Designation: F2413 – 05

Standard Specification for Performance Requirements for Foot Protection[1]

This standard is issued under the fixed designation F2413; 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.

INTRODUCTION

For more than sixty years, the predecessor to this specification, ANSI Z41, established the performance criteria for a wide range of footwear to protect from hazards that affect the personal safety of workers.

The value of these standards was recognized early in the history of Occupational Safety and Health Administration (OSHA) and incorporated as a reference standard in the Code of Federal Regulations (CFR) 1910.

The specification contains performance requirements for footwear to protect workers' feet from the following hazards by providing: (*1*) impact resistance for the toe area of footwear; (*2*) compression resistance for the toe area of the footwear; (*3*) metatarsal impact protection that reduces the chance of injury to the metatarsal bones at the top of the foot; (*4*) conductive properties which reduce hazards that may result from static electricity buildup; and reduce the possibility of ignition of explosives and volatile chemicals; (*5*) electric shock resistance, to protect the wearer when accidental contact is made with live electric wires; (*6*) static dissipative (SD) properties to reduce hazards due to excessively low footwear resistance that may exist where SD footwear is required; (*7*) puncture resistance of footwear bottoms; (*8*) chain saw cut resistance; and (*9*) dielectric insulation.

1. Scope

1.1 This specification covers minimum requirements for the design, performance, testing, and classification of footwear designed to provide protection against a variety of workplace hazards that can potentially result in injury.

1.2 The objective of this specification is to prescribe fit, function, and performance criteria for footwear that is intended to be worn to reduce injuries.

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 individuals may be exposed.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B117 Practice for Operating Salt Spray (Fog) Apparatus

F1116 Test Method for Determining Dielectric Strength of Dielectric Footwear

F1117 Specification for Dielectric Footwear

F1818 Specification for Foot Protection for Chain Saw Users

F2412 Test Methods for Foot Protection

2.2 *Federal Standards:*[3]

CFR 1910.132 Personal Protective Equipment–General Requirements

CFR 1910.136 Personal Protective Equipment–Occupational Foot Protection

2.3 *Canadian Standards Association Standard:*[4]

[1] This specification is under the jurisdiction of ASTM Committee F13 on Pedestrian/Walkway Safety and Footwear and is the direct responsibility of Subcommittee F13.30 on Footwear.

Current edition approved March 1, 2005. Published March 2005. DOI: 10.1520/F2413-05.

[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 U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

[4] Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON Canada M9W1R3.

CAN/CSA Z195 Protective Footwear

3. Terminology

3.1 *Definitions:*

3.1.1 *footwear*, *n*—wearing apparel for the feet (such as shoes, boots, slippers, or overshoes) excluding hosiery.

3.1.1.1 *Discussion*—This term can refer to either left foot or right foot units or pairs.

3.1.2 *insert*, *n*—footbed normally made of a foam product with leather or fabric cover shaped to cover the entire insole which can be inserted between the foot and insole board.

3.1.3 *insole*, *n*—foundation of the shoe; the inner sole of the shoe which is next to the foot, under the sock liner or the insert, onto which the upper is lasted.

3.1.4 *last*, *n*—solid hinged form, in the general shape of a foot, around which footwear is constructed.

3.1.5 *lasting*, *v*—building of footwear around a specific foot form.

3.1.6 *lining*, *n*—term used to describe all components that can be used to construct the interior of the upper part of the footwear.

3.1.7 *outsole and heel*, *n*—exterior bottom platform of the footwear; the bottom surface.

3.1.8 *product category*, *n*—description for a type of footwear designed and manufactured for a specific hazard or hazards.

3.1.9 *product classification*, *n*—footwear manufactured to meet a minimum performance requirement for a specific hazard or hazards.

3.1.10 *protective footwear*, *n*—footwear that is designed, constructed, and classified to protect the wearer from a potential hazard or hazards.

3.1.11 *protective toe cap*, *n*—component designed to provide toe protection that is an integral and permanent part of the footwear.

3.1.12 *quarter*, *n*—entire back portion of the footwear upper.

3.1.13 *shall*, *v*—mandatory action.

3.1.14 *should*, *v*—advisory comment.

3.1.15 *size*, *n*—length and breadth measurements of footwear determined by using a specific grading; the American system of footwear grading.

3.1.16 *socklining*, *n*—material placed over the insole which is imprinted with a brand name or other designation.

3.1.17 *upper*, *n*—parts of a shoe or boot that are above the sole.

4. Significance and Use

4.1 This specification contains requirements to evaluate the performance of footwear for the following:

4.1.1 Impact resistance for the toe area of footwear,

4.1.2 Compression resistance for the toe area of footwear,

4.1.3 Metatarsal protection that reduces the chance of injury to the metatarsal bones at the top of the foot,

4.1.4 Conductive properties which reduce hazards that may result from static electricity buildup, and reduce the possibility of ignition of explosives and volatile chemicals,

4.1.5 Electric shock resistance,

4.1.6 Static dissipative (SD) properties to reduce hazards due to excessively low footwear resistance that may exist where SD footwear is required,

4.1.7 Puncture resistance of footwear bottoms,

4.1.8 Chain saw cut resistance, and

4.1.9 Dielectric insulation.

5. Performance Requirements and Workmanship

5.1 *Impact Resistant Footwear*:

5.1.1 Impact resistant footwear shall also meet the requirements of 5.2 for compression resistant footwear.

5.1.2 Footwear shall be designed, constructed, and manufactured so that a protective toe cap is an integral and permanent part of the footwear.

5.1.3 The workmanship in the production and assembly of the footwear shall ensure that the footwear provides functionality to the wearer.

5.1.4 Classification shall be determined by evaluating three specimens in accordance with Test Methods F2412. The product classification for impact resistance represents the minimum force required for each classification that results in the toe area of the footwear having a minimum interior height clearance of 12.7 mm (0.50 in.) in men's footwear and 11.9 mm (0.468 in.) in women's footwear.

5.1.4.1 Impact resistance of footwear shall be classified as follows:

(1) Class 75 product classification men's footwear shall demonstrate a minimum interior height clearance of 12.7 mm (0.50 in.) during exposure to impact energy of 101.7 J (75 ft-lbf).

(2) Class 75 product classification women's footwear shall demonstrate a minimum interior height clearance of 11.9 mm (0.468 in.) during exposure to impact energy of 101.7 J (75 ft-lbf).

(3) Class 50 product classification men's footwear shall demonstrate a minimum interior height clearance of 12.7 mm (0.50 in.) during exposure to impact energy of 67.8 J (50 ft-lbf).

(4) Class 50 product classification women's footwear shall demonstrate a minimum interior height clearance of 11.9 mm (0.468 in.) during exposure to impact energy of 67.8 J (50 ft-lbf).

5.1.4.2 Any specimen that does not meet the minimum impact performance requirements for the product classification constitutes failure for the product category.

5.1.4.3 Protective toe footwear specimens or samples shall be retested for classification for any of the following changes:

(1) Change in material used to make protective toe cap, change in protective cap manufacturer, or changes in the design of the toe cap.

(2) Change in construction method used to make footwear.

(3) Change in the upper or insole material thickness greater than 25 %, change to the soling system, or a change in the hardness of the outsole.

(4) Shape of last used in the manufacturing of footwear.

5.2 *Compression Resistant Footwear*:

5.2.1 Compression resistant footwear shall also meet the requirements of 5.1 for impact resistant footwear.

5.2.2 Footwear shall be designed, constructed, and manufactured so that a protective toe cap is an integral and permanent part of the footwear.

5.2.3 The workmanship in the production and assembly of the footwear shall ensure that the footwear provides functionality to the wearer.

5.2.4 Classification shall be determined by evaluating three specimens in accordance with Test Methods F2412. The product classification for compression resistance represents the minimum force required that results in the toe area of the footwear having a minimum interior height clearance of 12.7 mm (0.50 in.) in men's footwear and 11.9 mm (0.468 in.) in women's footwear.

5.2.4.1 Compression resistance of footwear shall be classified as follows:

(1) Class 75 product classification men's footwear shall demonstrate a minimum interior height clearance of 12.7 mm (0.50 in.) during exposure to a compressive force of 11 121 N (2500 lbf).

(2) Class 75 product classification women's footwear shall demonstrate a minimum interior height clearance of 11.9 mm (0.468 in.) during exposure to a compressive force of 11 121 N (2500 lbf).

(3) Class 50 product classification men's footwear shall demonstrate a minimum interior height clearance of 12.7 mm (0.50 in.) during exposure to a compressive force of 7784 N (1750 lbf).

(4) Class 50 product classification women's footwear shall demonstrate a minimum interior height clearance of 11.9 mm (0.468 in.) during exposure to a compressive force of 7784 N (1750 lbf).

5.2.4.2 Any specimen that does not meet the minimum compression resistance requirements for the product classification constitutes a failure for the product category.

5.2.4.3 Compression resistant footwear shall be retested for classification for any of the following changes:

(1) Change in material to make protective toe cap, change in protective toe cap manufacturer, or changes in the design of the toe cap.

(2) Change in construction method used to make footwear.

(3) Change in the upper or insole material thickness greater than 25 %, change to the soling system, or a change in the hardness of the outsole.

(4) Shape of last used in manufacturing of footwear.

5.2.4.4 *Classifications*—Protective footwear shall be classified in accordance with the tables below for its ability to meet compression resistance and impact resistance. The proper classification shall be determined by the test results of three specimens for each requirement.

5.2.4.5 The lowest recorded compression or impact resistance of the three test specimens will determine the footwear classification. If the product fails to meet the class for which it is intended, you must retest. For example, if a product test results meet Class 50 for compression resistance and Class 75 for impact resistance, the rating of the footwear will be I50/C50.

Classification Table Impact
I/75 = 75 ft-lbs (101.7 J)
I/50 = 50 ft-lbs (67.8 J)

Classification Table Compression
C/75 = 2500 lb (11 121 N)
C/ = 1750 lb (7784 N)

Minimum Clearance (all classifications)
Men = 0.500 in. (12.7 mm)
Women = 0.468 in. (11.9 mm)

5.3 *Metatarsal Protective Footwear*:

5.3.1 Metatarsal protective footwear shall first meet the requirements of 5.1 for impact resistant footwear and 5.2 for compression resistant footwear.

5.3.2 Footwear shall be designed, constructed, and manufactured so that a metatarsal impact guard is positioned partially over the protective toe cap and extended to cover the metatarsal bone area. The metatarsal protection shall be an integral and permanent part of the footwear.

5.3.3 The workmanship in the production and assembly of the footwear shall ensure that the footwear provides functionality to the wearer.

5.3.4 Classification shall be determined by evaluating three specimens in accordance with Test Methods F2412. The product classification for metatarsal protection shall be made after the footwear has been classified for impact resistance and compression resistance.

5.3.4.1 Class 75 product classification metatarsal protective footwear for men shall first meet the performance requirements for Class 75 Impact Resistant and Class 75 Compression Resistant footwear. Subsequent to meeting these performance requirements, the height of the wax form used to measure metatarsal protection shall be a minimum of 25.4 mm (1.0 in.) after exposure of impact energy of 101.7 J (75 ft-lbf).

5.3.4.2 Class 75 product classification metatarsal protective footwear for women shall first meet the performance requirements for Class 75 Impact Resistant and Class 75 Compression Resistant footwear. Subsequent to meeting these performance requirements, the height of the wax form used to measure metatarsal protection shall be a minimum of 23.8 mm (0.937 in.) after exposure of impact energy of 101.7 J (75 ft-lbf).

5.3.4.3 Class 50 product classification metatarsal protective footwear for men shall first meet the performance requirements for Class 50 Impact Resistant and Class 50 Compression Resistant footwear. Subsequent to meeting these performance requirements, the height of the wax form used to measure metatarsal protection shall be a minimum of 25.4 mm (1.0 in.) after exposure of impact energy of 67.8 J (50 ft-lbf).

5.3.4.4 Class 50 product classification metatarsal protective footwear for women shall first meet the performance requirements for Class 50 Impact Resistant and Class 50 Compression Resistant footwear. Subsequent to meeting these performance requirements, the height of the wax form used to measure metatarsal protection shall be a minimum of 23.8 mm (0.937 in.) after exposure of impact energy of 67.8 J (50 ft-lbf).

5.3.4.5 Any specimen that does not meet the metatarsal impact resistance performance requirement constitutes a failure for the product category.