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Standard Specification for Foot Protection for Chain Saw Users[1]

This standard is issued under the fixed designation F 1818; 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 This specification covers minimum requirements for the design, performance, testing, and certification of footwear and foot protective devices designed to provide cut resistance protection to the feet of operators of power chain saws.

1.2 The objective of this specification is to prescribe fit, function, and performance criteria for footwear and foot protective devices, worn by chain saw operators, which are intended to reduce foot injuries caused by contact with a running power saw chain.

1.3 This specification is not intended to serve as a detailed manufacturing or purchasing specification, but can be referenced in purchase contracts to ensure that minimum performance requirements are met.

1.4 Controlled laboratory tests used to determine compliance with the performance requirements of this specification shall not be deemed as establishing performance levels for all situations to which chain saw operators may be exposed.

1.5 Mandatory requirements are indicated by the use of the word shall; recommendations and advisory information is indicated by the use of the word should.

2. Referenced Documents

2.1 *ASTM Standards:*

D 1776 Practice for Conditioning Textiles for Testing[2]

F 1414 Test Method for Measurement of Cut Resistance to Chain Saws in Lower Body (Legs) Protective Clothing[3]

F 1458 Test Method for Measurement of Cut Resistance to Chain Saw of Foot Protective Devices[3]

2.2 *AATCC Standards:*[4]

AATCC Test Method 96—(1988) Dimensional Changes in Laundering of Woven and Knitted Fabrics, except Wool

AATCC Test Method 158—(1985) Dimensional Changes on Dry Cleaning in Perchloroethylene: Machine Method

2.3 *OSHA Standard:*[5]

29 CRF 1910.266

3. Terminology

3.1 *Definitions:*

3.1.1 *approve, v*—to be acceptable to the authority having jurisdiction.

3.1.2 *authority having jurisdiction, n*—the organization, office, or individual responsible for approving any equipment, installation, or procedure.

3.1.2.1 *Discussion*—The term *authority having jurisdiction* is used in this document in a broad manner since jurisdictions and the responsibilities of approval agencies vary.

3.1.3 *certification, n*—a system whereby an organization determines that a manufacturer has demonstrated the ability to make a product that complies with the requirements of the specification, authorizes the manufacturer to use a label on products that comply with the requirements of the specification, and conducts a follow-up program to verify the methods the manufacturer uses to determine compliance with the requirements of this specification.

3.1.4 *certification organization, n*—an independent, third-party organization that determines product compliance with the requirements of the specification with a labeling and listing follow-up program.

3.1.5 *chain saw, n*—a portable power-operated tool used for cutting wood which has cutters linked in a chain.

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

3.1.7 *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 (see *threshold stopping speed*).

3.1.8 *cut resistance, n—in textile testing for chain saws*, the ability of a material, while in contact with the linked cutters, to resist penetration of the cutters of a moving saw chain, independent of either jamming or chain stop.

[1] This specification is under the jurisdiction of ASTM Committee F23 on Protective Clothing and is under the direct responsibility of Subcommittee F23.20 on Physical Properties.

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[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] *Annual Book of ASTM Standards*, Vol 11.03.

[4] Available from American Association of Textile Chemists and Colorists (AATCC), One Davis Dr., P.O. Box 12215, Research Triangle Park, NC 27709-2215.

[5] Available from the Supt. of Documents, U. S. Government Printing Office, Washington, DC 20402.

3.1.9 *cut-through time, n—for chain saw cut resistance,* the time required for a running saw chain to affect complete breakthrough of a protective garment or protective device.

3.1.9.1 *Discussion*—When a cut through is effected, speed of the saw chain, and time required must be measured.

3.1.10 *follow-up program, n*—the sampling, inspection, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of products that are being made by the manufacturer to the requirements of the standard specification.

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

3.1.12 *foot protective device, n—for chain saw 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.

3.1.13 *footwear, n—for chain saw cut resistance,* a boot or shoe of any construction.

3.1.14 *gaiter, n—for chain saw cut resistance,* a foot protective device worn outside the footwear.

3.1.15 *jamming, n—for chain saw cut resistance,* the clogging action manifested by a protective garment which can produce a chain stop.

3.1.16 *label, v—for protective clothing,* to attach a symbol or other identifying mark, the use of which has been authorized by a certification organization.

3.1.17 *liner, n—for chain saw cut resistance,* foot protective device worn inside the footwear.

3.1.18 *list, v—for protective clothing,* to publish a register of equipment or materials which has been verified by a certification organization as being acceptable and meeting the requirements of standard specifications.

3.1.18.1 *Discussion*—The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the certification organization to identify a listed product.

3.1.19 *protective clothing, n*—any material or combination of materials used in an item clothing for the purpose of isolating parts of the body from a potential hazard.

3.1.19.1 *Discussion*—In this specification, the potential hazard is contact with a running chain saw.

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

3.1.21 *threshold stopping speed (TSS), n—for chain saw cut protection,* the maximum saw chain speed measured in metres per second (m/s) (feet per minute (f/m)) that does not produce a cut through when the chain saw is dropped onto the test specimen.

3.1.22 *toe area cut zone—in the testing of foot protective devices,* that area, excluding the sole, which extends from the frontmost part of the footwear, to a vertical plane 15 mm ± 0.25 mm (0.60 in. ± 0.01 in.) behind the toe box.

3.1.22.1 *Discussion—In the absence of a toe box,* the toe area cut zone extends to a vertical plane 65 mm ± .25 mm (2.60 in. ± 0.01 in.) from the front of the footwear.

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

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

3.1.25 *upper cut zone, n—in the testing of foot protective devices,* that area which starts near the top of the footwear and extends downward, but excludes the toe area cut zone.

4. Materials and Workmanship

4.1 Footwear and foot protective devices shall be constructed of materials which should remain functional and effective throughout seasonal climatic variations.

4.2 Footwear and foot protective devices shall not impede normal movement or the capability to perform the intended tasks.

4.3 The workmanship in the production and assembly of the footwear or foot protective device shall be such that the protective material is securely attached.

4.4 Footwear and foot protective devices shall be free of defects or imperfections which could detract from their function or performance. All hardware should be free of rough spots, burrs, or sharp edges.

5. Areas of Protection

5.1 The means of securing the footwear or foot protective device in position on the foot is considered part of its structure. A means of securing footwear includes laces, buckles, snaps, hooks, and any other items which may be considered as a means of holding the footwear or protective device securely in place. These means of securing the footwear or foot protective device shall not be removed for testing and care is to be taken so that the means of securing the footwear or foot protective device are not lodged between the forms and mounting brackets in such a way that they interfere with the integrity of the testing procedure.

5.2 Footwear and foot protective devices shall have a minimum area of protection as described in 5.2.1-5.2.3.

5.2.1 *Height of Protection*—The chain saw cut resistance area of the upper test cut zone shall extend downward from a minimum height of 178 mm (7 in.). (See Fig. 1.)[6]

5.2.2 *Width of Protection*:

5.2.2.1 *Slip On or Non-Frontal Closure Device*—The chain saw cut resistance area shall extend from Point A, at the front centerline to vertical lines on both sides of the footwear or the foot protective device. The top of the vertical lines are 70 mm (2.75 in.) from Point A when measured circumferentially along the top of the minimum protective area as shown in Fig. 1.

5.2.2.2 *Front Closure Device*—The chain saw cut resistance area shall extend from Point A, at the front centerline to vertical lines on both sides of the footwear or foot protective device. The top of the vertical lines are 75 mm (3.0 in.) from Point B when measured circumferentially along the top of the minimum protective area as shown in Fig. 2.

5.2.3 *Toe Area Protection*—Toe boxes at least 1.6 mm (0.60 in.) thickness steel shall be considered to be part of the protective area.

[6] This height can be measured by using a dowel having 64-mm (2½ in.) diameter and 178 mm (7 in.) length placed at the inside back of the heel of the footwear.

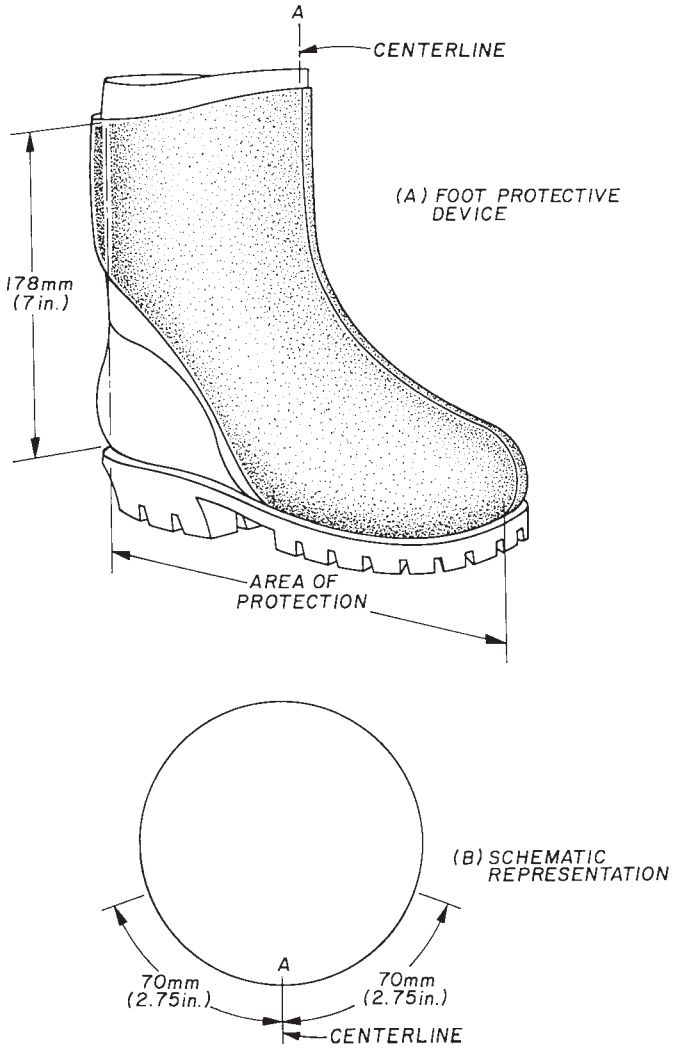

FIG. 1 Footwear With Slip-on or Non-frontal Closure Device

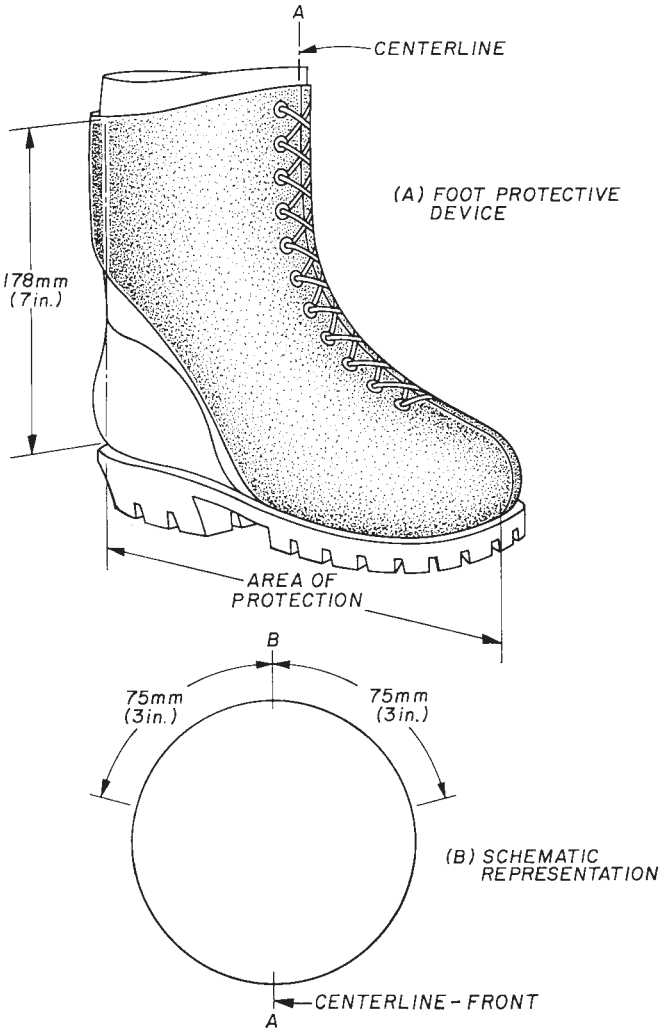

FIG. 2 Footwear With Front Closure Device

6. Conditioning

6.1 *Footwear*—Footwear with chain saw cut resistance integrated into the manufacture of the footwear shall be placed in a room with an ambient condition of 70 ± 10°F (21 ± 6°C) and a relative humidity of 50 % ± 15 % for at least 24 h.

6.2 *Foot Protective Devices Permanently Attached*:

6.2.1 *Textile Materials*—Textile foot protective devices which are permanently attached to the footwear are conditioned in the same manner as footwear.

6.2.2 *Non-Textile Materials*—Non-textile foot protective devices which are permanently attached to the footwear are conditioned in the same manner as footwear.

6.3 *Foot Protective Devices Not Permanently Attached*:

6.3.1 *Textile Materials*:

6.3.1.1 Unless otherwise directed by manufacturer's care and maintenance guidelines, as required in Section 9, the foot protective device shall be conditioned in the following manner.

6.3.1.2 *Commercial Laundering*—Wash specimens five times in accordance with AATCC 96, (1988) Level II, C, and tumble dry for 30 min (or until dry) at temperature of 60 ± 6°C (140 ± 10°F).

6.3.1.3 *Dry Cleaning*—Dry clean specimens three times, in accordance with AATCC 158, (1985).

6.3.1.4 The specimens shall be brought from the dry side to approximate moisture equilibrium for testing in the standard atmosphere for testing textiles as directed in Practice D 1776.

NOTE 1—Equilibrium is considered to have been reached when the increase in mass of the specimen in successive weightings, made at intervals of not less than 2 h does not exceed 0.1 % of the mass of the specimen.

6.3.2 *Non-Textile Materials*—Non-textile foot protective devices not permanently attached to footwear shall be conditioned in the same manner as footwear.

7. Inspection and Performance Testing

7.1 *Inspection*:

7.1.1 Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to ensure a reasonable and acceptable confidence level that products certified to standard are compliant.

7.1.2 Inspection for determining compliance with any design requirements established in the specification shall be performed on footwear or foot protective devices.

7.1.3 Testing for determining material and component compliance with the requirements detailed in this specification shall be performed on samples which are no better than components used in the actual construction of the protective clothing. The certification organization shall be permitted to also use sample materials cut from representative footwear or foot protective devices as defined by this specification.

7.2 *Performance Testing*:

7.2.1 *Performance Requirement (Minimum Threshold Stopping Speed)*:

7.2.1.1 After conditioning the samples as described in Section 6, the test specimens shall be tested in accordance with Test Method F 1458. With the running saw chain moving at a minimum initial speed of 15.25 m/s (3000 ft/min), the cut through time of the test specimen shall not be less than 1.5 s at following cut positions:

7.2.1.2 Six specimens, three left and three right, shall be tested at the approximate midpoint of the upper cut zone. Using the dowel noted in Test Method F 1458, a horizontal line will be extended from the midpoint of the dowel to where it intersects the centerline of the front of the footwear or foot protective device. The bracket on which the footwear or protective device rests is at an angle such that the tangent of the centerline at the cut point is horizontal and perpendicular to the guide bar.

7.2.1.3 Six specimens shall be tested in the toe area cut zone, three left outside and three right inside, at a point approximately 12 ± 2 mm (0.5 ± 0.1 in.) behind the edge of the toe box. The footwear shall be positioned so that the centerline of the guide bar is at an angle of 30° to the plane of the baseplate when mounted on the test bracket. The plane of the guide bar is vertical and is perpendicular to the area of the centerline of the footwear.

7.2.1.4 Footwear or foot protective devices which incorporate toe boxes of less than 1.6 mm (.060 in.) steel, or made of a material other than steel, shall be required to have an additional test cut made at a point between 25 to 40 mm (1.0 to 1.55 in.) form the front of the footwear. This test cut can be made on either the left side or right side of the toe area cut zone of the footwear. The footwear shall be positioned so that the centerline of the guide bar is at an angle of 0 to 30° to the plane of the base plate when the footwear is mounted on the test bracket. The plane of the guide bar is vertical and perpendicular to the centerline of the footwear.[7]

7.2.1.5 Footwear or foot protective devices which incorporate different protective materials or constructions at required areas of protection locations, other than the test cut locations specified above, shall be required to have additional test cuts made, as necessary, to evaluate such materials or constructions.

7.2.1.6 No test of either a foot protective device which is permanently attached, or foot protective device which is not permanently attached, shall result in a cut through of the footwear.

[7] OSHA Standard 29 CRF 1910.266 for logging and timber harvesting requires that "Safety boots or shoes (excluding low cut shoes) shall be provided in accordance with American National Standard for Men's Safety-Toe Footwear, Z41.1-1967."

8. Certification

8.1 *General*:

8.1.1 Footwear and foot protective devices that are labeled as complying with this specification shall meet or exceed all applicable requirements detailed in the specification and shall be certified.

8.1.2 All certifications shall be performed by an approved certification organization.

8.1.3 Compliant footwear or foot protective devices shall be labeled and listed. Such footwear and foot protective devices shall also have a label and identification that meets the requirements specified in Section 10.

8.2 *Certification Program*:

8.2.1 The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified. The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

8.2.1.1 The certification organization should have a sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the organization.

8.2.2 The certification organization shall refuse to certify products to this specification that do not comply with all applicable requirements of this specification.

8.2.3 The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent upon compliance with all applicable requirements of this specification. There shall be no conditional, temporary, or partial certifications. Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not manufactured in compliance with all applicable requirements of this specification.

8.2.3.1 The contractual provisions covering certification programs should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products. Without these clauses, certifiers would not be able to move quickly to protect their names, marks, or reputations. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

8.2.4 A certification organization shall have, or contract with, laboratory facilities and equipment for conducting proper tests, a program for calibration of all instruments, and procedures to ensure proper control of all testing. These procedures shall include the use of laboratory manuals, data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification, and training programs.

8.2.4.1 Investive procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

8.2.5 Manufacturers shall be required to establish and maintain a program of production, inspection, and testing.

8.2.6 The manufacturer and the certification organization shall evaluate any chances affecting the form, fit, or function of the certified product to determine its continual certification to this specification.

8.2.7 Product certifications shall include a follow-up inspection program, with at least two random and unannounced visits per 12-month period.

8.2.7.1 Such factory inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it may be necessary to purchase samples in the open market for test purposes.

8.2.8 The certification organization shall have a program for investigating field reports alleging malperformance or failure of listed products.

8.2.9 The operating procedures of the certification organization shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

8.2.10 The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

9. Care and Maintenance

9.1 Footwear and foot protective devices shall be maintained according to the manufacturer's instructions.

9.2 If footwear or a foot protective device is damaged, check with the manufacturer's instructions for replacement criteria. It may no longer provide the minimum protection required by this specification.

9.3 The protective material which covers the area outlined in Section 5 shall not be modified.

9.4 Failure to follow manufacturer's instructions may result in the protective garment or device no longer meeting the minimum protection required by this specification.

9.5 Manufacturer should also provide some guidance relative to retirement of footwear or foot protective devices.

10. Identification

10.1 Footwear or foot protective devices meeting this specification shall be provided with:

10.1.1 The certification organization's label and means to identify the manufacturer.

10.1.2 A label that states: "This product has been certified to comply with F 1818."

10.1.3 Instructions for use, care, repair, replacement, cleaning, and drying.

10.1.4 Any necessary informational and advisory material which includes at least the following or similar statement:

10.1.4.1 **WARNING**—No one can guarantee that an injury will not occur or will be less severe because an operator wears this footwear or foot protective device. This footwear or foot protective device is intended under limited conditions, to assist the wearer in reducing the severity of injury from a running power saw chain which accidentally contacts the saw operator's foot. Failure to follow the manufacturer's instructions may result in the footwear or foot protective device no longer providing the minimum protection required by this specification.

10.1.5 Visible and permanent tracing information related to manufacturer's production lots.

10.1.5.1 Purchasers might wish to include a requirement in purchase specification for an additional label containing certain information such as *date of manufacture*, *manufacturer's name*, *lot identification number*, and so forth, to be located in a protected location on the footwear or foot protective device to reduce the chance of label degradation and as a backup source of information to aid in tracking.

11. Packaging and Package Marking

11.1 Each pair of footwear or foot protective device meeting this specification shall meet the following labeling requirements:

11.1.1 The information required by 10.1.1 and 10.1.2.1 shall be permanently marked with characters at least 3 mm (0.125 in.) high on a *white* label permanently placed in a clearly visible location on the outside of the footwear or foot protective device.

11.1.2 The information required by 10.1.3 and 10.1.4 shall be printed on a durable material and attached to each pair of footwear or foot protective device, such that it can be removed by the purchaser, read, and then stored for future reference. The size of the print shall be clearly visible and legible in characters no less than 3 mm (0.125 in.) in height.

11.2 The required labels shall be printed at least in English.

12. Keywords

12.1 chain saw; foot protection; specification