

INCH-POUND

MIL-DTL-32536

7 October 2015

DETAIL SPECIFICATION

CONCRETE CAPPING MATERIAL, RAPID SETTING

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the procurement requirements for concrete capping material, rapid setting. The concrete capping material, rapid setting may be used alone to cap crater repairs or after backfilling with MIL-DTL-32537 flowable fill backfill material, rapid setting as part of the Airfield Damage Repair (ADR) program.

1.2 Classification. The concrete capping material, rapid setting has the following types as specified in the contract or purchase order (see 6.2).

1.2.1 Types. The types are as follows:

- Type I - 2900 lb. super sack
- Type II - 50 lb. bucket
- Type III - 60 lb. bag

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-32537 Flowable Fill Backfill Material, Rapid Setting

(Copies of these documents are available online at <https://assist.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

Comments, suggestions, or questions on this document should be addressed to DLA Troop Support - Industrial Hardware Division (ATTN: Code FHTE), 700 Robbins Avenue, Philadelphia, PA 19111-5096 or email trpsptspecspa@dlamail. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

MIL-DTL-32536

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C39/C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C78/C78M	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C143/C143M	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C157/C157M	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C191	Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C469/C469M	Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes
ASTM C882/C882M	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C1581/C1581M	Standard Test Method for Determining Age at Cracking and Induced Tensile Stress Characteristics of Mortar and Concrete under Restrained Shrinkage

(Copies of these documents are available from www.astm.org or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First Article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. The concrete capping material shall be a commercially available, preblended rapid setting concrete mix that contains all constituent materials necessary for onsite production and meets the following requirements:

- a. The concrete mix must only require the addition of water to produce a usable material. No liquid admixtures will be accepted.
- b. The concrete mix must be compatible with citric acid for increased working time.
- c. The same material must be readily packaged in 2,900 lb. super sacks, 50 lb. buckets and 60 lb. bags.
- d. The concrete mix must be compatible with mixing in large (standard transit trucks), small mixers (vertical and horizontal) and by hand (drill and paddle).

MIL-DTL-32536

e. The concrete mix must be compatible with volumetric mixers but cannot rely on the use of local aggregates for extension.

f. The concrete mix must be capable of producing both small and large volumes (1/2 cubic foot to 8 cubic yards).

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Laboratory Certification Program. The rapid setting concrete material must be qualified under the Tri-Service Spall Repair Certification Program (Phases I and II), which is a laboratory screening of prospective rapid setting concrete capping materials. The specifications and criteria that the material must meet are listed in Table I.

TABLE I. Tri-Service Spall Repair Certification Program Requirements.

Test Description		Testing Specifics	Criteria
Compressive Strength	ASTM C39	-	≥ 3000 psi @ 2 hr
		-	≥ 5000 psi @ 1 day
		-	≥ 5000 psi @ 7 day
		-	≥ 5000 psi @ 28 day
Flexural Strength	ASTM C78	-	≥ 350 psi @ 2 hr
		-	≥ 600 psi @ 7 day
		-	≥ 600 psi @ 28 day
Bond Strength	ASTM C882	Repair Material to Repair Material	≥ 1000 psi @ 1 day
		Repair Material to Ordinary PCC	≥ 1000 psi @ 1 day
Modulus of Elasticity	ASTM C469	-	$2 \leq x \leq 6$ Mpsi @ 2 hr
		-	$2 \leq x \leq 6$ Mpsi @ 28 day
Time of Set	ASTM C191	-	Initial Set: ≥ 15 min
		-	Final Set: 25 - 35 min
Slump	ASTM C143	Within 5 min of added water	≥ 3 inch
Length Change	ASTM C157	Stored in air	$-0.04\% \leq x \leq +0.03\%$ @ 28 day
		Stored in water	
Coeff. of Thermal Expansion	ASTM C 531	Begin test @ 7 days	$\leq 12 \cdot 10^{-6} \text{ } ^\circ\text{F}^{-1}$
Shrinkage Potential	ASTM C1581	-	$\leq 40 \mu\epsilon$ @ 14 day
		-	No cracking @ 28 day

3.4 Full Scale Aircraft Trafficking. The rapid setting concrete capping material must have the ability to perform under representative aircraft loads by being subjected to the following testing protocol:

- A minimum of 5, 10'x10'x 2' crater repairs will be conducted.
- 14" of MIL-DTL-32537 flowable fill backfill will be placed using the dry placement method. The flowable fill will cure for 15 min before the rapid setting concrete is placed.
- The rapid setting concrete will be placed using an ADR simplified volumetric mixer.

MIL-DTL-32536

- d. Trafficking plan – Approximately 2 hr after completion, each crater will be trafficked to 112 passes using a fighter aircraft load cart. The 112-pass level (normal distribution) is the threshold established for expedient ADR repairs. The single-wheel load cart will be loaded to a minimum of 35,235 lb with a 325-psi tire pressure, representative of the wheel specifications for a typical fighter aircraft. In the following days each crater will be trafficked to a total of 3,500 passes with the load cart.
- e. Cylindrical samples of concrete shall be obtained during placement to ensure the material meets the compressive strength requirements outlined in Table I.

3.4.1 Survey measurements. Survey measurements of each crater repair will be performed before and after trafficking. A difference in elevation of 1.25 inches or greater will be considered failure.

3.4.2 Excessive cracking due to structural failure or Foreign Object Damage (FOD) potential noted during trafficking will also cause a crater repair to be considered failed.

3.5 Live-Flight Operations. The rapid setting concrete capping material must meet the following testing protocol:

- a. A minimum of 5, 10'x10'x 2' crater repairs will be conducted.
- b. 14" of MIL-DTL-32537 flowable fill backfill will be placed using the dry placement method. The flowable fill will cure for 15 min before the rapid setting concrete is placed.
- c. The rapid setting concrete will be placed using an ADR simplified volumetric mixer.
- d. Trafficking plan – Approximately 2 hr after completion, each crater will be trafficked to 112 passes using a fighter aircraft load cart. The 112-pass level (normal distribution) is the threshold established for expedient ADR repairs. The single-wheel load cart will be loaded to a minimum of 35,235 lb with a 325-psi tire pressure, representative of the wheel specifications for a typical fighter aircraft. In the following days each crater will be trafficked to a total of 3,500 passes with the load cart.
- e. Cylindrical samples of concrete shall be obtained during placement to ensure the material meets the compressive strength requirements outlined in Table I.
- f. The following day, the craters will be subjected to live fighter and cargo aircraft operations. For cargo aircraft, these will include maximum effort landings, takeoffs, acceleration/deceleration, 180-degree turns, and taxi movements. For fighter aircraft, operations will include maximum effort landings, take offs, aborted take offs (ATOs), 180-degree turns, taxi movements, and touch-and-go operations.

3.5.1 Survey measurements. Survey measurements of each crater repair will be performed before and after trafficking. A difference in elevation of 1.25 inches or greater will be considered failure.

3.5.2 Excessive cracking due to structural failure or Foreign Object Damage (FOD) potential noted during trafficking will also cause a crater repair to be considered failed.

4. VERIFICATION

4.1 Classification of inspection. The inspection and testing of the EBS shall be classified as follows:

- a. First article inspection (see 4.2)
- b. Conformance inspection (see 4.3)

4.2 First article inspection. First article inspection shall consist of all the tests specified (see 4.5).

4.3 Conformance inspection. Conformance inspection shall include all Table II tests.

4.4 Sampling. One package of concrete mix shall be taken from each lot and used for each conformance inspection.

MIL-DTL-32536

4.4.1 Lot Size. A lot shall consist of all packages of concrete mix manufactured under essentially the same conditions and submitted for inspection at one time.

4.5 Tests.

4.5.1 Material. The contractor shall furnish certification that the material complies with the requirements specified in 3.2.

4.5.2 First article test samples. The contractor shall provide to the government 28 Type I super sacks of concrete capping material to perform the full scale aircraft trafficking (paragraph 4.5.4) test. The contractor shall also provide 28 Type I super sacks of concrete capping material to perform live-flight operations (paragraph 4.5.5) test. See paragraph 6.4 for test laboratory address.

4.5.3 First article tests. The first article tests shall include all Table II tests and paragraphs 4.5.4 and 4.5.5.

TABLE II. First Article and Conformance Laboratory Tests.

<u>Property</u>	<u>Test Method</u>	<u>Requirement</u>
Compressive Strength	ASTM C39	Table I
Flexural Strength	ASTM C78	Table I
Bond Strength	ASTM C882	Table I
Modulus of Elasticity	ASTM C469	Table I
Time of Set	ASTM C191	Table I
Slump	ASTM C143	Table I
Length of Change	ASTM C157	Table I
Coefficient of Thermal Expansion	ASTM C531	Table I
Shrinkage Potential	ASTM C1581	Table I

4.5.4 Full Scale Aircraft Trafficking. The rapid-setting flowable fill backfill material after being subjected to the paragraph 3.4 testing protocol shall meet paragraph 3.4.1 and 3.4.2 requirements.

4.5.5 Live-Flight Operations. The rapid-setting flowable fill backfill material after being subjected to the paragraph 3.5 testing protocol shall meet paragraph 3.5.1 and 3.5.2 requirements.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Concrete capping material, rapid setting covered by this specification is intended to be used alone to cap crater repairs or after backfilling with MIL-DTL-32537 flowable fill backfill material, rapid setting as part of the Airfield Damage Repair (ADR) program.

MIL-DTL-32536

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. If first article samples are required (see 3.1).
- c. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Crater
Full scale aircraft trafficking
Live-flight operations
Super sack

6.4 First article test laboratory. First article test samples should be sent to:

U.S. Army Research and Development Center
CEERD-GS-V
3909 Halls Ferry Road
Vicksburg, MS 39180

Custodian:
Army - CE
Navy - AS
Air Force - 99

Preparing Activity:

DLA - IS

(Project 5610-2015-004)

Review Activity:
Army – AV
Navy – MC, YD

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