

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TEST FOR TEXTILES

PART 2—PHYSICAL TESTS

AS 2001.2.14

DETERMINATION OF TWIST IN YARNS

PREFACE

This edition of this standard was prepared by the Association's Committee on Testing of Textiles. The standard supersedes AS L48—1969, Method for the Determination of Twist in Yarn in Packaged Form.

During the preparation of this standard, cognizance was taken of the following standards:

ISO 2061-1972	Textiles—Determination of twist in yarns—Direct counting method
ASTM D1422-82	Test Method for Twist in Single Spun Yarns by the Untwist-Retwist Method
ASTM D1423-82	Test Method for Twist in Yarns by the Direct-counting Method
BS 2085: 1973	Determination of twist in yarns, direct-counting method
IWTO-25-70	Determination of the Twist of Wool Worsted Yarns

In the direct-counting method, applicable to single, plied and cabled yarns, one end of the yarn is held stationary while the other is rotated and the number of turns it takes to remove all the twist is counted. The number of turns per unit length is then determined.

In the untwist-twist method, applicable only to some single spun yarns, a specimen is untwisted and then retwisted in the opposite direction until it contracts to its original length. It is assumed that the same amount of twist has been inserted as was originally present. The turns per unit length are determined from the registration on the twist counter and the specimen length.

The designation of direction of twist and the method for its determination, based on AS 1505, Designation of Yarns, are also given together with a description of the essential requirements of the apparatus to be used.

This standard differs from ISO 2061 in that it provides additional information for alternative methods of test. In other respects it is similar to ISO 2061.

METHOD

1 SCOPE. The standard sets out methods for determining the amount of twist in yarns in turns per unit length in a given direction.

Procedures are given for determining the twist in singles, plied (folded) and cabled yarn.

Two procedures are given for single yarns as follows:

- (a) Method A—Direct-counting.
- (b) Method B—Untwist-twist.

2 APPLICATION. These methods apply to yarns capable of being untwisted. They are also applicable to yarns capable of being removed from fabrics.

Method A is applicable for the determination of ply and cabling twist. It may not be suitable for the determination of the twist in singles yarns containing fibres with a mean fibre length of less than 40 mm. For these yarns, Method B is preferred.

These methods are not applicable to core-spun, open-end spun and air-vortex yarns. Open-end and air-

vortex spun yarns can be identified by examination under low magnification for the presence of wrapper fibres.

3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1505 Designation of Yarns.

AS 2001 Methods of Test for Textiles
AS 2001.1 Conditioning Procedures.

4 DEFINITIONS. For the purpose of this standard, the definitions given in AS 1505 apply.

5 PRINCIPLE.

5.1 Method A—Direct-counting. The twist in a known length of yarn is removed by rotating one end of the specimen until the components of the yarn are straight and parallel. The number of turns required to remove the twist is reported in turns per unit length of the twisted yarn.

5.2 Method B—Untwist-twist. The twist in a known length of yarn is removed by rotating one end of the specimen and then the twist is inserted in the opposite direction until the yarn contracts to its original length. One half the number of turns registered by the twist counter is divided by the length of the twisted specimen to determine turns per unit length.

6 APPARATUS.

6.1 Conditioning facility. Means of providing and maintaining a standard atmosphere as described in AS 2001.1.

6.2 Twist tester.

6.2.1 Method A—Direct-counting. A twist tester consisting of a pair of clamps, one of which is fixed, while the other is rotatable in either direction and positively connected to a numerical revolution counter. The distance between the clamps shall be adjustable to accommodate specimens of the lengths specified in Clause 7.3.2 to an accuracy of ± 0.5 mm. Means shall be provided for applying a known tension to the specimen.

6.2.2 Method B—Untwist-twist. A motorized twist tester consisting of a pair of clamps, one of which is fixed, while the other is rotatable in either direction and positively connected to a numerical revolution counter. The rate of rotation of the clamps shall be 1000 ± 200 turns per min. The moving part must not have any uneven movement during tests where the pre-tension is approximately 10 mN.

The tester shall be capable of being set to a gauge length of at least 250 mm and shall also be provided with a tensioning device, so constructed that a specific load may be applied at the beginning and end of the test. The force shall be removed completely during the intervening untwisting and twisting operations using a stopper which is preset to operate at an extension of one percent of the gauge length.

6.3 Dissecting needle.

7 SAMPLE AND TEST SPECIMENS. Care should be taken to ensure that the operator's hands are dry. Excessive handling of the sample and test specimens should be avoided.

7.1 Sample. The sample shall be selected in one of the following ways:

- According to the directions given in the relevant material specification.
- According to the procedure agreed upon by the interested parties, if such directions are not included in the material specification.
- According to the procedures approved by SAA for textile products*, if directions on sampling are not included in the material specification.
- Yarn from packages.*
 - Bulk sample.* Take a bulk sample of one or more cases, as representative of the lot to be tested, according to Table 1.

TABLE 1
RELATIONSHIP BETWEEN BULK SAMPLE
AND MINIMUM NUMBER OF CASES
TO BE SELECTED

Number of cases in shipment or lot	Minimum number of cases to be selected at random
3 or less	1
4 to 10	2
11 to 30	3
31 to 75	4
76 or more	5

Take care that none of the cases selected for sampling shows signs of damage or dampness incurred during transit.

- Number of laboratory sample packages.* In the absence of a material specification, select 10 yarn packages from the bulk sample, taking as nearly as possible the same number of packages from each case and choosing packages at random from the top, middle and bottom layers in the cases and from the middle and sides of the layers.
- Yarns from fabrics.* If woven or knitted fabrics need to be sampled, the sample shall be large enough to provide a sufficient number of test specimens.

7.2 Conditioning. Condition the sample in accordance with AS 2001.1.

7.3 Test specimens.

7.3.1 Number of test specimens. The number of tests to be carried out depends on the precision required and on the variability of the twist in the yarn.

Experience has shown that—

- for singles staple yarns measured by the direct method, the coefficient of variation (V) is about 15 to 25 percent and when measured by the untwist-twist method it is about 6 to 8 percent;
- for folded yarns the coefficient of variation has been found to be about 8 percent.

It is common practice to accept a precision of measurement of twist where the limit of error, e , is 5 percent of the mean twist at the 95 percent confidence level.

Hence the number of test specimens required to satisfy these conditions is as follows:

$$\begin{aligned}\text{Number of test specimens} &= 12 \text{ (where } V = 8\%) \\ &= 60 \text{ (where } V = 20\%) \end{aligned}$$

* In course of preparation.

For other conditions of precision, coefficients of variation of twist and the numbers of test specimens can be calculated from formulas in Appendix A, or obtained from the two graphs (Figs 1 & 2) which show the relationship between these parameters.

e.g. 20 test specimens will satisfy $V > 11\%$ and $e > 5\%$.

7.3.2 Length of test specimens. The length of test specimens shall be determined as follows:

- Continuous filament folded and cabled yarns.** The length of specimens of continuous filament yarn, folded yarn and cabled yarn, when measured between clamps without pre-tension shall be not less than 250 mm.
- Spun singles yarns—Direct-counting method.** Specimens of spun singles yarn to be tested by the direct-counting method shall be as long as possible, but shall be short enough to prevent drafting between the jaws when twist has been removed, i.e. somewhat less than the nominal length of the staple fibre used to spin the yarn.
- Spun singles yarns—Untwist-twist method.** The length of specimens of spun singles yarn to be tested by the untwist-twist method when measured between clamps without pre-tension shall be not less than 250 mm.
- Self-twist-twisted (STT) yarn—Untwist-twist method.** The length of specimens of self-twist-twisted (STT) yarn to be tested by the untwist-twist method shall be one-half cycle (typically 110 mm).

7.3.3 Yarns from packages. Remove test specimens from the package without altering the twist in the specimens. Do not take the specimens from the extreme outside portion or from within 5 m of either end, nor from within 0.1 m of each other.

Take as nearly as possible, an equal number of specimens from each package in the laboratory sample. Take at least two specimens from each package.

The total number of test specimens depends on the coefficient of variation of twist in the yarn and also on the precision required, (see Clause 7.3.1 and Appendix A).

NOTE: The difference in twist between unwinding from the side and overhead is $\frac{1}{\pi d}$, where d is the diameter of the package where the yarn is withdrawn. For example, for a 25 mm diameter package, the difference would be about 13 turns per m.

7.3.4 Yarns from fabrics. Yarns from fabrics shall be chosen as follows:

NOTE: In order to minimize changes in twist, specimens should not be unravelled from strips until they are placed in the twist tester.

- Woven fabrics.** Take warp specimens from different warp yarns. Take weft specimens from different picks.
- Warp knit fabrics.** Take test specimens from different warp yarns.
- Weft knit fabrics.** Take specimens from as many different, widely separated courses as possible for a single feed fabric, and from successive courses at the one place if it is a multi-feed fabric.

8 PROCEDURE.

8.1 General principles. General principles are as follows:

- Test specimens shall be conditioned and tested in the standard atmosphere specified in AS 2001.1.

- The clamps of the twist tester shall be set at the appropriate gauge length to an accuracy of ± 0.5 mm (see Clause 7.3.2).
- The test specimen shall be mounted in the twist tester by clamping one end, passing the other end through the open second clamp taking care not to disturb the twist, applying a pre-tension to the specimen (see Note) and closing the second clamp.

NOTE: Select the pre-tension (PT) as a function of the coefficient of twist (CT):

CT less than 80	PT = 1.0 ± 0.2 mN/tex
CT 80 to 150	PT = 2.5 ± 0.5 mN/tex
CT greater than 150	PT = 5.0 ± 1.0 mN/tex

where CT = twist (turns per metre) $\times \sqrt[3]{(\text{count in tex} \times 10^{-3})}$

CT should be determined by preliminary tests on the yarn.

- The revolution counter shall be set at zero and the rotatable clamp shall be rotated to remove and, if required, to re-insert twist as set out in the individual procedures.
- The number of turns per unit length shall be calculated from the number of revolutions of the clamp and the gauge length.

8.2 Singles yarn.

8.2.1 Method A—Direct-counting. After mounting the specimen as described in Clause 8.1(c), set the counter to zero and turn the rotatable clamp until it is possible to pass a dissecting needle from one clamp face to the other between the untwisted fibres.

NOTE: A second needle may be used, if necessary, to assist in untwisting the fibres.

8.2.2 Method B—Untwist-twist. The procedure for Method B shall be as follows:

- Set the distance between the clamps to be at least 250 ± 0.5 mm for spun singles yarns and at the half cycle for STT yarns.
- After mounting the specimen as set out in Clause 8.1(c) ensuring that the pointer attached to the first clamp (non-rotatable) has reached the predetermined initial position (e.g. zero on the quadrant) for the desired tension, tighten the second (rotatable) clamp, and rotate it in the direction which untwists the specimen. Untwist the specimen at a speed of 1000 ± 200 rpm (see Note).

NOTE: The rate of rotation is required to be such that all the original twist is allowed to unwind before it can be trapped by reinsertion twist being redistributed along the specimen. This requirement applies particularly to hairy staple yarns.

- Continue the rotation in the same direction and at the same speed, thus removing the original twist and imparting twist to the specimen in the direction opposite to the original twist. As twisting continues, the indicator attached to the first (non-rotatable) clamp will return towards its initial position. When the specimen length is equal to its initial length it will be under the original tension. Cease rotation of the clamp and note the counter reading.
- Remove at least 0.5 m of yarn between successive specimens and measure the required number of test specimens.

8.3 Self-twist-twisted (STT) yarn. The procedure shall be as follows:

