9300000 Materials for Concrete Repair.
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

Barry Smith
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Comments: (10-19-11) Horizontal Why is there no maximum time for initial setting under Rapid Hardening?

Response: The range was deleted to allow more products to qualify as Rapid Hardening products. This will allow for products that may be more of a Normal Setting product to qualify as a Rapid Hardening product. No change made.

With the removal of the compressive strength requirement at 3 hours, does that mean the initial is limited to 24 hours?

Response: Because we deleted the range for Rapid Hardening for initial setting, we deleted the requirement for the 3 hour strength. No change made.

Vertical Will the current products on the QPL for vertical need to be retested to FM 5-516?

Response: All current products have been tested under this requirement of FM5-516. This is not new, but was moved from a subarticle in 930 to the tables where the testing requirements were listed. No change made.

Is the intent to add 2 new categories to the QPL, High Performance and Ultra-high Performance?

Response: The current products meet the requirements of the category of Ultra-high performance. The intent is to add a new category for high performance that will allow for the use of some products that do not meet the current requirements, but will suffice for some types of vertical repairs. No change made.

Will the pourable version of the vertical products be tested for all physical property requirements after being mixed to the manufacturer's recommendation for pourable?

Response: Yes, the pourable products will have to meet all the physical properties at the pourable consistency. No change made.

Have the products currently listed been tested this way (pourable)?

Response: Currently there are no products on the QPL that are denoted as pourable. No change made.

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Comments: (10-24-11) Section 930-2.2: the correction "~~*0.02,048 lb/ft²*~~ *100 g/m²*" – suggest keeping lb/ft² and use 100 g/m² within parentheses, if it is essential.

Response: The test method is in metric units. The English conversion is meaningless since the result has to be reported in grams per square meters. No change made.

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Tom Richardson
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Comments: (11-4-11) I'm still waiting for Technical Department to complete their review but one item I noticed was the new "Time of Setting (Initial), minutes in table 1 with Rapid Hardening set at minimum 30 minutes. Basically it's the same as very rapid at 29 minutes. Manufactures offer two rapid set formulas to adjust set time between the Winter and Summer temperature differences. This new change eliminates most hot weather (summer) formulations. I suggest you keep the 60 minutes to give a contractor time for placement in the Florida Summer heat. It's one thing to get a quick set but it's another to get it out of the bucket for placement.

Response: The initial time of set is a minimum of 30 minutes. This change should allow for the use of more products with longer set times that would not meet the current 60 minute limit. No change made.

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Comments: (11-16-11) Why are we using metric units in this section and US units in all other area of this spec?

<<>>930-2.2 Material Supply, Storage, and Marking: The material shall be pre-proportioned including aggregate. Deliver products in original, unopened containers with manufacturer's name, date of manufacture, and clearly marked with all information described below, expiration date, product identification label and batch numbers. Store the material in an elevated dry and weather protected enclosure in full compliance with the manufacturer's recommendations. Material must be used within manufacturer's recommended shelf life. The material from which the containers are made shall have water vapor transmission not greater than 0.02,048 lb/ft2100 g/m2 in 24 hours as determined in accordance with Procedure B of ASTM E-96.

Response: The test method is in metric units. The English conversion is meaningless since the result has to be reported in grams per square meters. No change made.

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Fred Goodwin FICRI, FACI
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Comments: (11-17-11)
1. BASF uses a lot code that includes traceability to date of manufacture. Does this comply?

Response: Yes, this complies. No change made.

2. If manufacturing date is known and shelf life is publised, is it also required to have the material expiration date explicitly stated?

Response: If the expiration date can be calculated from the manufacture date and the shelf life, it does not have to be explicitly stated. No change made.

3. ASTM standards change. Suggest either listing a specific revision date so that the numbered sections do not change with subsequent revisions or listing the section headings such as "the initial reading shall be taken upon demolding and specimens then immediately placed into air storage with subsequent readings taken at 4, 7, 14, and 28 days." It is also necessary to specify the specimen dimensions as 1", 2" and 3" width and depth are allowed for 10" length prisms. This changes the surface to volume ration which is a major influence on the rate of drying shrinkage. Another influence not covered in C157 is the use of mineral oil as a release agent (C157 refers to C490 where this comes from).Oil inhibits evaporation and can influence the test results.

Response: The Specifications define the standard to be used as the most recent method at the time the contract is let (unless it is otherwise stated). The portions of the ASTM that are referenced do not have titles. The State Materials Office will generate revisions to Section 930 should the ASTM be revised and the sections get renumbered. The size of the specimen is determined by the ASTM requirements. It is not necessary to specify or allow the different widths and depths here. The mineral oil release agent is allowed per the test method so if the test is performed in accordance with the method, this is acceptable. No change made.

4. I think the intent is to have the strength of the repair material approximately match the strength of the substrate concrete. By setting minimum performance requirements in Table 1 and requiring rapid hardening for lower strength concrete and very rapid hardening for high strength concrete or low strength concrete, this does not achieve this objective. The strength development rate is really an indicator for return to service and is not really related to ultimate compressive strength.

Response: This is a current requirement that is not being changed with this revision. No change made.

5. No where do I find it explicitly stated that C39 is to be used for concrete and C109 for mortars. Also cylinders generally produce about 80-85% of cube compressive strength due to the different L/Diameter ratio of 2:1 and cubes having 1:1:1 L/W/D.

Response: Each test method indicates what it is to be used for – C39 concrete cylinders, C109 mortars. Products defined as a mortar will be tested in accordance with C109. Products defined concrete will be tested in accordance with C39. No change made.

6. Need to designate specimen size. If one wants to have comparable shrinkage values between mortar and concrete use the same bar size which then fixes the surface area to volume ratio so

everything dries at the same rate. If measurements on different bar sizes are carried out for a sufficient length of time (about 1 year) then the ultimate shrinkage becomes fairly close, but certainly not at 28 days.

Response: The nominal aggregate size will define the specimen size. No change made.

7. The properties of the substrate need to be defined in terms of strength and surface texture and moisture content. In slant shear bond testing, using a high strength substrate that is quite rough and in a SSD condition creates higher strength than using a low strength substrate that is smooth on the bonding surface and either very dry or saturated wet. Tensile adhesion testing per ASTM C1583 with defined substrate properties can then be reproduced in field applied materials as a performance check, slant shear cannot. Also C1583 has a better reproducibility than slant shear.

Response: Slant shear is used to determine a minimum bonding capability for initial acceptance. No performance check will be performed on field applied materials. No change made.

8. This appears to be wrong. The flow/slump test time for very rapid materials should be at a shorter interval after mixing than for rapid hardening materials. The way it is written, I could be reaching initial set during the flow testing if my material had an allowed initial set of 10 minutes and I were testing the flow at 15 minutes.

Response: The initial time of set is a minimum of 30 minutes. This change should allow for the use of more products with longer set times that would not meet the current 60 minute limit. No change made.

9. The water to cement ratio needs to be defined to control the resistivity. I could conceivable use a superplasticizer to achive a very low W/C that would then produce high resistivity and still comply with the prescriptive and performance concistency requirements.

Response: If that is part of the product components, this would be allowed. The water to powder ratio is specified on the product sheet. Products are evaluated at the maximum water demand. No change made.

10. Need to include a better definition or reference for 89 gradation aggregates as this is unclear to this reader.

Response: Agree. Change made to reflect Section 901 aggregate definition.

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Comments: (11-18-11) 1. Section Number omission; At the beginning of **Section 930-4**, the section number that start the **General** comments should have been 930-4.1, but it was remained as 930-3.1,a minor oversight I want to make sure is addressed if I am not mistaken.

Response: #1, corrected, Spec's Department.

2.Compressive Strength; In **Section 930-54.3, Table 2**, Physical Properties of Repair Materials for Vertical Surfaces. If we are using the 7-day strength (5000 psi) minimum requirements under "Ultra-high Performance" as the minimum cut-off for the 28-day strength (Greater than or equal to strength at 7 days). What happens if the minimum 7-day strength falls short of 5000 psi, would the 28-day strength minimum requirement still be based on the 7-day minimum? In other words, if the 7-day strength is not meeting the minimum requirement of 5000 psi, let's say it's at 4500 psi, should that be the minimum for the 28-day strength (Greater than or equal to strength at 7 days, 4500psi)?

Response: If it is a material that requires a minimum 7 day strength and it does not meet, it would not be approved for use on the QPL.

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I have reviewed this proposed specification change and have two minor comments:

First, in Table 1 there is a chart line within the section labeled "Maximum Length Change %" for the second item that reads "Allowable shrinkage at" then it moves to the next page for the rest of the statement "28 days when air….." This line makes it hard to read and understand.

Response: Page breaks are programmed to fall at designated area within the program. The breaks that are shown in the version here may not be the breaks in the final version. We can program a page break, but this may cause a page with very little text and the table be forced to the next page. No change made.

Second, in Table 3 there is a the same situation a chart line within the section labeled "Maximum Length Change %" for the first item this time that reads "Allowable expansion at 28 days" then it moves to the next page for the rest of the statement "when cured compared to the length at one day" This line makes this also hard to read and understand. This may be corrected in the final format but I thought it was worth mentioning.

Response: Page breaks are programmed to fall at designated area within the program. The breaks that are shown in the version here may not be the breaks in the final version. We can program a page break, but this may cause a page with very little text and the table be forced to the next page. No change made.