



Designation: F1458 – 15 (Reapproved 2022)

Standard Test Method for Measurement of Cut Resistance to Chainsaw of Foot Protective Devices¹

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1. Scope

1.1 This test method measures cut resistance of foot protective devices that are designed to protect the foot when operating a chainsaw.

1.2 This test method may be used to test for compliance to minimum performance requirements in established safety standards.

1.2.1 By agreement between the purchaser and the supplier, or as required by established safety standards, this test method can be used to determine any one or both of the following: (1) chain speed 50 (CS50), (2) success/failure (jamming/chain stop) at specified chain speed.

1.3 This test method may be used to determine levels of protection for areas of coverage as stipulated in established safety standards.

1.4 The values stated in SI units are to be regarded as standard.

NOTE 1—The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

1.5 *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.*

1.6 *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 This test method is under the jurisdiction of ASTM Committee F23 on Personal Protective Clothing and Equipment and is the direct responsibility of Subcommittee F23.20 on Physical.

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2. Referenced Documents

2.1 *ASTM Standards:*²

F1414 Test Method for Measurement of Cut Resistance to Chainsaw in Lower Body (Legs) Protective Clothing
F1494 Terminology Relating to Protective Clothing

2.2 *AATCC Test Methods:*³

AATCC 96 Dimensional Changes in Laundering of Woven and Knitted Fabrics, Except Wool (1988)
AATCC 158 Dimensional Changes on Drycleaning in Perchloroethylene: Machine Method

2.3 *Military Standards:*⁴

MIL-STD-105 Sampling Procedure and Tables for Inspection by Attributes
MIL-C-12369 Cloth, Ballistic, Nylon

2.4 *Federal Standard:*⁵

FS 5100-86 Type II, Cloth, Duck, Nylon, Polyurethane Coated

3. Terminology

3.1 *Definitions:*

3.1.1 *centerline, n*—in foot protective devices, a line that extends from the toe of the footwear horizontally along the sole to the heel vertically to the top of the footwear, and diagonally to the point of intersection at the toe.

3.1.2 *chainsaw, n*—a portable power-operated tool that has cutters linked in a chain used for cutting wood.

3.1.3 *chain speed, n*—the speed of synchronized movement of linked cutters around a bar and sprocket.

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 Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215, <http://www.aatcc.org>.

⁴ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

⁵ Available from U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001, <http://www.gpo.gov>.

3.1.4 *chain speed 50 (CS50)*, *n*—for chainsaw protection, the mean speed at which cut-through occurs.

3.1.4.1 *Discussion*—This value establishes the relationship between the probability of cutting through the chainsaw leg protective clothing (or foot protective device) and the speed of the saw chain. For lower chain speeds, the probability of cut-through approaches zero, while for higher chain speeds, the probability of cut-through approaches one.

3.1.5 *chain stop*, *n*—for chainsaw cut resistance, the resulting action when a material clogs (jams) the drive sprocket or slows the speed sufficiently to prevent advancement of the saw chain.

3.1.6 *cut resistance*, *n*—the ability of a material, while in contact with the linked cutters, to resist cut-through of the cutters of a moving saw chain, independent of either jamming or chain stop.

3.1.7 *foot*, *n*—the terminal part of the vertebrate leg, including the ankle, upon which an individual stands.

3.1.8 *foot protective device*, *n*—for chainsaw cut resistance, an article of personal equipment which covers the foot and ankle for the purpose of providing limited protection from injury due to contact with a moving saw chain.

3.1.9 *footwear*, *n*—a boot or shoe of any construction.

3.1.10 *gaiter*, *n*—for chainsaw cut resistance, a foot protective device permanently attached to the outside of the footwear.

3.1.11 *jamming*, *n*—for chainsaw cut resistance, the clogging action manifested by a protective garment or device that can produce a chain stop.

3.1.12 *saw chain*, *n*—a closed loop of cutters linked together for use in a portable power-operated tool.

3.1.13 *toe area cut zone*, *n*—in the testing of foot protective devices, that area excluding the sole that extends from the frontmost part of the footwear to a vertical plane 15 ± 0.25 mm behind the toe box; or in the absence of a toe box, the area that extends to a vertical plane 65 ± 6.25 mm from the front of the footwear.

3.1.14 *toe box*, *n*—in testing of foot protective devices, a component inserted into the toe area of footwear.

3.1.15 *upper*, *n*—that area of the footwear above the sole.

3.1.16 *upper cut zone*, *n*—in the testing of foot protective devices, the area starting at the top of the area of protection on the footwear and extending downward to include the entire upper, but excluding the toe area cut zone.

3.2 For definitions of other protective clothing terms used in this test method, refer to Terminology F1494.

4. Summary of Test Method

4.1 Test specimens are securely mounted on a test apparatus.

4.2 A chainsaw, of specific characteristic and operating at a designated speed, is brought into contact with the test specimen at specified locations.

4.2.1 The cutting action of the saw chain will achieve one of three results: (1) complete cut-through, (2) no cut-through while saw chain continues to run, or (3) complete chain stop.

4.3 Data collection of cut resistance and CS50 is measured electronically by means of wires placed on the top and the bottom of the test specimen to measure cut-through time, and an electronic means to measure chain speed just prior to contact with test specimen and after contact is initiated.

5. Significance and Use

5.1 The purpose of this test method is to provide a measurable criterion of performance defining the level of cut resistance to the cutting action of a saw chain provided by foot protective devices.

5.2 The protection which can be demonstrated by the foot protective devices tested in accordance with this test method is achieved by: (1) the material resisting cutting when put in contact with the moving saw chain; (2) a part of the material being drawn into the saw chain and drive mechanism to block the saw chain movement; (3) the materials resisting cutting and absorbing rotational energy so that saw chain speed can be slowed down sufficiently to stop the movement of the saw chain; or (4) any combination of these.

5.3 In case of a dispute arising from differences in reported test results, when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier should perform 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 from the same lot of components to be evaluated. The test specimens should then be randomly assigned in equal numbers to each laboratory for testing. If a bias is found, either its cause must be determined and corrected, or the purchaser and the supplier must agree to interpret future test results in light of the known bias.

6. Apparatus

6.1 *Specimen Holder for Calibration*, in accordance with Test Method F1414.

6.2 *Mounting Bracket for Footwear and Footwear with Protective Devices*:

6.2.1 The mounting bracket must enable the footwear to be moved so that test cuts can be made at stipulated positions (see Figs. 1-4).

6.2.2 The mounting bracket shall enable footwear to be secured for testing in a manner that neither enhances nor inhibits the cut resistance of the foot protective device.

NOTE 2—Securing or mounting mechanisms should enable footwear, if necessary, to be used for multiple evaluations of protective devices.

6.3 *Footwear Form for Mounting Removable Foot Protective Device*.^{6,7}

6.3.1 The footwear form used for mounting a removable foot protective device shall be similar to that shown in Fig. 5.

⁶ The sole source of supply of the footwear form known to the committee at this time is Satra, Satra House, Rockingham Road, Kettering, Northants, NN16 9JH, England.

⁷ If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.