

Australian Standard®

Methods of test for fibre ropes

Method 1: Dimensions, linear density, breaking force and elongation

PREFACE

This Standard was prepared by the Standards Australia Committee on Ropes and Cordage to supersede Appendices B and C of AS 1504—1983, *Fibre rope—Three-strand, hawser laid*, and Appendices B and C of AS 1752—1983, *Fibre rope—Eight-strand plaited*. The methods have been expanded to allow for the testing of man-made fibre ropes for static life rescue lines. This Standard is based on ISO 2307, *Ropes—Determination of certain physical and mechanical properties*.

METHOD

1 SCOPE This Standard sets out methods for measuring the diameter, length of lay, linear density, breaking force and elongation of fibre rope.

2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

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| 2193 | Methods for calibration and grading of force-measuring systems of testing machines |
| 4142 | Fibre ropes |
| 4142.1 | Part 1: Care and safe usage |
| 4142.2 | Part 2: Three-strand hawser-laid and eight-strand plaited |
| 4142.3 | Part 3: Man-made fibre rope for static life rescue lines |

3 DEFINITIONS For the purpose of this Standard, the definitions given in AS 4142.1, AS 4142.2 and AS 4142.3 and those below apply.

3.1 Breaking elongation—the elongation of a specimen at the instant the breaking force is reached.

3.2 Breaking force—the maximum force recorded in breaking a test specimen.

NOTE: This is also the minimum force needed to break a test specimen.

3.3 Elongation—the increase in the length of the rope between two specified tensions.

3.4 Reference tension—a force specified in the Tables in AS 4142.2 for the ropes covered by that Standard, otherwise it is the force, in newtons, numerically equal to $1.25 \times d^2$, where d is the nominal diameter of the rope or the rope size number, as appropriate.

4 PRINCIPLE

4.1 Diameter The diameter of the rope is determined by one of the following methods:

- (a) For ropes of less than 16 mm diameter, by use of a pair of rope callipers while the rope is at reference tension.
- (b) For ropes of 16 mm diameter or more, by reading a diameter tape wound around the rope's circumference while the rope is at reference tension.
- (c) For eight-strand plaited ropes, by reference to the appropriate Table in AS 4142.2 after measuring the linear density of the rope.

4.2 Length of lay The length of lay is obtained by measuring the length of 5 lays, or 10 lays, of a test specimen whilst at reference tension, and dividing by 5 or 10, respectively.

4.3 Linear density The linear density is obtained by dividing the total mass of a conditioned test piece by its length at reference tension.

4.4 Breaking force The breaking force is obtained by stretching a specimen and recording the force needed to break it, or severely damage it. In the case of large diameter ropes of three-strand hawser-laid or eight-strand plaited construction, where the breaking force is in excess of the capacity of the testing machine, or where the diameter is too great for any practicable method of attaching the rope to the testing machine, a special method is employed to obtain the breaking force (see Appendix A).

4.5 Elongation The elongation is obtained by recording the change of length of a specimen as it is stretched. In the case of certain large diameter ropes (see Clause 4.4) a special method is employed to obtain the elongation (see Appendix A).

5 APPARATUS The following apparatus is required:

- (a) A steel rule or steel tape, graduated in millimetres and accurate to at least 0.5 mm.
- (b) A balance capable of determining the mass to an accuracy of 0.1%.
- (c) A rope-rule calliper having a movable jaw which slides freely in the shank of the fixed jaw, and having jaw faces not less than 3 mm in width. The length of the jaws shall be at least twice the diameter of the rope being measured. The calliper shall be graduated in millimetres and accurate to 0.1 mm.
- (d) A diameter tape.
- (e) A tensile testing machine, having grips of one of the types shown in Figures 1, 2 or 3, capable of exerting tension sufficient to break the rope being tested, allowing a constant rate of travel of the moving element and complying with the requirements of Grade B machines specified in AS 2193.
- (f) A conditioning facility for providing and maintaining a standard atmosphere of $20 \pm 2^\circ\text{C}$ and a relative humidity of $65 \pm 2\%$.

6 SAMPLES AND TEST SPECIMENS

6.1 Sample A test sample shall be taken from one end of a coil selected for testing. Each test sample shall be representative of the balance of the coil.

6.2 Conditioning Condition the sample for 24 h in the atmosphere described in Clause 5(f). Preparation of test specimens and subsequent testing shall, if possible, be conducted without removal from the standard atmosphere, or otherwise within 30 min after removal from that atmosphere.

6.3 Test specimens At least two test specimens shall be prepared. Their length shall be sufficient for each specimen to be mounted for testing as described in Clause 7, Steps (a) and (b).

7 PROCEDURE The procedure shall be as follows:

- (a) Mount a test specimen on the tensile testing machine, as shown in Figure 1 for wedge grips, in Figure 2 for bollard grips using splices or in Figure 3 for bollard grips used with clamps, and increase the tension until the reference tension is reached.
- (b) Place gauge markers (M in Figures 1 to 3), near the ends of the test specimen, so that each gauge mark is—
 - (i) for wedge grips, in line with the grips;
 - (ii) for bollard grips where the rope is spliced, 150 mm from the last turn of the splice; or
 - (iii) for bollard grips where the rope is clamped, where the rope is clear of the bollard.

Ensure the distance between the gauge markers is not less than 1000 mm.

- (c) Measure the distance between the gauge marks to obtain the gauge length. Record the gauge length.
- (d) Measure and record the distance between the grips of the machine.
- (e) For ropes of less than 16 mm diameter, measure the diameter as shown in Figures 4 and 5.
- (f) For ropes of 16 mm diameter or more, wrap the diameter tape around the rope. Read off the diameter in millimetres.
- (g) Repeat Step (e) or Step (f), as appropriate, twice more at different places along the length of the specimen to obtain a total of three diameter readings.
- (h) Measure the length of 10 lays or, if this is not possible, the length of 5 lays.
- (i) Increase the tension by moving the moving element of the machine at a constant rate to increase the distance between the grips of the machine.

The rate of movement should be equal to between 6% and 10% of the gauge length per minute. It shall not exceed 250 mm/min.

On machines which do not automatically record the rope tension and distance travelled by the moving jaw, record the tension and distance travelled by the moving jaw at uniform intervals of time, preferably every 10 s or 12 s. If this is not possible, increase the tension until a value equal to 75% of the specified minimum breaking force is reached, stop the machine for as short a time as possible and measure the distance between the gauge marks.

- (j) For rope for static life rescue lines, stop the machine for as short a time as possible when the tension in the specimen is 784 N (80 kg wt) and 3675 N (375 kg wt) and measure the distance between the gauge marks.
- (k) For all types of ropes, continue to move the grips apart at the constant rate until the rope snaps, a strand breaks or the tensile force being recorded falls. Note this tensile force as the breaking force, the elongation reached, and where the break occurred. If the break occurred outside the gauge marks, disregard the results unless the force registered at the time of break was not less than 90% of the specified minimum breaking force.