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Series 4
Série des 4

WITHDRAWAL

March 2019

Selected standards in the series Textiles

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RETRAIT

Mars 2019

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CAN/CGSB-4.2

Textile test methods

No. 4.5-M86

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No. 5.2-M87

Linear density of yarn in SI units (ICS 59.080.20)

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Breaking strength of fabrics — Grab method **—** Constant-time-to-break principle (ICS 59.080.30)

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Breaking strength of high-strength fabrics — Constant-time-to-break principle (ICS 59.080.30)

No. 9.4-M91

Breaking strength of yarns — Single strand method (ICS 59.080.20)

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Breaking strength of yarns — Skein method (ICS 59.080.20)

No. 9.6-93

Breaking strength of nonwoven textiles (ICS 59.080.30)

CAN/CGSB-4.2

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Bobines de fil vendues au détail — Détermination de la masse (ICS 59.080.20)

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Masse linéique du fil en unités SI (ICS 59.080.20)

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Résistance à la rupture des tissus de haute résistance — Principe de rupture à temps constant (ICS 59.080.30)

Nº 9.4-M91

Résistance à la rupture des fils — Méthode à fil simple (ICS 59.080.20)

Nº 9.5-M89

Résistance à la rupture des fils — Méthode de l'écheveau (ICS 59.080.20)

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Résistance à la rupture des non-tissés (ICS 59.080.30)

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Colourfastness to perspiration (ICS 59.080.01)

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Dimensional change of textile fabrics to open-head steaming (ICS 59.080.30)

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Resistance to micro-organisms — Surface-growing fungus test — Pure culture (ICS 59.080.01)

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Effect of solvents on the permanence of textile finishes (ICS 59.080.01)

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Allongement (ICS 59.080.30)

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Évaluation du changement dimensionnel et de l'aspect des tissus enduits, contre-collés, stratifiés et thermocollés à la suite de nettoyages à sec (ICS 59.080.40)

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CAN/CGSB-4.155-M88

Résistance à l'inflammation des revêtements de sol mous — Plans d'échantillonnage (ICS 59.080.60)

CAN/CGSB-4.158-75

Designation of yarns (ICS 59.080.20)

CAN/CGSB-4.158-75

Désignation des fils (ICS 59.080.20)

CAN/CGSB-4.159-75

Universal system for designating linear density (Tex system) (ICS 59.080.20)

CAN/CGSB-4.159-75

Système universel de désignation de la masse linéique (système Tex) (ICS 59.080.20)

CAN/CGSB-4.160-75

Integrated conversion table for replacing traditional yarn numbers by rounded values in the Tex system (ICS 59.080.20)

CAN/CGSB-4.160-75

Table générale de conversion pour le remplacement des titres traditionnels des fils par des valeurs arrondies du système Tex (ICS 59.080.20)

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CAN/CGSB-4.2
No. 9.4-M91

Supersedes CAN/CGSB-4.2
Method 9.4
December 1984
Extended
April 1997
Reaffirmed
April 2004
Reaffirmed
November 2013

Textile test methods

Breaking strength of yarns — Single strand method

ICS 59.080.20

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NATIONAL STANDARD OF CANADA

CAN/CGSB-4.2
No. 9.4-M91

Supersedes CAN/CGSB-4.2
Method 9.4
December 1984
Extended
April 1997
Reaffirmed
April 2004
Reaffirmed
November 2013

Textile test methods

Breaking strength of yarns — Single strand method

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE.

Prepared by the
Canadian General Standards Board CGSB

Approved by the
Standards Council of Canada
Conseil canadien des normes

Published November 1991 by the
Canadian General Standards Board
Gatineau, Canada K1A 1G6

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Acknowledgment is made for the translation of this National Standard of Canada by the Translation Bureau of Public Works and Government Services Canada.

CAN/CGSB-4.2
No. 9.4-M91

Supersedes CAN/CGSB-4.2
Method 9.4
December 1984
Extended
April 1997
Reaffirmed
April 2004
Reaffirmed
November 2013

Preface to the National Standard of Canada

This National Standard of Canada has been extended and reaffirmed by the CGSB Committee on Textile Test Methods and Terminology. Editorial changes have been made by the addition and correction of the following paragraphs:

FOREWORD

This method is very similar to the breaking strength portions of the International Standard ISO 2062:1972, Textiles — Yarn from packages — Method for determination of breaking load and elongation at the breaking load of single strands — (CRL, CRE and CRT testers). A new edition of ISO 2062 was published in 2009.

9.1 **Source of Referenced Publications** — The publications referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone 819-956-0425 or 1-800-665-2472. Fax 819-956-5740. E-mail ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site www.tpsgc-pwgsc.gc.ca/ongc-cgsb.

National Standard of Canada

CGSB Ottawa Canada K1A 1G6	TEXTILE TEST METHODS	CAN/CGSB-4.2
	Breaking Strength of Yarns — Single Strand Method	No. 9.4-M91

Supersedes CAN/CGSB-4.2
Method 9.4
December 1984
Extended April 1997
Reaffirmed April 2004
Reaffirmed November 2013

FOREWORD

This method is very similar to the breaking strength portions of the International Standard ISO 2062:1972, Textiles — Yarn from packages — Method for determination of breaking load and elongation at the breaking load of single strands — (CRL, CRE and CRT testers). The ISO standard also includes determination of elongation and therefore pre-tensioning of the specimens in the clamps which are not part of CAN/CGSB-4.2 No. 9.4-M. There are slight differences in the number of specimens required in each standard.

The ISO standard requires 500 mm initial clamp separation, with 250 mm permitted by mutual agreement. CAN/CGSB-4.2 No. 9.4-M permits optional 500 or 250 mm separation with clamps utilizing snubbing devices and 250 or 125 mm between the centre of split-drum clamps.

1. PURPOSE AND SCOPE

1.1 This method determines the breaking strength of single strands of yarns, including monofilaments, single yarns, plied or folded yarns, cabled yarns, cords, threads and twines. It is designed primarily for testing yarn in package form but can be used for single strands removed from a fabric.

1.2 The method is applicable to testing yarns either in the conditioned state or when wet.

1.3 The method may be used with constant-rate-of-extension type (e.g., strain gauge), constant-rate-of-traverse type (e.g., pendulum), or constant-rate-of-loading type (e.g., inclined plan) testing machines (Note 1).

1.4 Automatic yarn-testing machines may be used provided they can be operated under the conditions specified.

1.5 The testing and evaluation of a product against this method may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this method has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements prior to its use.

2. PRINCIPLE

2.1 Breaking strength is defined as the maximum tensile force observed during a test in which the specimen is stretched until it breaks.

2.2 A single strand of yarn is held between two clamps of a testing machine and tension is applied so that rupture of the specimen occurs within a specified interval of time.

Note 1: The three types of testing machines do not necessarily give the same breaking strength of a given sample of yarn when tested at a constant-time-of-break. Good experimental agreement (differences of 5% or less) has been reported in the literature between the results obtained on CRE and CRT testers when the times-to-break were the same, but the agreement with the results obtained on CRL testers was not as good (averages differed from those on CRE or CRT testers by as much as 15%).

3. APPLICABLE PUBLICATIONS

3.1 The following publications are applicable to this method:

3.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2 — Textile Test Methods:

No. 1-M — Precision and Accuracy of Measurements

No. 2-M — Conditioning Textile Materials for Testing

No. 5.2 — Linear Density of Yarn in SI Units.

3.2 Reference to the above publications is to the latest issues, unless otherwise specified by the authority applying this method. The source for these publications is shown in the Notes section.

4. DEFINITION

4.1 **Breaking strength**: the maximum tensile force observed during a test in which the specimen is stretched until it breaks.

5. APPARATUS

5.1 **Machines**: tensile testing machines for use in this method shall operate on one of the following principles (Note 1):

a. constant-rate-of-extension (CRE)

b. constant-rate-of-traverse (CRT)

c. constant-rate-of-loading (CRL).

5.1.1 ***Constant-rate-of-extension (CRE) machine:*** a testing machine in which one end of the specimen is held by a virtually stationary clamp and the other end is gripped in a clamp that is driven at a constant speed. A suitable system for detecting and recording the force applied is provided.

5.1.2 ***Constant-rate-of-traverse (CRT) machine:*** a testing machine in which one end of the specimen is held by a clamp driven at a constant speed while the other end is gripped in a clamp attached to a weighing mechanism of a type that permits movement of the attached clamp — e.g., as in pendulum machines. The specimen is therefore not extended at a constant rate (Note 2).

5.1.3 ***Constant-rate-of-loading (CRL) machine:*** a testing machine in which one end of the specimen is held by a stationary clamp while the other end is gripped in a clamp that moves at varying speeds so as to increase the tensile force on the specimen at a predetermined rate.

5.1.4 The three types of machines shall be capable of being operated at speeds such that the specimens will be broken in the time interval specified in par. 7.3.

5.1.5 The maximum error of the indicated force, at any point in the range in which any of the machines described in par. 5.1.1, 5.1.2 and 5.1.3 is used, shall not exceed 2% of the true force.

5.2 **Clamps**: the clamps of the machines shall be capable of holding the specimen without allowing it to slip and shall be so designed that they do not cut or otherwise weaken the specimen. The gripping surfaces of flat-faced jaws shall be plane and parallel (Note 3). When specimens cannot be satisfactorily held in this way, lining materials that will not injure the specimen (e.g., thin cork, adhesive tape) may be used on the gripping surfaces. Split-drum clamps, or clamps equipped with snubbing devices, may also be used.

5.3 **Stop watch** or **interval timer.**

Note 2: Significant errors due to inertia are frequently encountered in testing machines in which the moving parts of the weighing mechanisms are massive (e.g., CRT machines) especially if such machines are used on materials with low extensibilities or are operated at high speeds. Caution should therefore be exercised in testing specimens that break near the lower end of the force range of such machines.

Note 3: As a practical method of determining the degree of flatness and parallelism of the gripping surfaces of each clamp, it is recommended that a sheet of thin white paper between two sheets of carbon paper be placed between the gripping surfaces, and the surfaces then be brought together with light pressure. Areas of contact will be shown by darkening of the white sheet.

6. TEST SPECIMENS

6.1 Conditioned Test

6.1.1 The yarn shall be conditioned in accordance with CAN/CGSB-4.2 No. 2-M.

6.1.2 Where the yarn to be tested is wound in the form of a tight package, sample skeins may be prepared to facilitate conditioning, and the single-strand specimens subsequently taken from the skeins. Such skeins shall collectively be representative of the bulk sample.In reeling the skein, the yarn shall be taken from the end of the package if this is the normal (industrial) method of use; otherwise the yarn shall be taken from the side of the package. Skeins shall be reeled under conditions that avoid tension greater than that needed to lay the yarn smoothly on the reel. The skeins shall be of sufficient total length to provide the number of test specimens required (par. 6.1.4). Skeins prepared for the determination of yarn linear density, CAN/CGSB-4.2 No. 5.2-M, may conveniently be used.

6.1.3 In the case of yarns from fabrics, each yarn is usually removed from the fabric immediately prior to testing, care being taken to avoid loss of twist.

6.1.4 The number of specimens tested shall be as given in Table 1 (Note 4).

TABLE 1

Type of Yarn	Number of Specimens	
	Spun Yarns	Filament Yarns
Single yarns	60	30
Plied yarns	30	20
Cabled yarns	20	20

6.2 Wet Test

6.2.1 Prepare the specimens according to the procedure described in par. 6.1.2 to 6.1.4 inclusive. It is not necessary to condition the yarn as directed in par. 6.1.1.

Note 4: *In calculating the values in Table 1, it was assumed that the coefficients of variation (V) were:*

for single spun yarns	*18.5%*
for plied spun and single filament yarns	*13%*
for plied filament and cabled yarns	*11%*

It was also assumed that a mean breaking strength having a standard error of the mean (E) not greater than approximately 2.5% of the mean was required.

These assumed values of V are somewhat higher than will be found in practice in most cases. If the value of V that actually applied to the yarn under test is known, the number of specimens required can be calculated and will usually be less than specified in Table 1.

The selection of another value for the standard error of the means will also affect the number of specimens required.

The procedure for calculating the number of specimens required for different values of V and E is given in CAN/CGSB-4.2 No. 1-M, par. 8.6 and 8.7.

If the standard deviation (σ) of the yarn being tested is known, the number of specimens (N) to test (so that there is a probability of P% that the determined mean will not differ from the true mean by more than a specified amount h) is then given by:

$$N = \left(\frac{\sigma}{h}\right)^2 \cdot Zp^2$$

where Zp^2 may be obtained from the following table:

Probability	*Zp^2*
90%	*2.70*
95%	*3.84*
99%	*6.64*

6.2.2 Immerse the skein, or the group of specimens clamped at both ends to prevent loss of twist, in distilled water at room temperature to which has been added 0.2 to 0.4 g/L of a neutral nonionic wetting agent. Thoroughly rinse the specimens in distilled water, taking care to avoid loss of twist or stretching of the specimens (Note 5).

7. PROCEDURE

7.1 The distance between the proximal edges of flat-jaw clamps or clamps equipped with snubbing devices shall be either 250 ± 2 mm or 500 ± 2 mm and the distance between the centres of split-drum clamps shall be 125 ± 2 mm or 250 ± 2 mm at the start of the test (Note 6).

7.2 Secure the specimen centrally in the clamps of the testing machine so that the specimen is just taut and is parallel to the direction of application of the force.

7.3 Select a force range of the testing machine such that the specimen will break between 20 and 85% of the full-scale capacity (Note 2). Adjust the machine speed so that the average time-to-break of the specimens is 20 ± 3 s unless otherwise specified. This may not be practicable with some testing machines. In such cases, adjust the machine so that the specimens break in a time as close to 20 s as possible, and report the actual time-to-break.

7.4 If a specimen slips in the clamps or breaks within the clamps, or if there is any reason to suspect faulty operation of the machine, the result obtained should be discarded. If a specimen breaks at the edge of the clamps, the break shall be examined to determine whether or not it could have resulted from damage by the clamps. If no evidence of this can be found, the result shall be retained.

8. REPORT

8.1 Calculate and report in newtons the average breaking strength for the yarn from the individual values.

8.2 Report the following additional information:

8.2.1 The type of tensile testing machine and force range used.

8.2.2 The type of clamp used and initial distance between clamps.

8.2.3 The average time to break the specimen.

8.2.4 The state of the specimens (conditioned or wet).

8.2.5 The number of specimens tested.

8.2.6 Where required, the coefficient of variation shall also be reported.

8.2.7 The number of this method: CAN/CGSB-4.2 No. 9.4-M91.

9. NOTES

9.1 **Source of Referenced Publications** — The publications referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Sales Unit, Ottawa, Canada K1A 1G6. Telephone (819) 956-0425 or 956-0426. Fax (819) 956-5644.

Note 5: The only conclusive evidence that the time of immersion has been sufficient to wet the yarn thoroughly is that further immersion does not produce any additional change in breaking strength. This method of determination must be used in cases of dispute. For routine testing, however, it may be sufficient to immerse the yarn for 1 h. This procedure should be used with caution when testing yarns that do not wet out readily.

Note 6: When testing highly extensible materials, it may be necessary to use shorter distances between the clamps with some machines, in order to obtain sufficient traverse of the clamp through which the force is applied to break the specimen.