

Australian Standard[®]

AS 1141.27:2015

Methods for sampling and testing aggregates Method 27: Resistance to wear by attrition

1 SCOPE

This Standard sets out the method for testing aggregate or rock for resistance to wear using the Deval attrition machine, and for measuring the attrition value of freshly crushed rock.

2 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

AS

- 1141 Methods for sampling and testing aggregates
- 1141.2 Method 2: Basic testing equipment
- 1141.3.1 Method 3.1: Sampling—Aggregates
- 1141.3.2 Method 3.2: Sampling—Rock spalls and boulders
- 1141.14 Method 14: Particle shape by proportional calliper
- 1152 Specification for test sieves

3 APPARATUS

The following apparatus complying with the requirements of AS 1141.2 and as follows is required:

- (a) *Deval attrition machine*—consisting of two hollow steel cylinders closed at one end and furnished with a tightly fitting steel cover at the other. The cylinders shall have internal dimensions of 200 mm in diameter and 340 mm in length, and shall be mounted on a shaft with their axes inclined at 30° to the axis of rotation of the shaft, and the axes shall intersect at the midpoints of the hollow cylinders' axes (see Figure 1).

The rate of rotation shall be 30 rev/min to 33 rev/min.

- (b) *Sieves*—53.0 mm, 37.5 mm and 2.36 mm test sieves in accordance with AS 1152.
- (c) *Balance*—having a limit of performance not exceeding ± 5 g.
- (d) *Oven*—thermostatically controlled, to operate at a temperature within the range of 105°C to 110°C.
- (e) *Dishes and trays*.

4 SAMPLING

Samples shall be obtained in accordance with AS 1141.3.1 when testing aggregate, and in accordance with AS 1141.3.2 if rock spalls are sampled to be crushed to provide material for the test portion. Obtain a bulk field sample of at least 60 kg of the aggregate to be tested if the test portion is to be prepared remote from the sampling site, or sufficient material to provide a test portion of at least 30 kg mass if the test portion is screened at the sampling site. The mass of spalls required will depend on the efficiency of the crusher used in preparing the test portion required.

5 PREPARATION OF TEST PORTION

The test portion shall be prepared as follows:

- (a) Sieve the bulk sample over 53 mm and 37.5 mm sieves, and separate the material passing the 53 mm and retained on the 37.5 mm sieve. Discard the remainder of the sample.
- (b) Discard any particles which are found to be misshapen when tested in accordance with AS 1141.14, using a proportional calliper ratio of 2:1.
- (c) Discard any particle where the fractured edges have been rounded by mechanical handling processes.
- (d) By quartering or other suitable means, divide the test sample into the required number of test portions of approximately 5 kg and adjust the mass of each test portion to within the mass of one stone by the addition or subtraction of stones. Discard excess material.
- (e) Thoroughly wash the aggregate comprising each test portion, to remove all dust from its surfaces.
- (f) Allow the moisture to evaporate from the surface or blot it off with a soft cloth, and subsequently oven dry the test portion to constant mass in an oven operating between 105°C and 110°C.

6 PROCEDURE

6.1 General

The aggregate shall be tested to at least one of Clause 6.2 (the dry attrition test) or Clause 6.3 (the wet attrition test). Each procedure requires two test portions to be used.

6.2 Dry attrition test

The procedure is as follows:

- (a) Select two test portions, determine the mass of each test portion to the nearest 1 g and record (m_1).
- (b) Place each test portion in one of the cylinders of the Deval attrition machine, bolt on the covers and set the machine to run for 10 000 rotations.
- (c) Keeping each test portion separate, remove all material from each cylinder and screen each test portion on a 2.36 mm sieve.
- (d) Thoroughly wash the material retained on the sieve to remove all dust from the surface of the stone for each test portion.
- (e) Dry the material retained on the 2.36 mm sieve from each test portion to constant mass in an oven operating between 105°C and 110°C. Determine and record the retained mass (m_2) for each test portion.

6.3 Wet attrition test

The apparatus employed, the mass of the test portions used, and the procedure followed shall be the same as the dry attrition test, except that a mass of clean water equal to the mass of each test portion is added with the test portion prior to the securing the cylinder covers.

7 CALCULATION

Calculate the ratio of the loss in mass to the original mass of the test portion, expressed as a percentage, for both tests of each test procedure, from the following equation:

$$A = \frac{m_1 - m_2}{m_1} \times 100$$

where

A = percentage loss in mass

m_1 = mass of oven dried test portion before attrition, in grams

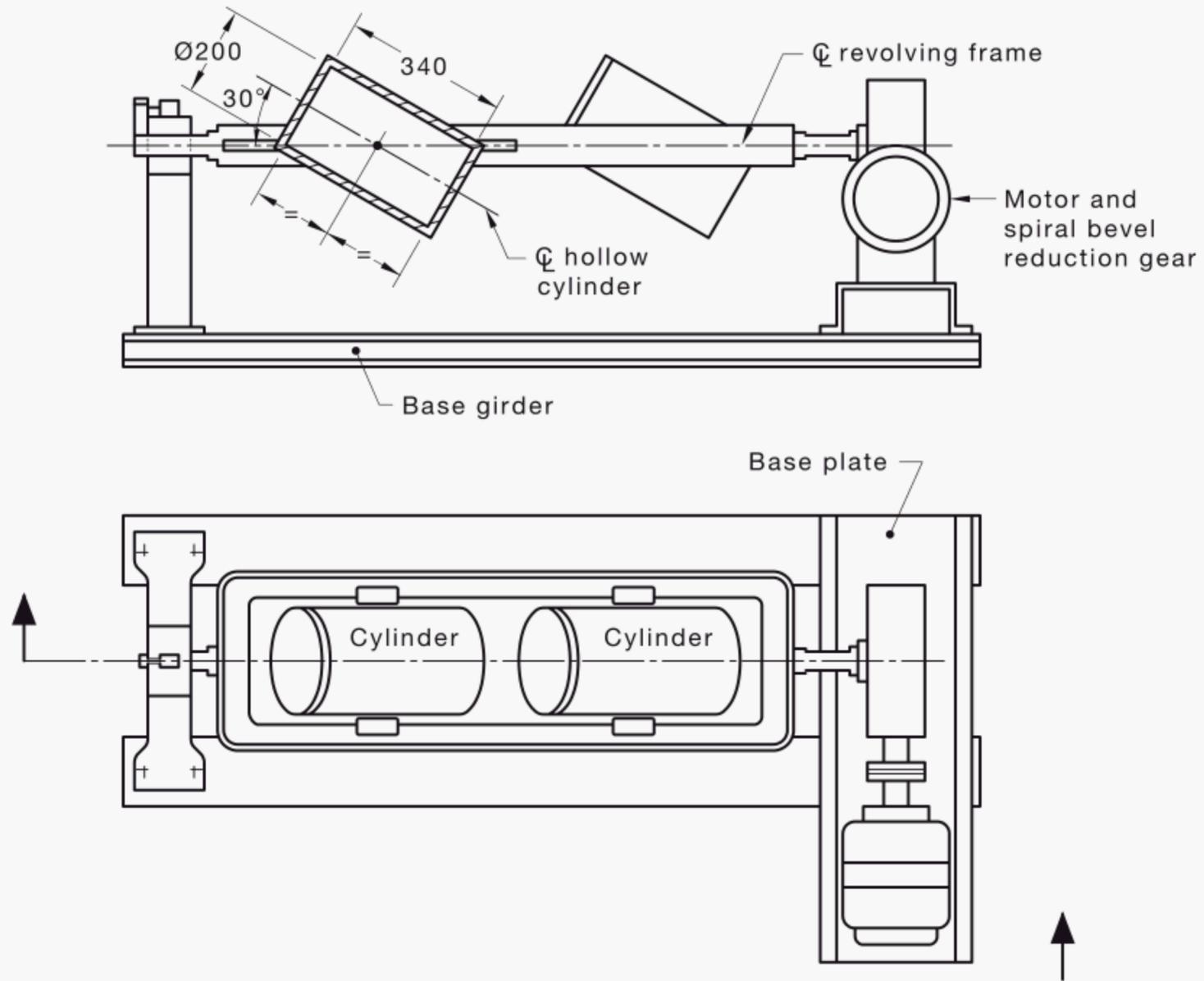
m_2 = mass of oven dried test portion retained on the 2.36 mm sieve after attrition, in grams

The attrition value of the sample tested is the mean of the two values of A , obtained for the two test portions. Dry and wet attrition values shall be calculated separately.

8 REPORT

The following shall be reported:

- (a) Sampling procedure.
- (b) Sample identification
- (c) Other details of sample as required.
- (d) The attrition value(s) to the nearest 0.1%.
- (e) The number of this Standard (i.e. AS 1141.27).



DIMENSIONS IN MILLIMETRES

FIGURE 1 DEVAL ATTRITION MACHINE

NOTES

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This Australian Standard® was prepared by Committee CE-012, Aggregates and Rock for Engineering Purposes. It was approved on behalf of the Council of Standards Australia on 22 January 2015 and published on 20 February 2015.

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Originated as AS 1141.27—1995.
Second edition AS 1141.27:2015.

This Standard was issued in draft form for comment as DR AS 1141.27:2014.

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Published by Standards Australia Limited
GPO Box 476, Sydney, NSW 2001, Australia

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