

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1774.22—2000

Refractories and refractory materials—Physical test methods
Method 22: Refractory mortar—Test methods

RECONFIRMATION NOTICE

Technical Committee MN-007 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 4 April 2013.

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Refractories Manufacturers Association of Australia
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NOTES

Australian Standard™

AS 1774.22

Refractories and refractory materials—Physical test methods**Method 22: Refractory mortar—Test methods**

PREFACE

This Standard was prepared by the Standards Australia Committee MN/7, Refractories and Refractory Materials as a revision of AS 1774.22—1985, *Methods for physical testing of refractories and refractory materials*, Method 22: *Bonding strength of refractory mortar*.

In the preparation of this Standard cognizance was taken of BS 1902.11:1990 *Methods of testing refractory materials*, Part 11: *Refractory mortars and putties* and GB 5024.1—85 *Test methods for refractory mortars*.

The objective of this revision is to provide a suite of tests for the evaluation of refractory mortars.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	3
1.2 REFERENCED DOCUMENTS.....	3
1.3 DEFINITIONS.....	3
1.4 SAFETY.....	3
1.5 GENERAL APPARATUS.....	3
1.6 PREPARATION OF MORTAR.....	4
SECTION 2 DETERMINATION OF CONSISTENCY	
2.1 GENERAL.....	5
2.2 PENETROMETER METHOD.....	5
2.3 TAP FLOW METHOD.....	7
SECTION 3 DETERMINATION OF TROWELABILITY	
3.1 SCOPE.....	10
3.2 APPARATUS.....	10
3.3 PROCEDURE.....	10
3.4 TEST REPORT.....	10
SECTION 4 DETERMINATION OF WATER RETENTION	
4.1 SCOPE.....	11
4.2 APPARATUS.....	11
4.3 PROCEDURE.....	11
4.4 TEST REPORT.....	11



SECTION 5 DETERMINATION OF JOINT STIFFENING TIME

5.1	PRINCIPLE	12
5.2	APPARATUS	12
5.3	SAMPLING	12
5.4	PROCEDURE	12
5.5	TEST REPORT	13

SECTION 6 DETERMINATION OF BONDING STRENGTH

6.1	PRINCIPLE	14
6.2	APPARATUS	14
6.3	SAMPLING OF TEST MORTAR	14
6.4	PREPARATION OF TEST SPECIMEN	14
6.5	FIRING PROCEDURE	15
6.6	TEST PROCEDURE	15
6.7	TEST REPORT	15

SECTION 7 DETERMINATION OF COLD SHEAR BONDING STRENGTH

7.1	SCOPE	16
7.2	APPARATUS	16
7.3	SAMPLING AND PREPARING SPECIMENS	16
7.4	PROCEDURE	17
7.5	CALCULATIONS	18
7.6	TEST REPORT	18

SECTION 8 DETERMINATION OF REFRACTORINESS BY PIER TEST

8.1	PRINCIPLE	19
8.2	APPARATUS	19
8.3	PREPARATION OF MORTAR	19
8.4	TEST PROCEDURE	19
8.5	TEST REPORT	20

SECTION 9 SIEVE ANALYSIS

21

SECTION 10 DETERMINATION OF PERMANENT DIMENSIONAL CHANGE

10.1	SCOPE	22
10.2	PRINCIPLE	22
10.3	APPARATUS	22
10.4	PREPARATION OF MORTAR	22
10.5	PROCEDURE	22
10.6	CALCULATIONS	23
10.7	TEST REPORT	24

METHOD

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out methods for the preparation and testing of specimens of refractory mortars for determining a range of properties.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1774	Refractories and refractory materials—Physical test methods
1774.3	Method 3: Determination of cold modulus of rupture
1774.10	Method 10: Pyrometric cone equivalent (refractoriness)
1774.19	Method 19: The determination of sieve analysis and water content
1774.30	Method 30: Drying and firing schedules
2243	Safety in laboratories (series)
2701	Methods of sampling and testing mortar for masonry constructions
2701.7	Part 7: Method for determination of water retention
2780	Refractories and refractory materials—Glossary of terms

1.3 DEFINITIONS

For the purpose of this Standard, the definitions in AS 2780 apply.

1.4 SAFETY

This Standard may involve hazardous materials, operations, and equipment. This Standard does not purport to address the safety problems 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.

Reference should be made to relevant parts of AS 2243.

1.5 GENERAL APPARATUS

1.5.1 Balance

A weighing device capable of weighing at least 5 kg to the nearest 10 g.

1.5.2 Drying oven

A fan-forced, ventilated oven capable of maintaining a temperature of $110 \pm 5^\circ\text{C}$.

1.5.3 Mixer

A planetary or paddle mixer having the casing and blades constructed of a material that is inert to the materials being mixed.

1.5.4 Spacing rods

Spacing rods which are made of corrosion resistant metal, 2.00 ± 0.05 mm in thickness, and of appropriate length.

1.5.5 Test brick

A standard brick of appropriate composition which shall be compatible with the mortar being tested.

NOTE: The nominal dimensions of a standard brick are 230 mm × 115 mm × 75 mm.

1.5.6 Timing device

Any timing device capable of recording time in seconds.

1.6 PREPARATION OF MORTAR

If the mortar is supplied in ready-to-use form the entire contents of the container shall be thoroughly re-mixed, or, if the mortar is supplied in dry form, proceed as follows:

- (a) Weigh the required amount of mortar and record the mass.
- (b) Place the mortar in the mixer and dry mix for the minimum time necessary to achieve homogeneity.

With the mixer operating add 90% of the estimated liquid requirement, at 20°C to 25°C, within a time of 30 s.

- (c) Continue mixing for 1 min, then add additional liquid in small amounts, and mix until the batch appears to have the desired consistency.
- (d) Record the total mass of liquid added.
- (e) Leave to stand for an appropriate time according to manufacturer's recommendations.

NOTE: To reproduce a consistency within a specified flow range, (see Clauses 2.2 or 2.3), it may be necessary to make several trial mixes with varying percentages of water, making each trial with fresh mortar.

SECTION 2 DETERMINATION OF CONSISTENCY

2.1 GENERAL

The consistency of a wet mortar shall be determined by either the penetrometer or tap-flow method.

NOTE: The relationship between the two methods can be determined for any given mortar, but different relationships may exist for different mortars.

2.2 PENETROMETER METHOD

2.2.1 Scope

This method provides a quantitative measure of the consistency of a wet mortar by determining a penetration value.

2.2.2 Principle

Mortar, mixed with a measured amount of liquid (usually water) is placed in a cylindrical cup. A cylinder is dropped from a known height into the wet mortar and the average depth of penetration of the cylinder into the sample is used as a measure of consistency.

2.2.3 Apparatus

Penetration determining devices consisting of a penetrometer, cylinder and vertical rod, and a sample container. They are detailed as follows:

(a) *Penetrometer*

See Figure 1. Consisting in part of a cylinder attached to a vertical drop rod. A trigger device shall allow the vertical rod and cylinder to drop freely and vertically through 175 mm.

NOTE: Minimum length of rod above the top rod guide is 175 mm.

(b) *Cylinder and vertical rod*

A cylinder of 25 ± 0.1 mm diameter and 70 ± 0.1 mm height shall be attached to the base of a smooth vertical rod. The total mass of the cylinder and rod shall be 70 ± 0.1 g. The cylinder shall be made of a material which is resistant to corrosive components of the mortar.

(c) *Sample container*

A cylinder cup of 75 ± 1 mm internal diameter and 75 ± 1 mm internal height. The sample container shall be made of a material which is resistant to corrosive components of the mortar.

(d) *Timing device*

Refer to Clause 1.5.6.

2.2.4 Sampling

Prepare the mortar according to Clause 1.6 and samples should be taken in accordance with established sampling procedures.

2.2.5 Procedure

The procedure shall be as follows:

- (a) Set up the penetrometer (2.2.3(a)) in a level and stable position ensuring that all parts are clean and the vertical rod moves freely.
- (b) Raise the cylinder and rod so that the base of the cylinder is 100 ± 0.5 mm above the top of the sample container. Clamp the cylinder and rod in position with the trigger device. See Figure 1.

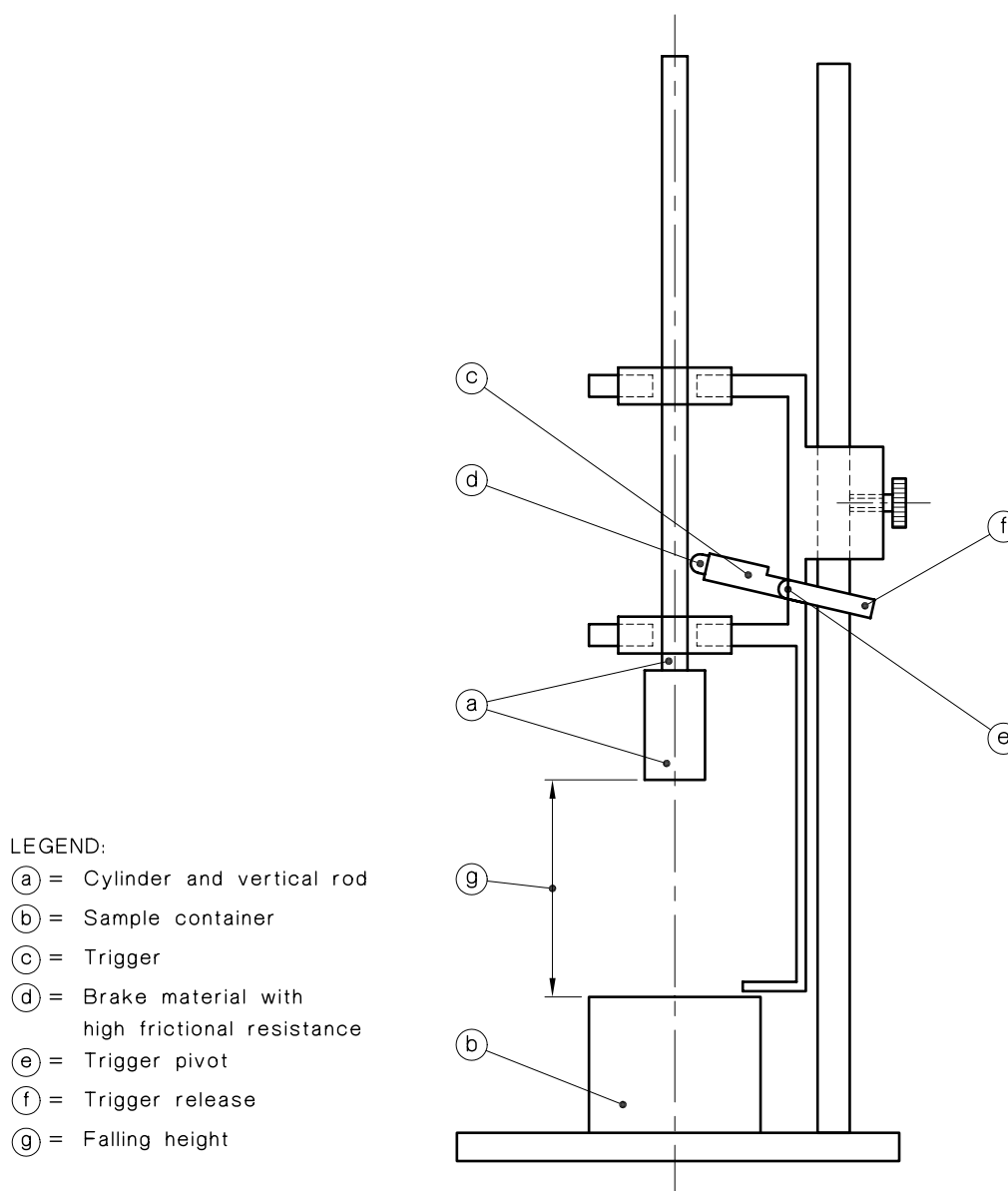


FIGURE 1 SCHEMATIC SKETCH OF THE PENETROMETER

- (c) Either —
- (i) measure the length of rod above the top rod guide to the nearest millimetre; or
 - (ii) set up a direct reading gauge, reading to the nearest millimetre, on the apparatus to indicate the cylinder height relative to top of the sample container, i.e. to indicate '0' when the base of the cylinder is level with the top of the sample container and to indicate '75' when the cylinder touches the bottom of the empty sample container.
- (d) Fill the sample container with the prepared mortar, taking care to avoid entrapped air. Level the mortar surface with a scraper and place the sample container on the penetrometer base centrally underneath the cylinder.

- (e) Release the clamp/trigger and allow the cylinder and rod to fall freely. After 5 seconds measure and record the depth of penetration of the cylinder into the surface of the wet mortar and determine penetrations as follows:

- (i) Where measuring the height of rod above the top rod guide:

$$\text{Penetration (mm)} = L_o - L_f - 100 \quad \dots 2.1$$

where L_o = Original height of rod, in millimetres

L_f = Final height of rod, in millimetres

- (ii) Where using a direct reading gauge:

$$\text{Penetration (mm)} = \text{Gauge reading}$$

- (f) Clean and dry the penetration cylinder. Repeat Steps (b) to (e).

2.2.6 Test result

The average of the two penetration test results shall be taken as the consistency of the wet refractory mortar.

2.2.7 Test report

The test report shall include the following:

- (a) The consistency of the mortar to the nearest millimetre.
- (b) Where applicable, details of the preparation of the wet mortar according to Clause 1.6, including the following:
 - (i) The amount of water added as percent of dry weight, to the nearest 0.1%.
 - (ii) The temperature of both the dry mortar and the water used, to the nearest 1°C.
 - (iii) Total mixing time after all water has been added, in minutes.
- (c) Any observation which may have an affect on the result.
- (d) Reference to this Standard, i.e. AS 1774.22.

2.3 TAP FLOW METHOD

2.3.1 Scope

This method describes a procedure for measuring the consistency of mortars by determining a flow value.

2.3.2 Principle

Mortar, mixed with a measured amount of liquid (usually water) and moulded to shape, is placed on a metal surface which is then raised and dropped through a known height a given number of times. The resulting average increase in the diameter of the base of the sample is then measured and the value (i.e. flow value) used as a measure of consistency.

2.3.3 Apparatus

2.3.3.1 Balance

See Clause 1.5.1.

2.3.3.2 Flow table and mould

Complying with the requirements of AS 2701.7.

2.3.3.3 Callipers

Complying with the requirements of AS 2701.7, or any callipers capable of measuring to 250 mm with an accuracy of 1 mm.

2.3.3.4 Tamper

Made of a non-absorptive, inert material and having a diameter of 10 mm to 15 mm and a convenient length. The tamping face shall be flat and at right angles to the length of the tamper.

2.3.3.5 Trowel

Having a steel blade 100 mm to 150 mm in length, with straight edges.

2.3.3.6 Castable mixer

See Clause 1.5.3.

2.3.3.7 Thermometer

Capable of measuring temperatures in the range 0°C to 50°C, to an accuracy of $\pm 1^\circ\text{C}$.

2.3.4 Procedure**2.3.4.1 Sample size division**

The thoroughly-mixed sample shall be reduced to approximately 5 kg.

2.3.4.2 Temperature measurement

The temperature of the sample shall be measured by inserting the thermometer into the centre of the material.

2.3.4.3 Determination of flow

Flow shall be determined as follows:

- (a) Wipe the flow table top clean and dry then place the flow mould (2.3.3.2) in the centre.
- (b) Place a 25 mm layer of mortar in the mould and, using just enough pressure to ensure uniform filling, tamp approximately 20 times with the tamper (2.3.3.4). Fill the mould with additional mortar, and tamp as for the first layer.
- (c) Cut off the mortar to a plane surface flush with the top of the mould by drawing a straight edge of a trowel (2.3.3.5), held nearly perpendicular to the mould, with a sawing motion across the top of the mould.
- (d) Wipe the table top clean and dry, removing any water from around the edge of the mould.
- (e) Lift the mould away from the mortar within 1 min of completing the mixing operation in Clause 1.6, and immediately drop the table exactly 15 times in 9 s.
- (f) Using the callipers (2.3.3.3), record four measurements of the base diameter of the castable at the scribed marks on the table.
- (g) Obtain the percent flow by one of the following means:
 - (i) Where using the callipers specified in AS 2701.7, add the four measurements.
 - (ii) Where using ordinary callipers, determine the average of the four measurements and calculate percent flow using the following equation:

$$\text{Percent flow} = 100 \times (D_{\text{av}} - D_{\text{orig}})/D_{\text{orig}} \quad \dots 2.2$$

where

D_{av} = average base diameter, in millimetres

D_{orig} = original base diameter, in millimetres