



## Standard Test Methods for Operability of Zippers<sup>1</sup>

This standard is issued under the fixed designation D 2062; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

~~<sup>ε1</sup>Note—Editorial changes were made throughout March 1998.~~

### 1. Scope

1.1 These test methods cover procedures for determining the following characteristics of zippers:

	Sections
Opening and Closing of Zippers	14-17
Separator Functioning of Zippers	18-22
Sticking of Zippers at Stops	10-13

~~1.2 The values stated in SI units are to be regarded as the standard.~~

1.2 The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

D 123 Terminology Relating to Textiles

D 2050 Terminology Relating to Zippers<sup>2</sup> Subassemblies

D 2051 Test Method for Durability of Finish of Zippers to Laundering

D 2052 Test Method for Colorfastness of Zippers to Drycleaning

D 2053 Test Method for Colorfastness of Zippers to Light

D 2054 Test Method for Colorfastness of Zipper Tapes to Crocking

D 2057 Test Method for Colorfastness of Zippers to Laundering

D 2058 Test Method for Durability of Finish of Zippers to Drycleaning

D 2059 Test Method for Resistance of Zippers to Salt Spray (Fog)

D 2060 Test Methods for Measuring Zipper Dimensions

D 2061 Test Methods for Strength Tests for Zippers

### 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of zipper terms used in ~~this standard~~ these test methods, refer to Terminology D 2050. For definitions of other textile terminology used in ~~this standard~~ these test methods, refer to Terminology D 123.

### 4. Significance and Use

4.1 The significance of specific tests is discussed in the appropriate sections.

4.2 These test methods are considered satisfactory for acceptance testing of commercial shipments of zippers because the methods have been used extensively in the trade for this purpose, even though current estimates of between-laboratory precision are quite large in some cases.

~~4.2.1 In case of a dispute arising from differences in reported test results when using Test Methods D2062 for acceptance testing~~

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee ~~D-13~~ D13 on Textiles and are the direct responsibility of Subcommittee D13.54 on Subassemblies. The methods were developed in cooperation with the Slide Fastener Assn., Inc.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

of commercial shipments, the purchaser and the supplier should conduct comparative tests to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of material of the type in question. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret future test results in the light of the known bias.

4.2.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative test should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, the test samples should be used that are as homogeneous as possible, that are drawn from the material from which the disparate test results were obtained, and that are randomly assigned in equal numbers to each laboratory for testing. Other materials with established test values may be used for this purpose. The test results from the two laboratories should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a bias is found, either its cause must be found and corrected, or future test results must be adjusted in consideration of the known bias.

4.3 The method(s) in the standard along with those in Test Methods D2051, D2052, D2053, D2054, D2057, D2058, D2059, D2060, and D2061

4.3 The method(s) in the standard along with those in Test Methods D 2051, D 2052, D 2053, D 2054, D 2057, D 2058, D 2059, D 2060, and D 2061 are a collection of proven test methods. They can be used as aids in the evaluation of zippers without the need for a thorough knowledge of zippers. The enumerated test methods do not provide for the evaluation of all zipper properties. Besides those properties measured by means of the enumerated test methods there are other properties that may be important for the satisfactory performance of a zipper. Test methods for measuring those properties have not been published either because no practical methods have yet been developed or because a valid evaluation of the information resulting from existing unpublished methods requires an intimate and thorough knowledge of zippers.

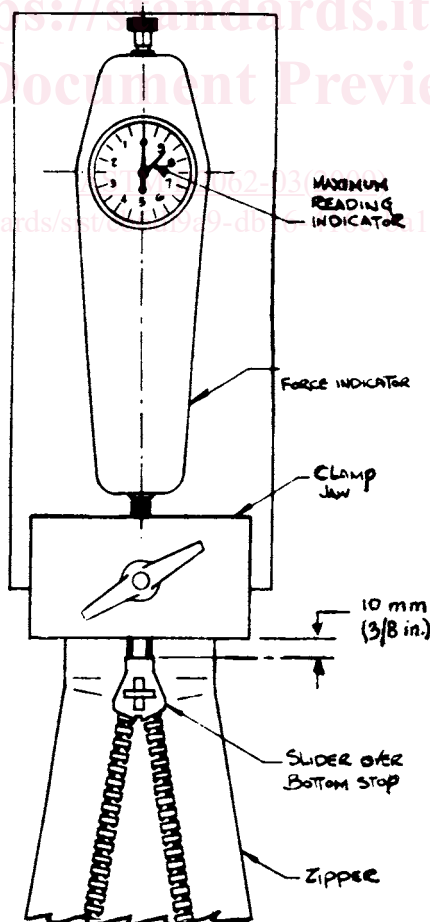


FIG. 1 Slider Sticking on Bottom Stop

## 5. Apparatus

5.1 *Force Indicator*<sup>3</sup> (Fig. 1)—A 50-N or 10-lbf capacity force indicator equipped with a direct-reading dial graduated in 0.5-N or 0.1-lbf divisions, a maximum-reading indicator, and a clamp suitable for attaching the zipper tape ends to the indicator.

5.2 *Spacer*—A piece of metal designed to fit in the pin cavity of the fixed retainer of the specimen and having a length equal to the element pitch of the specimen.

5.3 *Hooks*, suitable for attaching the force indicator to the slider pull of a specimen.

## 6. Sampling

6.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of individual containers from each shipping carton as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider individual containers from each shipping carton to be the primary sampling units.

NOTE 1—An adequate specification or other agreement between the purchaser and supplier requires taking into account the variability between shipping cartons and between zippers in a container to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

6.2 *Laboratory Sample and Test Specimens*—As a laboratory sample for acceptance testing, take a number of zippers specified in Section 6 at random from each container in the lot sample. Consider the zippers as both the laboratory sample and the test specimens.

## 7. Number of Specimens

7.1 *Variables*—Take a number of zippers per individual container from each shipping carton such that the user may expect at the 90 % probability level that the test result for an individual container is no more than 10 % of the average above or below the true average for the individual container. Determine the number of zippers per individual container as follows:

7.1.1 *Reliable Estimate of  $v$* —When there is a reliable estimate of  $v$  based upon extensive past records for similar materials tested in the user's laboratory as directed in the method, calculate the number of specimens using Eq 1:

$$n = (t^2 \times v^2) / A^2 = 0.0270 \times v^2 \quad (1)$$

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where:

$n$  = number of specimens (rounded upward to a whole number),

$v$  = reliable estimate of the coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single-operator precision,

$t$  = 1.645, the value of student's  $t$  for infinite degrees of freedom, for two-sided limits, and a 90 % probability level ( $t^2 = 2.706$ ),

$A$  = 10.0 % of the average, the value of the allowable variation, and

0.0270 = value calculated from  $t^2/A^2$ .

7.1.2 *No Reliable Estimate of  $v$* —When there is no reliable estimate of  $v$  for the user's laboratory, Eq 1 should not be used directly. Instead, specify the fixed numbers of specimens shown in Table 1. These numbers of specimens are calculated using values of  $v$  which are listed in Table 1 and which are somewhat larger values of  $v$  than are usually found in practice. When a reliable estimate of  $v$  for the user's laboratory becomes available, Eq 1 will usually require fewer specimens than are listed in Table 1.

7.2 *Attribute Properties*—Unless otherwise agreed upon, as when specified in an applicable material specification, take the fixed number of 20 specimens for detecting slider movement with the pin partially seated or not seated.

## 8. Test Specimen

8.1 Each test specimen shall consist of a completely assembled zipper, except that for the opening and closing method, a length

<sup>3</sup> Drawings for the force indicator fixture shown is available from the various zipper manufacturers upon request.

**TABLE 1 Specimens Required Under Conditions of Unknown Variability in User's Laboratory, Percent of the Average**

Names of the Properties	Number of Specimens	Basis <sup>A</sup>
Sticking at top stops	47	$v = 41.3$
Sticking at bottom stops	32	$v = 34.4$
Opening zipper	15	$v = 23.4$
Closing zipper	27	$v = 31.1$
Force to move slider, pin fully seated	43	$v = 39.5$

<sup>A</sup> The values of  $v$  in Table 1 are somewhat larger than will usually be found in practice (see 7.1.2).

of chain with an appropriate slider may be used. Use a zipper or chain not less than 150 mm (6 in.) long.

## 9. Conditioning

9.1 Specimens to be tested by the use of these methods need no special conditioning. Testing may be conducted under prevailing room conditions.

## STICKING OF ZIPPERS AT STOPS

### 10. Summary of Test Method

10.1 The slider is pulled against the stops with a prescribed force after which the force required to move the slider away from the stops is determined.

### 11. Significance and Use

11.1 The slider should move away from the stops readily. The force required to move the slider is, therefore, a measurement of the serviceability of the zipper in end use applications.

### 12. Procedure

#### 12.1 *Top Stop:*

12.1.1 Disengage any interfering slider-locking elements. Secure the bottom tape ends of the completely assembled and open zipper in the clamp of the force indicator as shown in Fig. 1. Locate the clamp edge approximately 10 mm ( $\frac{3}{8}$  in.) from the outermost edge of the bottom stop. With the force indicator set at zero, hold the pull of the slider in a horizontal plane and move the slider manually downward in a vertical plane against or over the top stops until a force of 18 N (4 lbf) is registered on the force indicator. Remove the specimen from the indicator clamps.

12.1.2 Secure the top tape ends of the completely assembled and closed zipper in the clamp of the force indicator. Locate the clamp jaws 10 mm ( $\frac{3}{8}$  in.) from the outermost component. The tape ends must touch each other at the point of clamping.

12.1.3 Set the force indicator hand at zero. Hold the pull of the slider in a horizontal plane and move the slider manually downward in a vertical plane until it is clear of the top stops. Record the maximum reading on the force indicator to the nearest 0.5 N or 0.1 lbf.

#### 12.2 *Bottom Stop:*

12.2.1 With the tape ends clamped as shown in Fig. 2, set the force indicator at zero. Move the slider downward in a vertical plane until it is against or over the bottom stop and until a force of 18 N (4 lbf) is registered on the force indicator.

12.2.2 Without disturbing the slider, secure the bottom tape ends of the specimen in the clamp of the force indicator (see Fig. 1) approximately 10 mm ( $\frac{3}{8}$  in.) from the outermost edge of the bottom stop. Hold the pull of the slider in a horizontal plane and move the slider manually downward in a vertical plane until it is clear of the bottom stop. Note and record the maximum reading on the force indicator to the nearest 0.5 N or 0.1 lbf.

### 13. Report

13.1 State that the specimens were tested as directed in Sections 10-13 of ASTM Test Methods D 2062. Describe the material(s) or product(s) sampled and the method of sampling used.

13.2 Report the following information:

13.2.1 Specific property measured, that is, “sticking at top stops”, or “sticking at bottom stops,”

13.2.2 Observed maximum force required to move the slider from the top stops or from the bottom stops for each specimen tested, and

13.2.3 Number of specimens tested.

## OPENING AND CLOSING OF ZIPPERS

### 14. Summary of Test Method

14.1 Using a force indicator, the slider is pulled along the zipper chain alternately in the opening and closing directions and the force required to maintain each movement is recorded.

### 15. Significance and Use

15.1 The force required to move the slider on the chain is a measure of the ease with which the zipper will operate in end use applications.

### 16. Procedure

#### 16.1 *Opening:*

16.1.1 Disengage all slider locks from the chain, except on automatic locking sliders. Secure the top end of the completely assembled and closed zipper or chain in the clamp of the force indicator (see Fig. 3) so that the outermost edge of the outermost