

**SECTION 930**  
**PACKAGED, DRY, RAPID HARDENED AND VERY RAPID**  
**HARDENED CONCRETE OR MORTAR MATERIALS FOR**  
**CONCRETE REPAIR**

**930-1 Description.**

This Section covers the materials for packaged, dry, cementitious concrete or mortar materials for rapid repairs to hardened portland cement concrete pavements and structures. Materials that contain organic compounds, such as bitumens, epoxy resin, and polyesters as the principal binder are not included.

Packaged, dry concrete material shall contain aggregate of which more than 5% by weight of the total mixture is retained on a 3/8 inch [9.5 mm] sieve.

Packaged, dry mortar material may contain aggregate of which less than 5% by weight of the total mixture is retained on a 3/8 inch [9.5 mm] sieve. These materials may not be extended by the addition of aggregate in the field.

Aqueous solutions of inorganic compounds and aqueous emulsions or dispersions of inorganic compounds may be used to replace some or all of the required mixing water. These liquids must be furnished as components of the packaged materials.

**930-2 Applicable Documents.**

Florida Test Methods:

- FM 1-T 022 Compressive Strength of Cylindrical Concrete Specimens.
- FM 1-T 106 Compressive Strength of Hydraulic Cement Mortar Using 2 inch [50 mm] Cubic Specimens.
- FM 1-T 131 Type of Setting of Hydraulic Cement by Vicat Needle.
- FM 1-T 154 Time of Setting of Hydraulic Cement by Gilmore Needles.
- FM 1-T 160 Length Change of Cement Mortar and Concrete.
- FM 1-T 126 Making and Curing Concrete Test Specimens in the Laboratory.
- FM 1-T 248 Reducing Field Samples of Aggregates to Testing Size.
- FM 5-516 Determining Low-Levels of Chloride Concrete and Raw Materials.

Others:

- ASTM C 387 Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
- ASTM C 494 Specification for Chemical Admixtures for Concrete.
- ASTM E 96 Test Methods for Water Vapor Transmission of Materials in Sheet Form.

**930-3 Classification.**

Two types of packaged, dry cementitious materials for concrete repairs (rapid hardening and very rapid hardening) are identified in Table 1.

Table 1 Physical Requirements				
Minimum Compressive Strength, psi [MPa]				
	3 hours	1 day	7 day	28 day
Rapid Hardening	500 [3.447]	2,000 [13.79]	4,000 [27.58]	*
Very Rapid Hardening	2,000 [13.79]	4,000 [27.58]	6,000 [41.37]	*

Maximum Length Change (FM 1-T 160)
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	Rapid Hardening	Very Rapid Hardening
Allowable increase, after 28 days in water, based on length at one day, %	+0.15	+0.15
Allowable decrease, after 28 days in water, based on length at one day, %	-0.15	-0.15
Allowable difference between increase in water and decrease in air determination, %	0.20	0.20

\*The strength at 28 days shall not be less than the strength at seven days.

Consistency		
	Slump (Concrete) inches [mm]	Flow (Mortar) (%)
Rapid hardening, minimum consistency at 15 minutes after addition of the mixing liquid	3 [76.2]	100
Very rapid hardening, minimum consistency at five minutes after addition of the mixing liquid	3 [76.2]	80

Time of Setting, Minutes		
	Rapid Hardening	Very Rapid Hardening
Initial Set	30 to 60	10 to 29

### 930-4 Chemical Requirements.

The material shall not contain total chlorides or other corrosive ingredients in excess of 0.40 lb/yd<sup>3</sup> [0.24 kg/m<sup>3</sup>] of the hardened concrete when used in reinforced structures. Chloride determination shall be made in accordance with FM 5-516.

### 930-5 Sampling.

A LOT is the quantity of packaged repair material normally placed on a pallet. Generally, this quantity will weigh from 2,000 to 4,000 lbs. [900 to 1,800 kg].

A unit sample is a single package of material randomly selected from the LOT.

### 930-6 Specimen Preparation.

**930-6.1 Concrete:** Mechanically mix the packaged, dry concrete material with water and/or mixing liquid. Determine the properties of the unhardened mixture, and mold and cure the required specimens in accordance with FM 1-T 126.

(a) The sample of packaged dry material shall be any combination of whole packages yielding not less than 2/3 ft<sup>3</sup> [0.02 m<sup>3</sup>] of hardened material.

(b) Base the quantity of water, other liquid component, or both added to the sample on the quantity per bag stated in the instructions for use.

(c) Place the sample in the mixing machine and add the required amount of liquid. Start mixing immediately and continue mixing for the length of time indicated in the directions for use.

(d) When making the slump test, schedule work so the test will be completed in 5 ±1/2 minute after the mixing liquid is added to the very rapid hardening materials or 15 ±1/2 minute after mixing the liquid with the rapid hardening materials.

(e) Mold the required number of specimens using additional samples as may be necessary, mixing in accordance with (a) through (d). Do not use the mixtures for molding test specimens when the slump test is less than that specified in Table 1.

Where the nominal maximum particle size is not greater than 1 inch [25 mm] the use of cylindrical molds 4 inches [102 mm] in diameter by 8 inches [203 mm] in length is suggested.

**930-6.2 Mortar:** Mechanically mix packaged, dry mortar material with mixing liquid. Determine the properties of the unhardened mixture, and mold and cure the specimens in accordance with FM 1-T 106 or modifications as outlined herein.

(a) The sample obtained from the packaged dry material shall weigh  $6.6 \pm 0.05$  lb [ $3.0 \pm 0.02$  kg] and shall be representatively obtained from a whole package in accordance with FM 1-T 248.

(b) Base the quantity of water, or other liquid component, or both added during mixing on the quantity per unit of weight stated in the directions for use.

(c) When making the flow test, schedule work so the test will be completed in  $5 \pm 1/2$  minute after the start of mixing liquid with the very rapid hardened materials or  $15 \pm 1/2$  minute after mixing the liquid with the rapid hardening materials.

(d) Mold the required number of specimens using additional samples as necessary mixing in accordance with (a) through (c). Do not use the mixtures for molding test specimens when the flow is less than that specified in Table 1.

**930-6.3 Temperature:** In those cases where the manufacturer has indicated in the package markings, or elsewhere, that the packaged repair material can be mixed and applied at temperatures that lie beyond the range of  $70 \pm 15^\circ\text{F}$  [ $20 \pm 8^\circ\text{C}$ ], the product must meet the requirements of Table 1. Specimens shall be mixed, molded and cured during the first three hours within  $\pm 2^\circ\text{F}$  [ $\pm 1^\circ\text{C}$ ] of the extreme temperature(s) stated by the manufacturer in the package markings.

### **930-7 Test Methods.**

Manifestly Faulty Specimens - Treat manifestly faulty specimens in accordance with 15.2 in ASTM C 494.

Compressive Strength - Prepare and test three test specimens for each age of test and each level of mixing temperature. Test in accordance with FM 1-T 022 for concrete and FM 1-T 106 for mortar. The average strength of the test specimens for each age of test and each preparation temperature shall be not less than that prescribed in Table 1.

Length Change - Make and cure the test specimens in accordance with FM 1-T 160, except omit the curing period in Section 6 and Paragraph 6.3. Both 7.1.1 and 7.1.2 shall apply. The average length change of the test specimens for each preparation temperature and for each storage condition after 28 days shall meet the requirements shown in Table 1.

### **930-8 Rejection.**

All broken packages will be rejected.

Material that fails to meet any of the requirements of this Specification will be rejected.

Rejection and reason(s) for rejection should be reported to the producer or supplier promptly and in writing.

Material in local storage in the hands of a vendor for more than six months after completion of tests shall be retested before use and rejected if it fails to conform to any of the requirements of this Specification.

### **930-9 Certification.**

When specified in the purchase order or contract, a producer, supplier, or an independent testing laboratory shall furnish certification to the purchaser that the material has been tested in accordance with this Specification and found to meet the requirements. When specified in the purchase order or contract, a report of test results on samples taken from material shipped shall be furnished. Date of the test report furnished in accordance with the purchase order request shall not be more than 45 days prior to shipment of the order.

**930-10 Qualified Products List.**

The material use for application described in 930-1 shall be a product included in the Qualified Products List.

**930-11 Marking.**

All packages shall be marked to contain the following information:

- (a) Must be marked with LOT identification number and material expiration date.
- (b) Directions for use that shall include but are not limited to:
  - (1) The type and kind of adhesive recommended (if any) to bond fresh repair material to the concrete or mortar being repaired.
  - (2) The recommended amount of water, other liquid component, or both, to be mixed with the package contents.
  - (3) The recommended length of mixing time or sequence of mixing and resting times in minutes.
- (c) Date the material was packaged.
- (d) The yield in cubic feet [cubic meters] or yield in square feet per inch [square meters per millimeter] thickness when mixed with the recommended amount of liquid.
- (e) The net weight in each container. The contents of any container shall not vary by more than 2% from the weight stated in the markings. The average weight of filled containers in a LOT shall be not less than the weight stated in the markings.

**930-12 Packaging.**

The material from which the containers are made shall have water vapor transmission not greater than 2,048 lb/ft<sup>2</sup> [10 Mg/m<sup>2</sup>] in 24 hours as determined in accordance with Procedure B of ASTM E 96.

The packaged materials shall be in containers weighing 50 to 55 pounds [23 to 25 kg].

**930-13 Additional Testing.**

The Department reserves the right to conduct further field testing if desired.

**930-14 Mixing.**

The material(s) shall be mixed in accordance with manufacturer's recommendations.

**930-15 Field Representation.**

Manufacturers will be required to provide field representation upon request.