



Designation: F450 – 13 (Reapproved 2019)

Standard Test Methods for Vacuum Cleaner Hose—Durability and Reliability (Plastic)¹

This standard is issued under the fixed designation F450; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover the determination of the effect of anticipated stresses and strains that vacuum cleaner and extractor hoses will receive in normal use.

1.2 These test methods apply to plastic (regular and reinforced) vacuum cleaner and extractor hoses for household use.

1.3 The following tests are included:

	Section
Torsional Flex	6
Hot and Cold Flex with Aging	7
Abrasion, External Surfaces	8
Flex	9
Pull Test on Hose Fittings with Aging	10
Crush	11
Stretch Ratio	12
Extractor Hoses	13

1.4 These test methods are individual tests as agreed upon between the hose and vacuum manufacturer.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ These methods are under the jurisdiction of ASTM Committee F11 on Vacuum Cleaners and are the direct responsibility of Subcommittee F11.30 on Durability-Reliability.

Current edition approved Oct. 1, 2019. Published October 2019. Originally approved in 1979. Last previous edition approved in 2013 as F450 – 13. DOI: 10.1520/F0450-13R19.

2. Referenced Documents

2.1 *ASTM Standards*:²

D638 Test Method for Tensile Properties of Plastics

D695 Test Method for Compressive Properties of Rigid Plastics

F395 Terminology Relating to Vacuum Cleaners

F595 Test Methods for Vacuum Cleaner Hose—Durability and Reliability (All-Plastic Hose) (Withdrawn 2010)³

3. Terminology

3.1 *Definitions*—Refer to Terminology F395.

4. Significance and Use

4.1 These test methods can be used by buyers of vacuum cleaner hose to specify the test criteria the hose must meet to be acceptable for their purposes.

5. Sampling

5.1 The sample size shall be one that is mutually agreed upon between the hose manufacturer and the vacuum cleaner manufacturer.

TEST METHODS F450-13:2019

6. Torsional Flex Test

6.1 *Scope*—This test method covers the determination of the adhesion of the reinforcement wire coating to the hose jacket, the jacket strength, and the strength of the reinforcement wire for plastic hose with inside diameter from 1 to 2 in. (25 to 51 mm).

6.2 *Apparatus*—The apparatus shown in Fig. 1 is suitable for this test method with the following provisions:

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

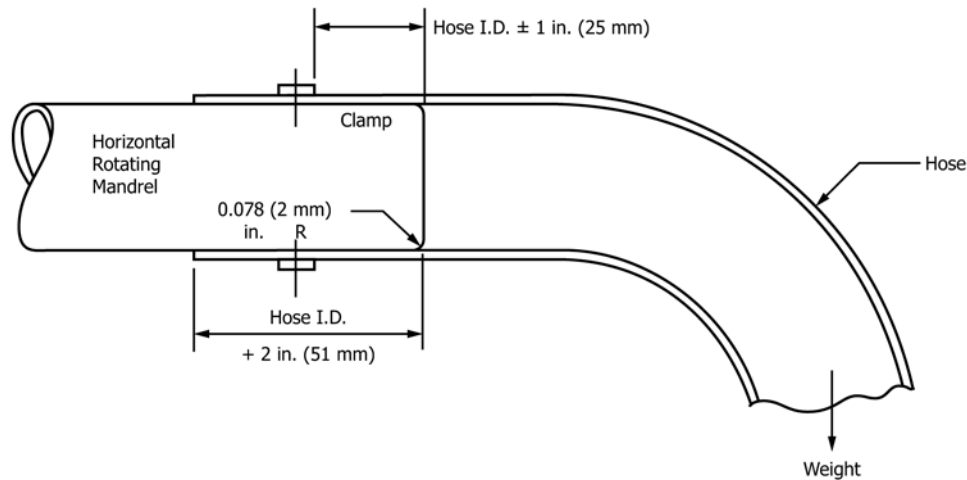


FIG. 1 Schematic for Torsional Flex Test

6.2.1 Means to rotate test mandrel in a horizontal plane at 20 ± 1 rpm, both clockwise and counter-clockwise.

6.2.2 Test weight of 48 ± 1 oz (1360 ± 28 g) with provision to attach to sample hose.

6.2.3 Suitable clamp to attach sample hose to mandrel that retains the hose without causing failure at the clamp during the test.

6.2.4 Test mandrel with diameter same as inside diameter of hose with 0.078 in. (2.0 mm) radius at the ends of the mandrel (see Fig. 1).

6.2.5 Guide for weight to prevent hose sample from swinging during test cycle.

6.2.6 Instrument to measure cycles to failure or to a specified end point.

6.3 Test Specimen—The specimen shall be a length of hose 24 ± 1 in. (610 ± 25 mm) without fittings.

6.4 Conditioning—Condition the specimens at an ambient temperature of 68 to 81°F (20 to 27°C) for not less than 1 h prior to test.

6.5 Procedure:

6.5.1 Conduct the tests at 68 to 81°F (20 to 27°C).

6.5.2 Clamp the specimen to the test hose mandrel as shown in Fig. 1 and attach a weight to other end of hose sample.

6.5.3 Set measuring instrument at zero or record the initial reading.

6.5.4 Test half of the specimens by rotating clockwise and the other half by rotating counter-clockwise at 20 ± 1 rpm until failure or to a specified end point.

6.5.5 Failure may be evidenced by a broken reinforcing wire, tear, or hole that penetrates the hose jacket, or a collapsed coil or ply for a lined-type hose, or any combination thereof.

6.5.6 Additionally, breaking or damaging of the conductors, or an increase of more than 10 % of the conductor resistance, is considered to be a failure for current-carrying hoses.

7. Hot and Cold Flex Test with Aging

7.1 Scope—This test method covers the determination of the effect of temperature and flexing upon a hose sample with inside diameters from 1 to 2 in. (25 to 51 cm).

7.2 Apparatus:

7.2.1 Air-Circulating Oven or Environmental Chamber, to maintain 156°F (69°C) controlled to $\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$).

7.2.2 Cold Box—A cold box able to maintain 20°F (−6.7°C) controlled to $\pm 1^\circ\text{F}$ ($\pm 0.5^\circ\text{C}$).

7.3 Test Specimen—The specimen shall be a length of hose in which the length in inches or millimetres shall be determined as follows:

- 11.2 × inside diameter, in inches + 2 in.
- (11.2 × inside diameter, in millimetres + 51 mm)

7.4 Conditioning—Condition the specimens at an ambient temperature of 68 to 81°F (20 to 27°C) for not less than 1 h prior to test.

7.5 Procedure:

7.5.1 Bend a specimen in a “U” shape and tie the ends together at a position 1 in. (25 mm) from the ends as shown in Fig. 2.

7.5.2 Place the specimen into the oven, which has been brought to a steady test temperature of $156 \pm 2^\circ\text{F}$ ($69 \pm 1^\circ\text{C}$), and soak the sample for 20½ h.

7.5.3 Remove the specimen from the oven and allow 30 min for samples to come to ambient temperature in accordance with 7.4.

7.5.4 Next, place the specimen in the cold box, which has been brought to a steady temperature of $20 \pm 1^\circ\text{F}$ ($-6.7 \pm 0.5^\circ\text{C}$) for 2 h.

7.5.5 Remove the specimen from the cold box, untie and immediately flex it 360°, three times, 1 s per flex, as shown in Fig. 3.

7.5.6 Failure may be evidenced by a tear or hole that penetrates the hose jacket to cause air leak, or a collapsed coil or ply for a lined-type hose, or any combination thereof. Reinforcement wires that pull away or holes worn in outer jacket that do not cause air leaks are not determined to be failures.

7.5.7 Retie the hose in its original position.

7.5.8 Allow 1 h for conditioning as specified in 7.4 before starting next cycle.

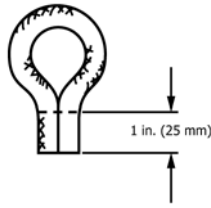


FIG. 2 Hose Position During Heat and Cold Soak

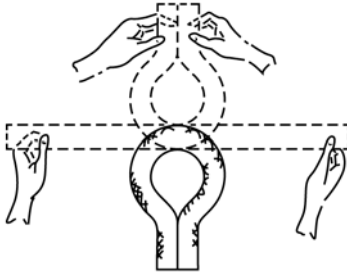


FIG. 3 Hose Flex Cycle

8.3 *Test Specimen*—The specimen shall be a full length hose, or a length of hose suitable for the test unit.

8.4 *Conditioning*—Condition the specimen at 68 to 81°F (20 to 27°C) ambient temperature for not less than 1 h prior to test.

8.5 *Procedure:*

8.5.1 Conduct the tests at 68 to 81°F (20 to 27°C).

8.5.2 Clamp a new sheet of standard wet-dry, 500-grit abrasive paper to the cylinder.

8.5.3 Clamp the specimen to the mechanism coupling. Attach the weight and place in the weight guide. The weight shall be in free suspension throughout the cycle.

8.5.4 Set the measuring instrument to zero or record starting value.

8.5.5 Cycle the specimen against the surface of the abrasive paper until failure of jacket or to a specified end point.

8.5.6 Failure may be evidenced by a tear or hole that penetrates the hose jacket to cause air leak, or a collapsed coil or ply for a lined-type hose, or any combination thereof. Reinforcement wires that pull away or holes worn in outer jacket that do not cause air leaks are not determined to be failures.

8.5.7 Additionally, exposure of the bare conductor wire is considered a failure in a current-carrying hose.

8.6 *Report*—The report shall include the following:

8.6.1 Number of cycles to failure or to a specified end point, whichever occurs first,

8.6.2 Description of failure,

8.6.3 Ambient test temperature,

8.6.4 Description of specimen, and

8.6.5 Number of pieces tested.

9. Flex Test

9.1 *Scope*—This test method covers the determination of the vacuum cleaner hose resistance to bending under an applied stress.

9.2 *Apparatus:*

9.2.1 *Special Abrasion Test Fixture*, as described in 8.2.1 and Fig. 4 except with driving arm rotating at 36 ± 1 cycles/min and the cylindrical segment replaced with pulley (9.2.2).

9.2.2 *Pulley*, a cold-rolled steel (or similar) grooved pulley as described in Fig. 6.

9.2.3 *Test Weight*, 160 ± 1 oz (4536 ± 28 g) for reinforced hoses and 80 ± 1 oz (2268 ± 28 g) for plastic hoses with provision for attaching to the specimen.

9.2.4 *Weight Guide*, to prevent weight from swinging during test cycling.

9.2.5 *Instrument*, to measure cycles to failure or to a specified end point.

9.2.6 *Clamps*, suitable for attaching the hose to the mechanism coupling on one end and attaching the weight to the other end without causing failure of the hose at these clamps.

9.3 *Test Specimen*—The specimen shall be a full length hose, or a length of hose suitable for the test unit.

9.4 *Conditioning*—Condition the specimen at 68 to 81°F (20 to 27°C) ambient temperature for not less than 1 h prior to test.

7.5.9 The steps covered in 7.5.1 – 7.5.8 constitute one cycle. Conduct this complete cycle of tests for four successive days, then permit the specimens to remain at ambient conditions for the unused balance of a 7-day period, then repeat until a failure occurs or until a specified end point is reached, whichever occurs first.

7.6 *Report*—The report shall include the following:

7.6.1 Number of cycles to failure or to a specified end point, whichever occurs first,

7.6.2 Condition of the specimen,

7.6.3 Ambient test temperature,

7.6.4 Description of specimen, and

7.6.5 Number of specimens tested.

8. Abrasion Test of External Surface

8.1 *Scope*—This test method measures the wear characteristics of a vacuum cleaner hose subjected to an abrasive surface.

8.2 *Apparatus:*

8.2.1 *Special Abrasion Test Fixture*, as described in Fig. 4 to produce a rate of 20 ± 1 cycles/min.

8.2.2 *Cylindrical Segment*, as described in Fig. 5.

8.2.3 *Test Weight*, 16 ± 1 oz (454 ± 3 g) with provision to attach to the specimen.

8.2.4 *Abrasive Paper*, wet-dry, 500-grit, for abrasion test surface.⁴

8.2.5 *Instrument*, to measure cycles to failure or to a specified end point.

8.2.6 *Weight Guide*, to prevent weight from swinging during test cycling.

8.2.7 *Clamps*, suitable for attaching the hose to the mechanism coupling on one end and attaching the weight to the other end without causing failure of the hose at these clamps.

⁴ Wet-dry, 500-grit, Tri-M-Ite Abrasive Paper, available from 3M Co., St. Paul, MN, has been found suitable for this purpose.