of 10,150 psi (70.0 MPa) per ASTM D695. The concrete repair adhesive shall be CRACKBOND LR-321 LV from Adhesives Technology Corp., Pompano Beach, Florida.

TABLE 4: CRACKBOND LR-321 LV

WORKING TIME^{1,2,3,4}

Base Material Temperature	Working Time
°F (°C)	
50 (10)	45 min
75 (24)	30 min
100 (38)	22 min

1. Working times are approximate, may be linearly interpolated between listed temperatures and are based on cartridge / nozzle system performance.
2. Application Temperature: Substrate and ambient air temperature should be from 50 °F to 100 °F (10 °C to 38 °C).
3. When ambient or base material temperature falls below 70 °F (21 °C), condition the adhesive to 70 - 75 °F (21 - 24 °C) prior to use.
4. Working time will increase (colder) or decrease (warmer) depending on temperature.

Super Low Viscosity Crack Injection

Advantages & Features

- Pressure injection or self-leveling super-low viscosity (SLV) structural repair of fine cracks < 1/8 in.
- Extended Gel/Cure Time
- Moisture insensitive
- Epoxy resin binder for mortar repair, patching and overlay of interior surfaces including aggregate
- Sealer for interior slabs and exterior above-ground slabs, decks, patios, driveways, parking garages and other structures
- Shear fracture repairs on interior and exterior concrete slabs
- Primer for industrial coatings

TABLE 5: CRACKBOND LR-321 SLV Adhesive Packaging, Dispensing Tools and Mixing Nozzles¹

Package Size	15.9 fl. oz. (470 ml) Cartridge	102 fl. oz. (3.0 L) Bulk Unit Gallon
Part #	A16-321SLV	BUG-321SLV
Recommended Mixing Nozzle	T12LV	N/A
Manual Dispensing Tool	TM16HD	
Pneumatic Dispensing Tool	TA16HD-A	
Case Qty.	10	1
Pallet Qty.	720	75
Pallet Weight (lb.)	1,091	747

1. Each cartridge is packaged with one mixing nozzle.



T12LV



TM16HD



TA16HD-A



A16-321SLV



BUG-321SLV

Super Low Viscosity Crack Injection

TABLE 6: CRACKBOND LR-321 SLV performance to ASTM C881-15^{1,2,3}

Property	Cure Time	ASTM Standard	Units	Sample Conditioning Temperature	
				50 °F (10 °C)	75 °F (24 °C)
				Class B ⁴	Class C
Gel Time - 60 Gram Mass	----	C881	min	55	49
Viscosity ⁵			cP	750	280
Pot Life ^{6,7}		----	min	----	27
Compressive Yield Strength	7 day	D695	psi (MPa)	11,700 (80.7)	11,800 (81.4)
Compressive Modulus			psi (MPa)	457,600 (3,155)	404,800 (2,791)
Tensile Strength		D638	psi (MPa)	7,020 (48.4)	8,010 (55.2)
Tensile Elongation			%	2.9	8.2
Bond Strength Hardened to Hardened Concrete	2 day	C882	psi (MPa)	2,850 (19.7)	1,870 (12.9)
	14 day		psi (MPa)	3,340 (23.0)	3,160 (21.8)
Bond Strength Fresh to Hardened Concrete	14 day		psi (MPa)	1,600 (11.0)	
Heat Deflection Temperature	7 day	D648	°F (°C)	122 (50.0)	
Water Absorption	14 day	D570	%	0.29	
Linear Coefficient of Shrinkage	48 hr	D2566		0.0008	

- Results based on testing conducted on a representative lot(s) of product. Average results will vary according to the tolerances of the given property.
- Full cure time is listed above to obtain the given properties for each product characteristic.
- Results may vary due to environmental factors such as temperature, moisture and type of substrate.
- CLASS B approved for use at temperatures equal to or greater than 50 °F (10 °C).
- Viscosity at 95 °F (35 °C) drops to approximately 150 cP.
- Property not referenced in ASTM C881.
- Pot life is measured as the workable and applicable time of 102 fl. oz. (3.0 L), when mixed at 75 °F (24 °C).

Specification: The concrete repair adhesive shall be a two-component, 2:1 mix ratio epoxy system supplied in premeasured containers. When cured 7 days and at a minimum temperature of 75 °F (24 °C), shall have a minimum compressive yield strength of 11,800 psi (81.4 MPa) per ASTM D695. The concrete repair adhesive shall be CRACKBOND LR-321 SLV from Adhesives Technology Corp., Pompano Beach, Florida.

TABLE 7: CRACKBOND LR-321 SLV WORKING TIME^{1,2,3,4}

Base Material Temperature	LR-321 SLV Working Time
°F (°C)	
75 (24)	27 min

- Working times are approximate, may be linearly interpolated between listed temperatures and are based on cartridge / nozzle system performance.
- Application Temperature: Substrate and ambient air temperature should be from 50 °F to 100 °F (10 °C to 38 °C).
- When ambient or base material temperature falls below 70 °F (21 °C), condition the adhesive to 70 - 75 °F (21 - 24 °C) prior to use.
- Working time will increase (colder) or decrease (warmer) depending on temperature.

Thixotropic Crack Injection

Advantages & Features

- Unique, medium viscosity thixotropic formulation ideal for injection of 1/4 in. to 3/8 in. blind-sided cracks
- Flows easily under pressure as it is being dispensed but stops flowing once pressure is removed
- Variable viscosity formula facilitates use in cracks which cannot be fully sealed

TABLE 8: CRACKBOND LR-321 TXO Adhesive Packaging, Dispensing Tools and Mixing Nozzles¹

Package Size	15.9 fl. oz. (470 ml) Cartridge	102 fl. oz. (3.0 L) Bulk Unit Gallon	3 Gallon (11 L) Kit
Part #	A16-321TXO	BUG-321TXO	B3G-321TXO
Recommended Mixing Nozzle	T-CSRV2	N/A	N/A
Manual Dispensing Tool	TM16HD		
Pneumatic Dispensing Tool	TA16HD-A		
Case Qty.	10	1	1
Pallet Qty.	720	75	50
Pallet Weight (lb.)	1,163	747	1,510

1. Each cartridge is packaged with one mixing nozzle.



T-CSRV2



TM16HD



TA16HD-A



A16-321TXO



BUG-321TXO



B3G-321TXO

Thixotropic Crack Injection

TABLE 9: CRACKBOND LR-321 TXO performance to ASTM C881-15^{1,2,3}

Property	Cure Time	ASTM Standard	Units	Sample Conditioning Temperature
				60 °F (16 °C)
				Class C
Gel Time - 60 Gram Mass ⁴	----	C881	min	20
Viscosity			cP	4,500
Compressive Yield Strength	7 day	D695	psi (MPa)	6,600 (45.5)
Compressive Modulus			psi (MPa)	248,151 (1,711)
Tensile Strength		D638	psi (MPa)	5,529 (38.1)
Tensile Elongation			%	2.8
Bond Strength Hardened to Hardened Concrete	2 day	C882	psi (MPa)	1,250 (8.6)
Heat Deflection Temperature	7 day	D648	°F (°C)	125 (51.7)
Water Absorption	14 day	D570	%	0.26
Linear Coefficient of Shrinkage	48 hr	D2566		0.002

1. Results based on testing conducted on a representative lot(s) of product. Average results will vary according to the tolerances of the given property.
2. Full cure time is listed above to obtain the give properties for each product characteristic.
3. Results may vary due to environmental factors such as temperature, moisture and type of substrate.
4. Gel time may be lower than the minimum required for ASTM C881.

TABLE 10: CRACKBOND LR-321 TXO WORKING TIME^{1,2,3,4}

Base Material Temperature	Working Time
°F (°C)	
50 (10)	45 min
75 (24)	30 min
100 (38)	22 min

1. Working times are approximate, may be linearly interpolated between listed temperatures and are based on cartridge / nozzle system performance.
2. Application Temperature: Substrate and ambient air temperature should be from 50 °F to 100 °F (10 °C to 38 °C).
3. When ambient or base material temperature falls below 70 °F (21 °C), condition the adhesive to 70 - 75 °F (21 - 24 °C) prior to use.
4. Working time will increase (colder) or decrease (warmer) depending on temperature.

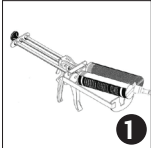
Specification: The concrete repair adhesive shall be a two-component, 2:1 mix ratio epoxy system supplied in premeasured containers. When cured 7 days and at a minimum temperature of 60 °F (16 °C), shall have a minimum compressive yield strength of 6,600 psi (45.5 MPa) per ASTM D695. The concrete repair adhesive shall be CRACKBOND **LR-321 TXO** from Adhesives Technology Corp., Pompano Beach, Florida.

Crack Injection Epoxies

Surface Preparation

Surface preparation will be dependent upon the application of the product. Old concrete must be clean and profiled or textured. New concrete should be a minimum of 28 days old. All dirt, oil, debris, wax, grease or dust must be removed. Prepare the surface mechanically using a scarifier, sandblast, shotblast or other equipment that will give the surface profile needed for the application. A roughened surface is imperative for good adhesion. Always be sure the bonding surfaces are prepared in advance before starting a new cartridge or mixing product. If at all possible, schedule dispensing to consume an entire cartridge at one time with no interruption of epoxy flow. For bulk, mix only enough product that can be used within the pot life, see Table 2 or 6 for appropriate product.

Cartridge Preparation



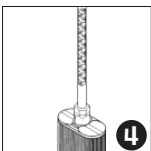
CAUTION: Check the expiration date on the cartridge to ensure it is not expired. **Do not use expired product!** Insert cartridge into the dispenser. Make sure it is properly positioned with the shoulder of the cartridge flush with the front top bracket of the dispenser. Point upward at about a 45° angle. Remove the plastic cap and plug from the top of the cartridge.



Continue to point the upward away from yourself and others while slowly applying pressure to dispenser moving any bubbles and product up through the cartridge until both products flow out evenly. The cartridge is now purged and balanced and ready for flow controller installation.

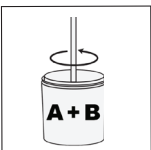


CRACKBOND **LR-321 LV** and CRACKBOND **LR-321 SLV** use a flow controller located inside the threaded end of the mixing nozzle and secured by a plastic cap. Insert the flow controller to the top of the threaded end of the cartridge where product will dispense and ensure it is securely seated. Install the mixing nozzle onto cartridge. Holding the dispenser straight up, slowly apply pressure to the dispenser moving any bubbles and product up through the nozzle until product reaches the tip. Tilting only slightly, dispense this first full stroke of material into a disposable container. The cartridge is ready for use



CRACKBOND **LR-321 TXO**: NOTE: No flow controller is required for CRACKBOND **LR-321 TXO**. Attach the mixing nozzle and dispense the first full stroke of material into a disposable container. The cartridge is ready for use.

NOTE: Schedule dispensing to consume an entire cartridge at one time with no interruption of flow to prevent material from hardening in mixing nozzle. Replace the nozzle if problems occur while dispensing product as the product may have begun to cure in the nozzle which will affect the mix ratio. Never transfer a used nozzle to a new cartridge. Repeat the cartridge balancing steps after replacing the nozzle.



Bulk Mixing Instructions

Thoroughly stir each component separately before mixing together. Mix only the amount of material that may be used before the working time expires. Proportion parts by volume into a clean pail at the exact and proper mix ratio - 2 parts by volume of component A and 1 part by volume of component B.

Mix thoroughly with a low speed drill (400 – 600 rpm) using a mix paddle attachment such as a Jiffy Mixer. Carefully scrape the sides and the bottom of the container while mixing. Keep the paddle below the surface of the material to avoid entrapping air. Proper mixing will take at least 3 minutes.

Bonding Agent Applications

Bonding fresh concrete to hardened concrete or when used as a bonding agent for repairing concrete spalls: Using a brush, roller or airless sprayer, apply an even coat of the bulk mixed CRACKBOND **LR-321 LV** to the clean and prepared concrete surface. While the epoxy is still tacky, place fresh concrete over the top of the mixed epoxy.

Spall Repair Applications

To avoid a feathered edge, cut around the spall into sound concrete with a grinder or circular saw using a diamond or concrete abrasive blade. The edge cut should be equal to the maximum depth of the spall or to at least, a minimum depth of 3/4 in. (19 mm). Chip out all loose concrete within the entire spall to a minimum depth of 3/4 in. (19 mm). Follow surface preparation instructions above to clean the spall. Estimate the amount of bulk product needed and mix Part A and Part B, 2 to 1 by volume. Mix Part A and B thoroughly. Slowly add 3 - 4 parts by volume of kiln-dried sand or aggregate of choice and mix well, pour and trowel until smooth/level. **Note:** The low viscosity of **LR-321 LV** and **LR-321 SLV** will aid in wetting out aggregate to create a repair mortar. Maximum mortar thickness is 1.5 in. (38 mm) per lift.

Installation Instructions

Distributed By:

The Chas. E.
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866-946-6668

www.phipps.com

Gravity Feed Crack Repair for Horizontal Applications

CRACKBOND LR-321 LV and SLV - For best results, cut a groove to open up the crack using an abrasive or diamond blade to a width of 1/8 in. (3.2 mm) and minimum depth of 3/8 in. (9.5 mm). Use a wire brush to abrade and then blow out the crack to remove all dust, dirt, grease, wax, oil or any other contaminants. Pour or inject CRACKBOND into the crack and its self-leveling ability will fill the entire area. Repeat application if necessary to completely fill crack. Follow the cartridge preparation set-up. For medium size cracks, use CRACKBOND LR-321 TXO.

Low Pressure Crack Injection for Vertical, Horizontal and Overhead Structural Repair

Before repairs are attempted, **examine the crack** to determine the type of repair that is required. Cracks in concrete and wood members are classified as either dynamic (moving) or static (dormant). Static cracks may occur from a one-time overload event such as an earthquake or flood. For static cracks in a structure that is to be rehabilitated, structural crack injection is recommended. By contrast, dynamic cracks are those which are caused by inadequate design, seasonal heaving, temperature swings or repeated overloading. Dynamic cracks CANNOT effectively be repaired using crack injection. Dynamic cracks can be sealed using a flexible repair material such as CRACKBOND JF (horizontal cracks).

Capping Paste for Crack Injection

Follow the crack injection product instructions on the label for horizontal, vertical and overhead installations. ATC recommends using CRACKBOND LR-321 LV and CRACKBOND LR-321 SLV for fine to medium crack repair. Using a wire brush, vigorously clean the crack as well as the surface surrounding the crack assuring the crack is not plugged with any semi-loose debris. Remove all dust, debris, oil and any other contaminants from the crack by blowing out the crack with clean oil-free compressed air. For best results crack must be dry at the time of injection. If water is seeping from crack, steps must be taken to stop the flow of water in order to achieve desired repair.



Use CRACKBOND EPOXY REPAIR PASTE as a capping paste to seal the crack on the outside. Follow the cartridge preparation instructions to prepare the cartridge. After balancing the cartridge and disposing the initial amount, apply CRACKBOND EPOXY REPAIR PASTE over the crack leaving spaces for port installations approximately 6 to 12 inches apart. Press the EPOXY REPAIR PASTE in the crack facing and smooth with a putty knife. It is recommended to apply at least 1 to 2 inches wide along the crack facing through the length of the crack. MIRACLE BOND REPAIR EPOXY may also be used as a capping paste.



Port Attachment

NOTE: Observe cure times for capping paste prior to beginning the crack injection process. ATC's CRPORTSS port contains a stainless steel ball bearing to help prevent leaking during vertical and overhead injections. Using a plastic putty knife, apply capping paste to the outer half of the port base. Ensure that the port passageway is not obstructed or blocked during the application. Place the coated port over the prepared gap using a slight twisting motion securing the port and centering directly over the gap. Check for voids or pin holes between the installed ports and the substrate being injected and seal.



Pump and Pneumatic Dispensing

DO NOT EXCEED 40 psi (0.28 MPa) PRESSURE TO THE PNEUMATIC DISPENSING TOOL OR INJECTION PUMP. An air pressure regulator MUST be used with a pneumatic dispenser. Start at a low setting and gradually increase pressure as needed until desired epoxy flow is achieved. Use maximum 40 psi (0.28 MPa) air pressure. Excessive

pressure may result in cartridge plunger leakage. Begin the injection process from the lowest port on a vertical surface moving up the wall. On horizontal surfaces, begin at the widest part of the crack (as marked prior to capping) and move outward. Inject epoxy into port until you either get flow from adjacent port or until epoxy stops flowing. Allow injection resin to cure for at least 24 hours. Ports and capping material can be removed with a chisel and/or grinder. Note: Some cracks may take more time to inject, especially hair-line cracks. Cracks may be smaller in width (or larger) than they appear from the surface.

Dispensing and Injection Tips

For basement walls where back side of concrete is not accessible, inject with slightly higher viscosity CRACKBOND LR-321 TXO. This is a unique thixotropic gel that will feed into small cracks and bridge the back side without runoff.

DO NOT dispense epoxy through gelled mixing nozzle. If epoxy gels in nozzle, replace nozzle and balance new cartridge before continuing.