

Australian Standard™

AS 1774.34

Refractories and refractory materials—Physical test methods

Method 34: Guide to the determination of extrusion pressure and curing time of taphole clay

PREFACE

This Guide was prepared by Standards Australia Committee, MN-007, Refractories and Refractory Materials.

The objective of this Guide is to provide manufacturers and users of refractories tap hole clays with qualitative methods to determine the consistency and heat setting behaviour of the product.

METHOD

1 SCOPE

This Guide provides recommended methods for determining the extrusion pressure (consistency) and the curing time of taphole clays.

2 REFERENCED DOCUMENTS

AS

2243 Safety in laboratories (series)

2780 Refractories and refractory materials—Glossary of terms

3 DEFINITIONS

For the purpose of this Guide, the definitions in AS 2780 and those below apply.

3.1 Required temperature

The required temperature is 50°C or a temperature as agreed between the interested parties.

4 SAFETY

For information on safety in laboratories refer to AS 2243.

For safety information on taphole clay materials, refer to the relevant material safety data sheets.

5 GENERAL APPARATUS

5.1 Balance

Capable of weighing up to 100 g to nearest 0.1 g.

5.2 Weighing scale

Capable of weighing 1500 g to the nearest 5 g.

6 DETERMINATION OF EXTRUSION PRESSURE

6.1 Principle

A specimen of taphole clay is heated to a required temperature and placed inside an extrusion mould that is at the same temperature. The taphole clay is extruded through an orifice at a constant rate. The extrusion pressure is calculated from the maximum force exerted during the extrusion process.

6.2 Apparatus

6.2.1 Extrusion mould assembly

A mould assembly, as shown in Figure 1, made of material inert to the taphole clay being tested.

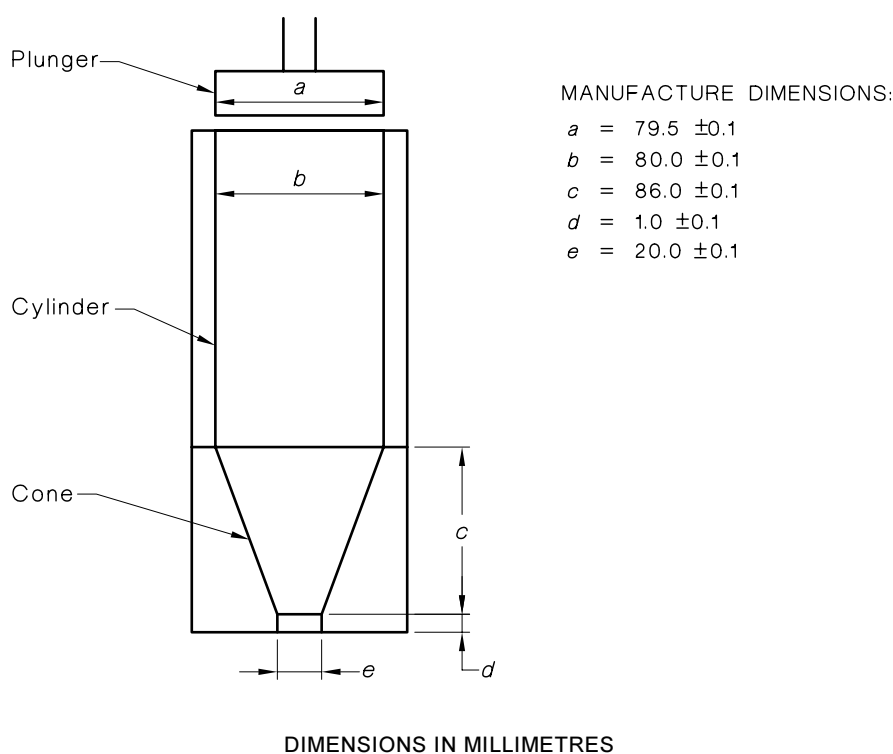


FIGURE 1 EXTRUSION MOULD ASSEMBLY

6.2.2 Drive unit

Capable of moving the plunger under load into the mould at constant rate of 50 ± 5 mm/min.

6.2.3 Force measuring device

Capable of measuring the force applied to the plunger to the nearest 0.1 kN.

6.2.4 Recorder

Capable of continuously recording the force applied, for example, a chart recorder.

6.2.5 Oven

Fan forced, capable of maintaining the required temperature to within 1°C.

6.2.6 Thermometers

The following are required:

- (a) A probe type thermometer capable of measuring the required temperature within 1°C.
- (b) A contact type thermometer capable of measuring the required temperature within 1°C.

6.3 Test specimens

The taphole clay specimen should have a volume of 0.7 L to within ±2%.

NOTE: To achieve the required volume of the test specimen, the required mass should be calculated from the bulk density of the taphole clay. If the bulk density is not known, a bulk density determination should be carried out on a representative sample (such as a curing time test piece).

The required mass of the test specimen may be calculated from the following equation:

$$M = \frac{0.7D}{1000}$$

where

$$\begin{aligned} M &= \text{mass, in kilograms} \\ D &= \text{density, in kilograms per cubic metre} \end{aligned}$$

6.4 Procedure

The procedure should be as follows:

- (a) Heat the extrusion mould sections and the taphole clay specimen to the required temperature.
NOTE: Some taphole clays may suffer from premature curing if stored for too long at 50°C. Follow the manufacturer's recommendation regarding the temperature sensitivity of the taphole clay.
- (b) Use the contact thermometer to check that all the extrusion mould sections are within 1°C of the required temperature.
- (c) Push the probe thermometer into the centre of the taphole clay specimen and check that the temperature is within 1°C of the required temperature.
- (d) Lubricate the inside of the cylinder and the outside of the plunger with oil. Assemble the extrusion mould, place the taphole clay specimen into the mould cavity, and place the plunger on top.
- (e) Without delay, place the extrusion mould assembly inside the drive unit.
- (f) Turn the drive unit on to push the plunger at a constant rate of 50 ± 5 mm/min. Start recording the extrusion force.
- (g) Stop the drive unit when the plunger is 11 ± 0.5 mm above the cone.
- (h) Record the maximum force exerted as $F_{\max}$, to the nearest 0.1 kN.

6.5 Calculation

The extrusion pressure should be calculated from the following equation:

$$EP = 10 \times F_{\max}/50.3$$

where

$$\begin{aligned} EP &= \text{extrusion pressure in megapascals} \\ F_{\max} &= \text{maximum force recorded in kilonewtons} \\ 50.3 &= \text{cross-sectional area of the extrusion cylinder in centimetres squared} \end{aligned}$$