

Document: 548.X, Specification for Crack Repair by Epoxy Injection

No.	Public Commenter Name	Pg #	Line #	Public Comment	Committee Response
1.	Kesner	3	8	Strike masonry – the standard does not mention masonry. Further masonry construction – grouted / ungrouted – is very different that concrete construction.	Editorial change. Remove “or masonry” this was overlooked during revision and should have been removed.
2.	Abdalla Madhoun	4	15	I think a slight but important modification should be done as follow: (“and” indicates that all of the connected items, conditions, requirements, (or) and events apply.	Nonpersuasive – the section is verbatim from 2018 Technical Committee Manual and required as is.
3.	Greg Moody	5	4	A definition of “port-to-port” would be useful.	Nonpersuasive – port-to-port is a method described in detail in 3.3.1.1. It is not appropriate as a definition.
4.	Abdalla Madhoun	5	15	from my experience and based on conflicts, I do believe that it should be mentioned that the contractor is the main contractor (official party of the contract) responsible for executing works (not only construction) under the signed contract	Nonpersuasive – definition is verbatim from the 2018 Technical Committee manual and required as is.
5.	Kesner	5	17	Definition is incorrect. The “and” should be changed to “or” with an optional “or both”. Crack stitching using embedded reinforcement will transfer stress, but not be a barrier. Routing and sealing is a barrier, but does not transfer stress. Both are valid types of crack repair.	Nonpersuasive – this specification written for a load-bearing repair of the crack; while the other types of repairs listed are valid, they are not within the scope of this specification. For this specification the definition is correct. The committee will consider this as new business.
6.	Abdalla Madhoun	6	2	I suggest adding (and give written response) at the end of the passage	Nonpersuasive – definition is verbatim from the 2018 Technical Committee manual and required as is.
7.	Kesner	6	11	The document is not a standard, and should not be referenced as one.	Editorial. Shifted to Foreword to Checklists.
8.	Kesner	7	1	The document is not a standard, and should not be referenced as one.	Editorial. Shifted to Foreword to Checklists.
9.	Greg Moody	7	20	“intact” is too burdensome. If there is a slight nick or tear in the label, the material must be discarded, which does not make sense. “Legible” is sufficient.	Nonpersuasive – label must be complete and intact to ensure no information is missing. The material is not required to be discarded and manufacturers can provide replacement labels.
10.	Greg Moody	8	4	Why “clean”? Does that mean the user needs to mop and vacuum the storage area first? Can’t we just say: “cool and dry”?	Nonpersuasive – “Clean” is a common term for a storage area to ensure there are no spilled materials and no hazards to workers.
11.	Greg Moody	8	4 and 5	Does that mean the materials need to be stored and transported with min-max thermometers?	There is no requirement for min-max thermometers.
12.	Robert Trout	8	16	I suggest the method of testing be in accordance with the manufacturers printed instructions. Who knows better than the maker of the equipment on how it should be tested? The test method described here is designed for	This requirement has not changed from the previous version, ACI 503.7-07. This will be considered as new business for the next revision.

Document: 548.X, Specification for Crack Repair by Epoxy Injection

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				gear driven pumps, and some displacement pumps, using spring actuated check valves. Lily Corporation equipment uses piston displacement pumps with pneumatically operated ball valves. Because of this design our equipment will fail this test every time. A printed copy of the manufacturers test methods should be supplied to the specifier/owner and the process demonstrated prior to beginning work.	
13.	Greg Moody	9	15	Is that +/- 5% of the major component?	This comment does not apply to the referenced section. The $\pm 5\%$ on page 8 is based on the overall ratio (50:50, 67:33, etc.).
14.	Abdalla Madhoun	11	1.7.6	it is a good practice to keep photos for documentation (before and after) and showing day and date of taking the photo	No action taken – This appears to be an opinion of the commenter and not comment on content.
15.	Kesner	11	10	The text and table are not clear – can a core for splitting tensile strength be used for visual inspection? Do I take 3 or 4 cores in the first 100 ft?	Editorial change for clarification. Adding “It is permitted to use a core sample for both splitting tensile strength and visual inspection, provided the core sample meets the requirements for both.”
16.	Kesner	11	10	This section is not clear. What are injection cores? The standard should instruct a person to remove core samples for confirmation of the crack injection and for splitting tensile strength testing (if specified).	Editorial change for clarification. Removing “injection and control” in favor of “Obtain core sample to evaluate injection repair”. Additional information is added to 1.7.7.1.1. See also 15, 18, and 19.
17.	Robert Trout	11	12	It is highly unlikely that a piece of equipment will go off-ratio by sitting idle. I suggest testing based on hours of operation. This is when the seals, o-rings, etc. are wearing and under pressure. Lily Corp. normally recommends testing weekly. Testing before the beginning of each shift should be sufficient to insure adequate performance for the shift.	This comment does not apply to the referenced section. The requirements listed on page 10 are based on observations in the field by specifiers who have experience a wide variety of continuous metering and mixing equipment.
18.	Kesner	11	13	Why not indicate that prior to coring, NDT methods such as SPR or a pachometer can be used to locate existing reinforcing steel. This is common language in Standards see ASCE C42 or ACI 562	Editorial addition to be in line with ACI 562. Adding “It is recommended non-destructive testing methods such as a pachometer or surface penetrating radar be used to locate existing reinforcing steel prior to coring.” See also 15, 16, and 19. GMZ/ACI Staff Engineer: Based on email exchange with Chair

Document: 548.X, Specification for Crack Repair by Epoxy Injection

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					<p>Mahmoud Reda Taha, please change this response to the following language. In both the Chair’s view and ACI Staff Engineer Zeisler’s view, this is an editorial change to the response to public comment:</p> <p>Editorial addition to be in line with ACI 562. Adding “Non-destructive testing methods such as pachometer or surface penetrating radar may be used to locate existing reinforcing steel prior to coring.” See also 15, 16, and 19.</p>
19.	Kesner	11	15	<p>The section is confusing. See comment related to line 10 – what are injection cores? Are you examining the core to confirm the crack depth, or how much of the crack is filled? This is not clear.</p> <p>Organizational question – Section 1.7.7.1.1 is titled core requirements. Why does the section instruct you on how to evaluate the adhesive penetration in this section?</p> <p>Technical question – what is the minimum size crack being examined? Epoxy will only penetrate into so fine a crack, but cracks can be extremely small. What is the standard?</p> <p>Is ASTM C496 limited to 4” cores? I did not get this impression reading the standard.</p> <p>What is the difference between nominal 2 in. cores and a core with a minimum diameter? Better to specify the diameter of the core – as use of nominal is not clear.</p>	<p>Editorial changes for clarification:</p> <ol style="list-style-type: none"> 1. Change heading to “Requirements for acceptable core samples” 2. Change “Obtain injection cores in a manner...” to “Obtain cores to evaluate injection repair in a manner...” 3. Add after 3rd sentence “Control cores for the splitting tensile test must be of the same diameter and taken from an uncracked area within 12 in. from the repaired crack.” Modifying section 1.7.7.2.2 to reflect this addition. 4. Minimum size is not defined in the specification only acceptable repair. 5. ASTM C42/C42M specifies minimum diameter of 3.70 inches, adjusting requirement to reflect. <p>See also 15, 16, 18 and 20.</p>
20.	Kesner	11	19	<p>Clearer to say – It is permitted to remove 2 in. diameter cores to verify adhesive injection. Cores used to verify adhesive injection shall be wide intersect cracks for at least 75% of the length of the core.</p>	<p>Editorial change for clarification: “It is permitted to obtain cores with a minimum diameter of 2 in. to visually verify adhesive penetration. Acceptable cores for visual inspection shall intersect cracks for at least 75% of the core length.”</p>
21.	Kesner	12	18	<p>Impact-echo?</p>	<p>Editorial change. Change “impact” to “impact-echo”</p>
22.	Kesner	12	22	<p>The references are not standards. Should they be referenced in a commentary?</p>	<p>Editorial change. Shifted to optional checklist.</p>
23.	Kesner	13	3	<p>How wide is the crack that is expected to be filled? 90%</p>	<p>This appears to be opinion and not an actionable item. The ability</p>

Document: 548.X, Specification for Crack Repair by Epoxy Injection

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				filled down to a size of 0.00x in.? As written, it is impossible to satisfy the standard.	to fill any particular sized crack is not an issue with the specification. If the specification cannot be met then the proposed repair is not appropriate.
24.	Kesner	13	6	Given the variability of splitting tensile test from a core sample, comparison to a single “control” result is a bad idea. Suggest something similar to the procedure in ACI 318 for low strength concrete. Or repaired strength shall be within some percentage of mean of three control samples.	This requirement has not changed from the previous version, ACI 503.7-07. This will be considered as new business for the next revision.
25.	Kesner	15	6	The minimum crack size should be mentioned earlier in the document. Best spot is likely in the scope section.	Methods and materials exist to repair cracks narrower than 0.002”. Limiting a crack size in the scope is not appropriate. The requirement in this section is to highlight the majority of materials have limitations but allow for specialized materials. Optional checklist applies here.
26.	Kesner	15	17	What is meant by “blasting” the crack with compressed air? Is a minimum air pressure to be used? Should the air be injected into injection ports?	This comment appears to be questions and not actionable items. “Blasting” is a common term at the job site where compressed air is used to remove unwanted dust or water. This section applies to work prior to installing ports.
27.	Robert Trout	17	22	Lily Corp. recommends that the port spacing be determined not by the thickness of the member to be injected but based on the width of the cracks. A wide crack will not require the ports to be placed as close together as a narrow crack since the resin will flow more easily. Where a narrow crack may require closer port spacing to insure penetration. It is highly unlikely that a concrete member 24” thick with .015” cracks can be filled successfully with ports 24” apart. 8” spacing is more appropriate. Generally, ports will be place between 8 and 18 inches apart.	This comment does not apply to the referenced section. Added an optional checklist item to allow alternate port placement.
28.	Robert Trout	19	7	Prior to beginning injection on a new project, Lily Corp. recommends that the crack be air pressure checked before the actual injection begins. An air pressure check is simply capping all of the set ports except one, attaching an air compressor the open port, pressurize the crack to about 100 p.s.i. and check for air leaks. If there are any holes in the surface seal, debonding of the surface seal or other failures they can be repaired before the inject process begins. If any failures are found a reassessment of the	This comment does not apply to the referenced section. While this is a good recommendation to verify preparation is it not a requirement so was not included in the specification.

Document: 548.X, Specification for Crack Repair by Epoxy Injection

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				<p>method used for the sealing of the cracks should be performed. Once a satisfactory method is determined then the air pressure check can be eliminated if deemed appropriate.</p>	
29.	Robert Trout	21	7	<p>Generally, we recommend beginning the injection process at the widest part of the crack regardless of its' location on the crack. Starting at the widest portion will enable the contractor to fill the crack more quickly and a "resin front" will then proceed to the narrower portions of the crack. It's easier to fill a bucket from the wide end of the funnel than the narrow end. I do not feel the ten minute wait before reinjecting the crack is required. I assume the wait is to allow the resin to self level. It is our position that the crack should be injected to refusal. This is when the dispensing equipment stalls. This is an indication that every void within the crack that can be filled at that pressure, that resin viscosity and under those temperatures has been filled. Once the dispenser stalls the contractor should remain on the crack for 5 minutes. Five minutes under pressure will do more to fill the crack than waiting ten minutes under no pressure. Going back and reinjecting all of the ports is unnecessary and costly. We also feel that injecting numerous ports at the same time results in better penetration and lower costs. Most injection equipment is capable of supplying more resin than one port can accept. By manifolding, injecting three to five ports at once, the contractor can now reduce the labor time by 3 to 5 times. Air entrapment is rarely an issue because most of the air will be vented through open ports, Boyle's Law and the fact that concrete is porous and will accept some air under pressure. Boyle's Law states that the volume of a gas is reduced under pressure. For example, one cubic foot of air pressurized to 150 p.s.i. will now occupy only 7% of the area. Even if no air vents from adjacent ports or is accepted into the surrounding concrete</p>	<p>This comment does not apply to the referenced section.</p> <p>The injection procedure on page 16 is only one example and use of another procedure can be specified.</p>

Document: 548.X, Specification for Crack Repair by Epoxy Injection

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				the remaining void within the crack is less than the required maximum of 10%.	