

ICS 91.080.40.

DMS 1430:2018
First edition

DRAFT PROPOSAL

Packaged, dry, combined materials for mortar and concrete – Specification

NOTE: This is a Draft Proposal and should not be regarded or used as a Malawi Standard

Packaged, dry, combined materials for mortar and concrete – Specification

Obtainable from the
Malawi Bureau of Standards
P O Box 946
BLANTYRE

Tel: +265 1 870 488
Fax: +265 1 870 756
E-mail: mbs@mbsmw.org
Website: www.mbsmw.org

Price based on 7 pages

© Copyright reserved

TABLE OF CONTENTS

Contents	Page
Foreword.....	i
Scope.....	1
Normative references	1
Ordering information.....	3
Materials	3
Preparation of aggregate.....	3
Proportioning	3
Physical properties	3
Packaging and package marking	4
Rejection.....	4
Sampling and testing	4
Accuracy of measurement.....	4
Sampling concrete.....	5
Mixing and testing concrete.....	5
Sampling mortar	6
Mixing and testing mortar	6
Keywords	7

FOREWORD

This Draft Malawi Standard was prepared in order to come up with specifications for packaged, dry, combined materials for mortar and concrete. The materials include cement, fine aggregate and coarse aggregate in correct proportion to be used by the ultimate consumer.

The standard is based on an American Standard Testing Methods standard ASTM C 387/C 387M, *Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete*.

Acknowledgement is made for the use of the above standard.

TECHNICAL COMMITTEE

This draft proposal was developed by the Technical Committee MBS/TC 9 Cement and lime products and the following companies and organisations were represented:

NOTICE

This draft proposal shall be revised every five years or earlier when necessary in order to keep abreast of progress. Comments are welcome and shall be considered when the draft proposal is being revised.

DRAFT PROPOSAL**Dry, combined materials for mortar and concrete –
Specification**

1 SCOPE

1.1 This specification covers the production, properties, packaging, and testing of packaged, dry, combined materials for concrete and mortars. The types of concrete and mortar covered are described in the following paragraphs in this section. Some of the mixtures covered by this specification may not be available in some areas.

1.1.1 High-Early Strength Concrete – For concrete building and repair jobs requiring a more rapid strength development such as required for the earlier removal of forms.

1.1.2 Normal Strength Concrete:

1.1.2.1 Normal Weight Concrete – For general concrete building and repair jobs where thicknesses exceed 50 mm. Typical uses include building or repairing sidewalks, patios, steps, footings, and for setting posts.

1.1.2.2 Lightweight Concrete Using Normal Weight Sand – For concrete building and repair jobs where lower concrete weights are desirable. These mixtures will produce concrete which is about 15 to 25 % lighter in weight than normal weight concrete.

1.1.2.3 Lightweight Concrete – For concrete building and repair jobs where the lightest concrete weight is desirable. These mixtures will produce concrete which is about 25 to 35 % lighter in weight than normal weight concrete.

1.1.3 High-Strength Mortar – For general concrete work requiring thicknesses of less than 50 mm [or where a high-strength grout mixture is required. Typical uses include topping, patching, and stuccoing. Often to as *sand mix*.

1.1.4 Mortars for Unit Masonry – For laying brick, block, and stone, and for masonry repairs. The following three types of masonry mortar are covered:

1.1.4.1 Type N – For general masonry work requiring normal mortar properties.

1.1.4.2 Type S – For use where a higher strength masonry mortar is required.

1.1.4.3 Type M – For use where the highest strength masonry mortar is required.

1.2 The values stated in either SI or inch-pound units shall be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 The following safety hazards caveat pertains only to the test method portion of this specification. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from the Malawi Bureau of Standards.

Note - For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- C 33 *Specification for Concrete Aggregates* (MS 842, Aggregates from natural sources – Aggregates for concrete)
- C 39/C 39M *Test Method for Compressive Strength of Cylindrical Concrete Specimens*
- C 91 *Specification for Masonry Cement* (MS 414, Masonry cement (Without air entrainment agents))
- C 109/C 109M *Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or [50 mm] Cube Specimens)*
- C 138/C 138M *Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete*
- C 143/C 143M *Test Method for Slump of Hydraulic- Cement Concrete*
- C 144 *Specification for Aggregate for Masonry Mortar*
- C 150 *Specification for Portland Cement* (MS 29, Cement – Specification)
- C 173/C 173M *Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method*
- C 185 *Test Method for Air Content of Hydraulic Cement Mortar*
- C 192/C 192M *Practice for Making and Curing Concrete Test Specimens in the Laboratory*
- C 207 *Specification for Hydrated Lime for Masonry Purposes* (MS 85-1, Limes for use in building – Specification – Part 1: Hydrated lime.)
- C 231 *Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method*
- C 260 *Specification for Air-Entraining Admixtures for Concrete*
- C 270 *Specification for Mortar for Unit Masonry*
- C 305 *Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency*
- C 330 *Specification for Lightweight Aggregates for Structural Concrete*
- C 494/C 494M *Specification for Chemical Admixtures for Concrete*
- C 595 *Specification for Blended Hydraulic Cements*
- C 618 *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*
- C 702 *Practice for Reducing Samples of Aggregate to Testing Size*
- C 989 *Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars*
- C 1157 *Performance Specification for Hydraulic Cement*
- C 1240 *Specification for Silica Fume Used in Cementitious Mixtures*
- C 1329 *Specification for Mortar Cement*
- C 1437 *Test Method for Flow of Hydraulic Cement Mortar*
- C 1438 *Specification for Latex and Powder Polymer Modifiers for Hydraulic Cement Concrete and Mortar*
- C 1506 *Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters*
- E 96/E 96M *Test Methods for Water Vapour Transmission of Materials*

3 ORDERING INFORMATION

The purchaser shall specify the material desired as concrete, high strength mortar, or mortar for use with unit masonry, and the respective physical requirements as specified in **Table 1** shall govern.

4 MATERIALS

4.1 Materials used as ingredients in packaged, dry, combined materials for mortar and concrete shall conform to at least one of the following requirements:

4.1.1 *Aggregates*, shall conform to Specification **C 33**, Specification **C 144**, or Specification **C 330**.

4.1.2 *Air-Entraining Admixtures*, shall conform to Specification **C 260**.

4.1.3 *Blended Cement*, shall conform to Specification **C 595** or Performance Specification **C 1157**.

4.1.4 *Chemical Admixtures*, shall conform to Specification **C 494/C 494M**.

4.1.5 *Flyash*, shall conform to Specification **C 618**.

4.1.6 *Ground Granulated Blast-Furnace Slag*, shall conform to Specification **C 989**.

4.1.7 *Hydrated Lime*, shall conform to Type S or Type SA of Specification **C 207**.

4.1.8 *Latex and Powder Polymer Modifiers*, shall conform to Specification **C 1438**.

NOTE 1 – Type II latex polymers should not be used in applications that may be more than superficially wet in service.

4.1.9 *Masonry Cement*, shall conform to Specification **C 91**.

4.1.10 *Mortar Cement*, shall conform to Specification **C 1329**.

4.1.11 *Portland Cement*, shall conform to Type I, IA, II, IIA, III or IIIA of Specification **C 150**.

4.1.12 *Silica Fume*, shall conform to Specification **C 1240**.

5 PREPARATION OF AGGREGATE

5.1 All aggregates shall be dried, without disintegration, to a moisture content of less than 0.1 mass %, computed on material dried substantially to constant mass % at 105 to 110 °C [221 to 230 °F].

6 PROPORTIONING

6.1 The proportions of cementitious material and aggregate shall be such that the strength requirements will be met when an amount of mixing water is used that produces for concrete the slump specified in **12.2** and for mortar the flow specified in **14.2**.

7 PHYSICAL PROPERTIES

Packaged, dry, combined materials for concrete, high strength mortar, and mortar for use with unit masonry shall conform to the respective physical requirements as given in **Table 1** for the material specified when the prescribed amount of water is added.

TABLE 1 – Physical Requirements

1	2	3	4
Kind of Material	Compressive strength, MPa min.		
	3 days	7 days	28 days
CONCRETE			
High early strength	17.0	24.0	–
Normal strength:			
Normal weight	–	17.0	24.0
Lightweight using normal weight sand ^A		17.0	24.0
Lightweight		17.0	
MORTAR			
High-strength mortar		20.0	35.0
Mortar for unit masonry:	Shall comply with property requirements of Specification C 270 ^B		
Type M			
Type S			
Type N			
^A Lightweight concrete using normal weight sand may contain some portion of lightweight fines. ^B The performance requirements for 28-day compressive strength, water retention, and air content are those for mortars made from masonry cement unless otherwise specified. Manufacturers wishing to comply with the air content requirements for mortar-cement mortar or cement-lime mortar must specify the ingredients used and comply with the applicable portions of Specification C 270 .			

8 PACKAGING AND PACKAGE MARKING

8.1 All packages shall be identified as conforming to Specification **C 387**, and as to kind and type of material listed in **Table 1** and the net mass in each bag printed thereon.

8.2 The yield in litres, and the amount of water recommended for mixing shall be marked on the package.

NOTE 2 – The amount of water recommended should be the amount required to produce a slump of 50 to 75 mm [2 to 3 in]

8.3 Container Construction – The material from which the containers are made shall have water vapour transmission not greater than 100 g/m² in 24 h as determined in accordance with Procedure B of Test Methods **E 96**. The strength of the container shall be adequate for the mass of concrete or mortar it is intended to contain.

9 REJECTION

The purchaser has the right to reject material that fails to conform to the requirements of this specification. Rejection shall be reported to the Producer or supplier promptly and in writing.

SAMPLING AND TESTING

10 ACCURACY OF MEASUREMENT

10.1 Use scales conforming to the applicable sections of *Handbook 44*¹ New and reconditioned scales shall be accurate to 60.1 % of the total capacity of the scale. When scales have been in use, they shall be accurate to 60.4 % of the total capacity of the scale.

¹ *Specifications, Tolerances, and Other Technical Requirements of Weighing and Measuring Devices, Handbook 44*, National Bureau of Standards

10.2 Record the mass of concrete in kilograms (pounds) to a minimum accuracy of 0.05 kg [0.1 lb.]. Record the mass of mortar in grams to an accuracy of within 1 g or 0.1%, whichever is greater.

11 SAMPLING CONCRETE

11.1 Use a sufficient quantity of whole packages to conduct all testing from a single batch.

12 MIXING AND TESTING CONCRETE

12.1 Determine the net mass of concrete in the package (or packages), then empty into a clean, watertight container.

12.2 Mix the concrete, determine the properties of the fresh concrete, and mould and cure the specimens in accordance with the applicable provisions of Practice **C 192/C 192M**, or modifications of them as outlined herein. Test the strength of the concrete in accordance with Test Method **C 39/C 39M**.

12.3 Mix the entire sample of the combined, dry material for concrete either by hand or by machine, except that hand mixing is not applicable to air-entrained concrete. Add mixing water in sufficient amount to produce a slump of 50 to 75 mm.

12.4 Use a watertight, clean metal container for hand mixing, using either a blunted bricklayer's trowel, hands protected by rubber gloves, or a shovel, whichever is more convenient. Mix the dry batch until the materials appear to be uniformly distributed. Add water while mixing until the concrete is homogeneous in appearance and has the desired slump. If prolonged mixing is required because of the addition of mixing water in increments while adjusting the slump, the batch must be discarded and a new batch made without interrupting the mixing to make trial slump tests.

12.5 Place all materials in the mixer to be used for machine mixing. A mixing period of 3 min followed by a 3 min rest, followed by 2 min final mixing is suggested, unless a different procedure is better adapted to the mixer being used. Cover the open end of the mixer during the rest period to reduce evaporation. Test the slump in accordance with Test Method **C 143/C 143M** upon completion of the mixing. If the slump test of the mixed batch shows that additional water is required, return the sample used for the slump test promptly to the mixer, add additional water, and remix the batch for 2 min. Retest the slump. If the slump is not from 50 to 75 mm [2 to 3 in.], discard the batch.

12.6 Discharge the mixed batch into a clean, watertight container that has been pre-dampened, then remix the batch by hand, using a scoop or trowel, until the batch appears to be uniform. Promptly determine the density in kilograms per cubic meter (or pound per cubic foot) in accordance with Test Method **C 138/C 138M**. Return samples used for the slump and unit weight test to the container, then remix the batch by hand and mould the specimens.

12.7 Mould six cylinders from each batch, using three cylinders for test at 7 days and three at 28 days, except that in the case of high early strength concrete, three cylinders shall be tested at 3 days and three at 7 days. Compression test specimens shall be cylindrical with a length equal to twice the diameter. The minimum specimen diameter shall be 75 mm [3 in.], but the maximum diameter is not limited, provided the number of specimens for a test as required in this section are moulded from a single batch and the sample taken in accordance with **11.1**. For acceptance, the average of the strengths of the three specimens tested at each age shall not be less than the compressive strength required in **Table 1** for the type of concrete under test and no individual specimen shall have a strength less than 90 % of the required strength.

12.8 The report of the tests of the concrete shall include the following:

12.8.1 Net mass of dry, combined material in the bag or bags determined by subtracting the mass of the empty bag or bags from the gross mass of the package.

12.8.2 Amount of mixing water (*W*) calculated in terms of kilograms (or pounds) per bag, based on mass of the bag.

$$W = (W_b/A)B$$

W_b = mass of water added to batch,

A = mass of dry material in batch, and

B = printed mass of bag contents.

12.8.3 Slump in millimetres (or inches) in accordance with Test Method **C 143/C 143M**.

12.8.4 Density (*D*) in kilograms per cubic meter (or pounds per cubic foot) in accordance with Test Method **C 138/C 138M**.

12.8.5 Yield (*Y*) of concrete as determined by Test Method **C 138/C 138M** in terms of litres (or cubic feet) per bag, based on printed mass of bag contents.

12.8.6 Air content, if required, shall be determined by one of the following Test Methods: **C 138/C 138M**, **C 173/C 173M**, (suggested for lightweight concrete); or **C 231**. The method used to determine the air content shall be reported.

12.8.7 Compressive strength at the ages specified in **Table 1**; report the method of mixing the concrete. State the size of the cylinder used in the report.

13 SAMPLING MORTAR

The contents of an entire package of dry, combined material for mortar for unit masonry or for concrete mortar shall be used as a sample. Determine the gross mass of the package and contents to the nearest 0.05 kg. Empty the entire contents of the package into a clean, watertight container. Determine the mass of the empty package and calculate the net mass of the package from the gross mass of the package and contents. Reduce the sample to the proper size for testing in accordance with Practice **C 702**.

14 MIXING AND TESTING MORTAR

14.1 Mortar mixing equipment shall be as specified in Practice **C 305**, except that the mixer must be provided with a bowl positioning adapter (**Note 3**) to ensure clearance for the largest size aggregate in the mix being tested. The mixing procedure shall be modified as given in **14.2**.

NOTE 3 – Description of such an adapter may be obtained from the Cement and Concrete Reference Laboratory of the National Institute of Standards Technology.

14.2 Mix 3000 ± 3 g of mortar in accordance with Practice **C 305** with the exception that the combined material is added at the time of cement addition in Practice **C 305**. Additional water may be added in the final mix period to adjust the flow. Determine the flow in accordance with Test Method **C 1437**. Use sufficient water to produce a flow of 110 ± 5 %.

14.3 *Compressive Strength* – Specimens shall be 50 mm cubes moulded, cured, and tested in accordance with procedures in Specification **C 270** for mortars for unit masonry and in accordance with Test Method **C 109/C 109M** for high strength mortars.

14.4 *Density and Yield* – Determination of density of the mixed mortar and yield per package of mortar.

14.4.1 Vigorously remix the remaining mortar by hand for 10 s using a spoon. Consolidate the mortar into a 400-mL measure in accordance with Test Method **C 185**.

14.4.2 Determine the net mass (*M*) of the mortar in the 400 mL measure to the nearest 1 g.

14.4.3 Calculate the density of the mortar in kilograms per cubic metre (or pounds per cubic foot) using the equations:

$$D_k = 5.2 \cdot M \text{ or } (D_p = 0.156M) \quad (1)$$

where:

D_k = density in kilograms per cubic metre

D_p = density in pounds per cubic foot

14.4.4 Calculate the yield (Y) per package in litres (cubic feet) as follows:

$$Y = (1 + R)PC/D \quad (2)$$

where:

R = ratio of mass (or weight) of mixing water to mass (or weight) of dry combined material in the batch of mortar.

P = the net mass (or weight) printed on the package.

C = Conversion factor. To determine the yield in litres, P must be in kilograms per cubic metre. The conversion factor is 1000.

14.5 Water Retention – For mortars for unit masonry, determine the water retention in accordance with Test Method **C 1506**.

14.6 Air Content (required for mortars for unit masonry and optional for high-strength mortars) – If the mixture proportions are known, calculate the air content in accordance with Specification **C 270**. If the proportions are not known, use Test Method **C 138/C 138M**, or Test Method **C 173/C 173M**, or Test Method **C 231** to determine air content.

14.7 The report of the tests shall include:

14.7.1 Net mass (or weight) of dry, combined material in the bag determined to 0.05 kg [0.1 lb],

14.7.2 Amount of mixing water (W) calculated in accordance with the formula specified in **12.8.2**,

14.7.3 Flow, in accordance with Test Method **C 1437**,

14.7.4 Density (D) in kilograms per cubic metre (or pounds per cubic foot) as determined in **14.4** in accordance with Test Method **C 138/C 138M**,

14.7.5 Yield (Y) of mortar in litres (or cubic feet) as determined in **14.4**,

14.7.6 Air content, if measured, and test method used to determine air content,

14.7.7 Water retention in per cent, if measured, and

14.7.8 Compressive strength at ages specified in **Table 1**.

15 KEYWORDS

15.1 aggregate-cement aggregate combinations; cement mortars; combined concrete/mortar materials; concrete admixtures; concrete, packaged; concrete specifications; dry combined concrete/mortar materials; mortar-cement mortar; mortar, packaged; packaged dry combined materials; packaged concrete/mortar materials

THE MALAWI BUREAU OF STANDARDS

The Malawi Bureau of Standards is the standardizing body in Malawi under the aegis of the Ministry of Industry and Trade. Set up in 1972 by the Malawi Bureau of Standards Act (Cap: 51:02), the Bureau is a parastatal body whose activities aim at formulating and promoting the general adoption of standards relating to structures, commodities, materials, practices, operations and from time to time revise, alter and amend the same to incorporate advanced technology.

CERTIFICATION MARK SCHEME

To bring the advantages of standardization within the reach of the common consumer, the Bureau operates a Certification Mark Scheme. Under this scheme, manufacturers who produce goods that conform to national standards are granted permits to use the Bureau's "Mark of Quality" depicted below on their products. This Mark gives confidence to the consumer of the commodity's reliability.

