

Protective Footwear Guide

ASTM F2413-11
ASTM F2892-11
CSA Z195-09
EN ISO 20345-2011
EN ISO 20346-2012
EN ISO 20347-2011



HYTEST[®]
SAFETY FOOTWEAR



WOLVERINE[®] 

**NOTE: CE marked footwear must be
recertified before June 2013**

2012 Edition

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Changes from 2011 edition are shown in red text

**American Society for Testing and Materials
(ASTM)**

**ASTM F2413-11 and
ASTM F2412-11**

The ANSI Z41 standard was withdrawn and replaced with an ASTM standard.

Several changes were made and ASTM F 2412-05 and ASTM F 2413-05 were published to provide test methods and performance standards respectively for 'Personal Protective Footwear' that will be sold in the United States.

The 2005 standards have now been revised and republished in 2011 with further changes.

- 1) There is now one Impact and Compression classification only - Class 75
- 2) Chainsaw and Dielectric protection deleted from the standards.
- 3) New method for producing wax form used in Metatarsal protection (Metguard) testing.
- 4) New procedure for checking consistency of modeling clay used in impact and compression tests.
- 5) Some wording changes to better harmonize with CSA and EN standards.
- 6) New conditioning requirement added when testing static dissipating footwear.
- 7) Electrical Hazard Resistance testing now at 18kV and current leakage less than 1mA

IMPORTANT NOTE:

Any changes in safety cap and any change in soling system or hardness of outsole requires the footwear to be re-qualified through testing at an independent testing laboratory.

Wolverine policy requires that all ASTM certified categories are retested and re-certified annually.

All ASTM F 2413-11 certified footwear must provide impact and compression resistance as specified in sections 5.1 and 5.2 of the standard.

Additional protection may be provided within the footwear and the requirements for these are given in section 5.3 through 5.9 of the standard.

- Sect 5.3 Metatarsal protection
- Sect 5.4 Conductive footwear
- Sect 5.5 Electrical shock resistant footwear
- Sect 5.6 Static Dissipative footwear
- Sect 5.7 Sole puncture resistance

PRODUCT CATEGORIES & QUALIFICATION TESTING

The protective footwear is first placed into product categories (groups) where each member of the category has the same outsole, last, toe cap and method of construction. Note that an outsole is a particular polymer, hardness and design.

The category can contain many patterns varying in upper design and new patterns can be added to a particular category at any time.

Qualification testing is required for all new categories, 3 pair of footwear (Men's size 9 and Women's size 8) must be tested in an independent lab and achieve satisfactory results before they can be marked as complying with ASTM F 2413-11.

Re-qualification testing is necessary when any change is made to existing footwear that is likely to affect results from the 'test area' of the footwear. The test area is defined as being forward of a plane located 1 inch (25.4mm) behind the back edge of the protective toe cap.

Changes such as those shown below require re-qualification;

- 1) Changes in the protective toe cap, protective insole or metguard materials
- 2) Changes in the design or supplier of the protective toe cap, protective insole or metguard
- 3) Changes to the outsole compound including hardness change.
- 4) Changes in the method of construction
- 5) A change of factory manufacturing the footwear
- 6) Changes in thickness (greater than 25%) of materials used for the upper, lining, sole, or insole portions of the footwear
- 7) Changes to the shape of the last

If the change does not apply to all the footwear in an existing category then a new category is established for the modified designs. If the change does apply to all the footwear then the entire product category is re-qualified.

REQUIREMENTS

Impact and Compression Resistance – Markings I and C respectively

There is one level of protection available for Impact (I) and Compression (C) resistance - Class 75.

The toe cap must be an integral part of the footwear design, the standard does not cover the use of 'after market add-on' protective toe devices.

Impact	Compression
I/75 = 75 ft. lbf (101.7 Joules)	C/75 = 2500 lbs

The test clearances after test for impact and compression tests are;

Men – 0.500 inch (12.7mm)

Women – 0.468 inch (11.9mm)

Note: A new test has been specified for checking that the modeling clay is of the correct quality and not too hard or soft. This test must be carried out every 6 months although it is recommended it is carried out prior to each set of impact tests.

Metatarsal – Marking Mt

Metatarsal protection is designed to prevent or reduce injuries when the toe and metatarsal areas of the foot are exposed to ‘drop’ hazards.

Footwear offering metatarsal protection must be designed and constructed with integral metatarsal guards. The standard does not cover the use of ‘aftermarket add-on’ guards.

The impact energy is the same as for toe impact

The test clearances after the metatarsal impact tests are;

Men – 1 inch (25.4mm)

Women – 0.937 inch (24mm)

Conductive Footwear – Marking Cd

Conductive footwear is designed to discharge static electricity from the wearer’s body through their shoes to ground. The floor must be clean and provide a good ground connection for the static charge to discharge. Conductive footwear is designed and manufactured to minimize static electricity and to reduce the possibility of ignition of volatile chemicals or explosives.

All exposed external metal parts must be non-ferrous. No exposed toplift attaching nails are permitted.

The electrical resistance of conductive protective footwear tested at 500V shall range between 0 and 500,000 ohms.

Electrical Shock Resistant Protection – Marking EH

EH protective footwear is designed to reduce the hazards due to accidental contact with live electrical circuits and electrically energized conductors or parts.

The outer surface of the sole and heel shall not be penetrated by any electrically conductive component.

Electric shock resistant footwear must be capable of withstanding the application of 18,000 volts at 60 Hz for 1 minute with no current flow or leakage in excess of 1.0 milli amperes under dry conditions. Test samples shall be taken as below:

Lot size (per product category)	Number of shoes to test
800 or less	2
801 to 22,000	3
22,001 and over	5

Static Dissipating Footwear – Marking SD

SD protective footwear is designed to reduce the accumulation of excess static electricity by conducting body charge to the ground while maintaining a sufficient high level of resistance that protects the wearer from electrical hazards due to live electrical circuits.

No exposed nails are permitted in SD footwear.

The footwear must be conditioned for a minimum of 24 hours at $21.1 \pm 1.1^\circ \text{C}$ ($70 \pm 2^\circ \text{F}$) and $50 \pm 2\%$ r.h. prior to testing and then worn by the test subject for 5 minutes before testing the resistance of the left foot, the right foot and the pair.

The electrical resistance at 50V tested through the wearer must be greater than 10^6 ohms (1 mega ohm) and not exceed 10^8 ohms (100 mega ohms).

Sole Puncture Resistant Footwear – Marking PR

Puncture resistant footwear includes a sole puncture resistant device (usually below the insole) which reduces the possibility of puncture wounds to the bottom of the feet when the wearer steps on sharp objects that penetrate the soles of the footwear.

The protective device must cover the maximum possible area of the forefoot and heel as the construction will allow. Additionally the plates must be stamped to identify the manufacturer's name (or trade name) and the month and year of manufacture.

Three pairs (random sizes) of puncture resistant devices should be tested as separate items and they should withstand a minimum nail penetration force of 270 pounds (1,200 Newtons). Additionally, they should show no signs of corrosion after they're exposed to a 5.0 % salt solution for a minimum of 24 hours in accordance with ASTM B117 and they should show no signs of cracking after being subjected to 1.5 million flexes per CAN/CSA Z195.

IDENTIFICATION (LABELING)

One half pair shall be clearly and legibly labeled in letters and numbers not less than 0.125 inches (3.75mm) high. The identification shall be a stitched-in, stamped or pressure-sensitized label or a combination of these methods. The identification should be enclosed in a rectangular border and placed on the inside or outside surface of the tongue, gusset, shaft or quarter lining.

A specific 3 line format is specified for the label

Line One – ASTM F2413-11

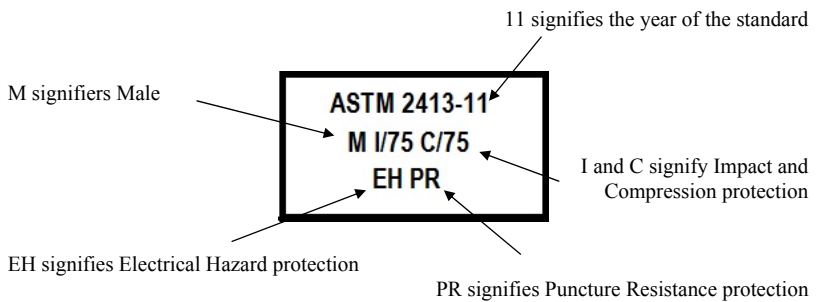
Standard Specification for Performance Requirements for Foot Protection (“11” signifies the year of the standard)

Line Two – F (Female) or M (Male) and

I/75 (Impact protection) and C/75 (Compression protection)

Line Three – used to reference additional protective properties provided and they should appear in the order that they appear in the standard and this handbook. Mt, Cd, EH, SD, PR.

Letters and numbers should be at least 3.75 mm tall



EXAMPLE ASTM F24513-11 LABEL

**American Society for Testing and Materials
(ASTM)**

ASTM F2892

Performance Requirements for Soft Toe Protective Footwear

ASTM F2892-11 is a new standard that has been introduced for protective footwear that DOES NOT provide toe protection.

REQUIREMENTS

With the exception of Impact, Compression and Metatarsal protection, the requirements and principles specified in ASTM F2413/F2412 apply.

IDENTIFICATION (LABELING)

One half pair shall be clearly and legibly labeled in letters and numbers not less than 0.125 inches (3.75mm) high. The identification shall be a stitched-in, stamped or pressure-sensitized label or a combination of these methods. The identification should be enclosed in an oval border and placed on the inside or outside surface of the tongue, gusset, shaft or quarter lining.

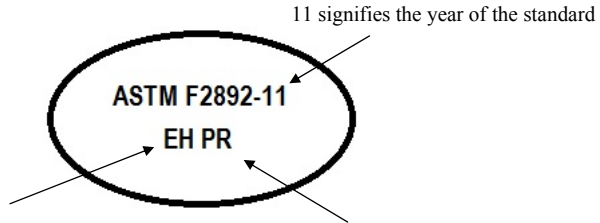
A specific 2 line format is specified for the label

Line One – ASTM F2892-11

Standard Specification for Performance Requirements for Foot Protection (“11” signifies the year of the standard)

Line Two – is used to reference the protective properties provided and they should appear in the order that they appear in the standard and this handbook. Cd, EH, SD, PR.

Letters and numbers should be at least 3.75 mm tall



EH signifies Electrical Hazard protection

PR signifies Puncture Resistance protection

EXAMPLE ASTM F2892-11 LABEL

Canadian Standards Association (CSA)

Z195-09 Protective Footwear

CAN/CSA Z195-02 provides test methods and performance standards for 'Protective Footwear' that will be sold in Canada. There are two grades of toe impact resistance and there are additional special requirements for puncture resistant protective soles, metatarsal protection, electrical shock protection, conductive and static dissipative footwear and chainsaw protection.

All footwear except conductive and static dissipative must have protective toecaps fitted.

DESIGN REQUIREMENTS

The protective toecap must be incorporated into the footwear during manufacturing and it should be an integral part of the footwear. The protective toecap must be made of a material that meets the requirements for impact resistance (Grade 1, 2). It must be smoothly finished and all the edges and corners should be rounded.

The puncture resistant protective sole (when incorporated in the footwear) should cover the sole including the heel area and it should be no more than 8mm from feather edge of the last and extend from the toe to at least 13 millimeters past the breast of the heel and be no more than 13mm from the feather edge around the heel area. If the footwear has no defined heel, the outside edge of the protective sole shall be no more than 8mm from the feather edge all around the last.

The metatarsal protector (when incorporated in the footwear) must cover the complete dorsum of the foot and it should be an integral part of the footwear. The metatarsal protector must overlap the edge of the protective toe cap.

The heel height shall not exceed 60 millimeters (from the ground to the top of the sole at the heel breast). Additionally, the construction must ensure that the heel of the foot is not lower than the ball of the foot when the footwear is on a level surface.

The sole of **electrical shock resistant footwear** shall not be penetrated by conductive or potentially conductive material (eg. Screws and nails) and be of sufficient thickness to protect the wearer from conductive or potentially conductive materials under normal use.

Static dissipative footwear shall be constructed to reduce the accumulation of excess static electricity by conducting body charge to ground.

Conductive Footwear should be constructed with a sole made from conductive compound and be chemically bound to the bottom components, for permanent control, to electrically ground the foot.

Chainsaw protective footwear shall prevent a running chainsaw from cutting all the way through the boot upper and protective toecap.

PERFORMANCE REQUIREMENTS

Test specimens should be finished, unworn protective footwear selected at random from production that is at least 14 days old, sufficient samples shall be tested to cover the full range of sizes available. All test specimens should be conditioned for a minimum of 40 hours at room temperature before being tested at room temperature. However, 50% of the samples for impact tests shall be conditioned at $-18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for a minimum of 12 hours and then tested at room temperature within 60 seconds of removing from the cold.

Protective Toecap Impact

The drop heights shown below according to grade of impact resistance shall be used for the impact tests on toe sections taken from finished footwear. The test clearances shown below must be observed and the toecap must not fracture through its thickness.

Grade	Toe Impact Energy (Joules)	Drop Height (meters)
1	125	0.56
2	90	0.40

Clearance (mm)	Men's sizes	Women's sizes
10.7	-	3
11.2	1 ½ -3	3 ½ -5
11.7	3 ½ -5	5 ½ -7
12.2	5 ½ -7	7 ½ -9
12.7	7 ½ -9	9 ½ -11
13.2	9 ½ -11	11 ½ -13
13.7	11 ½ -13	
14.2	13 ½ -15	

Note: A test is specified for checking that the modeling clay is of the correct quality and not too hard or soft. This test must be carried out at least once every 6 months.

Protective Toecap Corrosion

The protective toe cap shall not be adversely affected by corrosion after exposure to 5% salt solution for 24 hours in accordance with ASTM B117.

Penetration Resistant Protective Sole inserts

The protective sole insert (tested by itself) should;

- Withstand a minimum puncture force of 1,200 N (steel test pin)
- Show no signs of corrosion after being exposed to a 5% salt solution for 24 hours in accordance with ASTM B117
- Show no visible signs of cracking after it has been subjected to 1.5 million flexes

Metatarsal Protection

Footwear offering metatarsal protection must be designed and constructed with integral metatarsal guards. Men's size 9 and women's size 8 shall be impact tested using an impact energy of 101.7 Joules (impact velocity 2.99 ± 0.06 m/s)

A PU foot form is used together with a modeling clay cylinder.

The test clearances after the metatarsal impact tests are;

Men – 24.4mm

Women – 21.4mm

In addition the metatarsal protectors shall not be adversely affected by corrosion when tested using ASTM B117.

Electric Shock Resistant Sole

Each test specimen should withstand under dry conditions, a test potential of 18kV at 60 Hz for 1 minute without disruptive discharge to ground and the leakage current must not exceed 1 mA.

Static Dissipative Footwear

The electrical resistance of each test specimen tested at 500 V in a tray of water shall fall within the range 10^6 to $10^8 \Omega$ for a period of 5 seconds.

Conductive Footwear

The electrical resistance of each test specimen tested at 500 V in a tray of water shall fall within a range of 0 to 500,000 Ω for a period of 5 seconds.

Chainsaw Protective Footwear

Shall prevent a running chainsaw from cutting all the way through the boot upper. Protective toe caps that are not constructed of steel at least 1.6mm thick shall also prevent a running chain saw from cutting all the way through the cap.

Slip Resisting Footwear

Slip resistant footwear should have men's size 10 and/or women's size 8 tested following ISO 13287 in 'Heel' and 'Flat' contact modes using the following test surfaces.

- Dry Quarry tile
- Quarry tile wetted with distilled water
- Stainless steel wetted with distilled water

The results of the slip testing shall be marked on the footwear

IDENTIFICATION (LABELING)

At least one shoe or boot of each pair must bear the following information permanently marked in a conspicuous location:

- Manufacturer's or Listee's name or trademark or, the trade name and the certification agency's identification number
- The year and month of manufacture (codes may be used)
- The grade of toe protection and any type of additional protection provided

In addition to the marking requirements of the standard, CSA also require all footwear to bear a permanent marking indicating the outsole construction style or name. The marking shall be located under the top portion of the tongue or inside the right shoe/boot and shall be traceable to each submitter's certification record.

Footwear identified as slip resisting (slip resistant) shall have the six mean coefficients of friction attained during testing specified either on the packaging or on a label affixed to the footwear.

The six mean coefficients of friction attained during testing should be specified on a product information sheet included with each pair of footwear. The data may also be displayed on box/container labels. These six values represent the coefficients of friction attained for the heel and flat of the sole on the two primary test slipping surfaces: stainless steel and quarry tile.

The following is a suggested format for the statement of slip resistance performance:

"This footwear has been tested in accordance with the slip resisting requirements of CSA Z195. The following average coefficients of friction (CoFs) were attained under the specified test conditions:

Wet stainless steel ____ Heel CoF ____ Flat CoF

Wet quarry tile ____ Heel CoF ____ Flat CoF

Dry quarry tile ____ Heel CoF ____ Flat CoF"

In addition, a statement directing the user to "seek the advice of the footwear manufacturer or distributor regarding appropriate application based on test results" shall be included on the footwear hang-tag, the packaging, or a product information sheet provided with each pair of footwear.

Additional colored patches that are permanent in nature and of a material compatible with the footwear shall be applied to the outside of the right shoe at ankle height or on the tongue as specified below.

A **green triangle** (sides at least 20mm in length) to indicate sole puncture protection with a grade 1 protective toe



A 15 x 12mm **blue rectangle** patch to indicate grade 1 protective toe without protective sole



A **yellow triangle** (sides at least 20mm in length) indicates sole puncture protection with a grade 2 protective toe



A 15 x 12mm **grey rectangle** patch indicates grade 2 protective toe without protective sole



A **white rectangle** (approx 16 x 25mm) with an **orange omega** symbol indicates electric shock protection – Additional printed label or tag attached to the footwear that states “Warning: Electric shock resistance deteriorates rapidly in a wet environment and with wear” and «AVERTISSEMENT:La résistance aux chocs électriques se détériore rapidement en milieu humide et avec l’usure»



A **yellow rectangle** (approx 16 x 25mm) with **green‘SD’ and grounding** symbols indicating static dissipative – Additional printed label or tag attached to the footwear that states “Warning: This footwear should not be used in areas where there is a hazard of electric discharge” and «AVERTISSEMENT:Cette chausse ne doit pas être portée dans des endroits où il a l3isqué de décharge électrique »



Red rectangle (approx 16 x 25mm) with black ‘C’ and grounding symbols indicating electrically conductive – Additional printed label or tag attached to the footwear that states “Warning: This footwear should not be used in areas where there is a hazard of electric discharge” and «AVERTISSEMENT:Cette chausse ne doit pas être portée dans des endroits où il a l3isqué de décharge électrique »



White rectangle (approx 16 x 25mm) with green fir tree symbol indicates chainsaw protection



EN ISO 20345 – Safety Footwear for Professional Use

All safety footwear sold in Europe must comply with the EEC Directive for Personal Protective Equipment and be CE marked. All footwear must be recertified to the 2011 and 2012 standards before June 2013.

Note: CE Certificates have a 5 year expiry date.

Safety footwear has to meet the requirements of the European harmonized standard EN ISO 20345. The footwear has to be certified by a European Notified Body (for example – SATRA, ITS or CTC) prior to production and it must carry the CE mark shown in the label at the end of this section.

See also the explanation in the “User Information” that can be found at the end of this booklet for requirements as they apply to EN ISO 20346 Protective footwear and EN ISO 20347 Occupational footwear.

EN ISO 20344 provides test methods and EN ISO 20345 specifies performance standards for Safety Footwear that will offer the highest level of protection against defined risks.

Specifically, the footwear protects the wearer’s toes against injury from falling objects and crushing. The impact protection (falling objects) provided is 200 Joules and the compression protection (crushing) provided is 15,000 Newtons (1530 kgs). Additional protective features can be provided in the footwear and are identified by additional markings on the product.

There are 2 Classifications of footwear;

Code I – Footwear made from leather and other materials

Code II – All-rubber or all polymeric footwear

All Wolverine Safety footwear models are **Code I footwear** and the remainder of this document deals with code I only.

THE TEST PROPERTIES THAT APPLY TO ALL FOOTWEAR

Test specimens must be taken from smallest, middle and largest sizes of footwear unless indicated by †† for further details refer to Table 1 of EN ISO 20344

Design

Height of upper

Seat region

Whole footwear

Construction – insole security (if used)

Upper/outsole bond strength

Toe protection – cap security

Internal length of toe cap

Toe impact

Toe compression

Corrosion of metal toecaps ††

Behavior of non-metallic toe caps

Slip resistance

Ergonomics

Upper

Height below which all test standards apply

Tear strength

Tensile properties (split only)

Water vapor permeability

Water vapor coefficient

pH (leather only) ††

CrVI (leather only) ††

Lining

Tear strength
Abrasion
Water vapor permeability
Water vapor coefficient
pH (leather only) ††
CrVI (leather only) ††

Tongue

Tear strength
pH (leather only)
CrVI (leather only)

Insole/insock

Thickness ††
Water absorption and desorption ††
Insole abrasion ††
Insock abrasion ††
Cr VI (leather only) ††

Outsole

Thickness
Tear strength
Flexing resistance
Hydrolysis (PU only)
Interlayer bond strength
~~Oil resistance~~ (deleted as mandatory requirement in 2011)

Footwear complying with the requirements that are specified for all the above properties can be marked with **SB**, this is the basic product marking. Additional optional safety features and properties can be added to the footwear from the list below;

OPTIONAL SAFETY FEATURES AND ADDITIONAL MARKING

Outsole resistance to hot contact **HRO**

~~Outsole fuel oil resistance **FO** (made optional in 2011 standard)~~

Penetration resistant inserts **P**

Dimensional conformity

Penetration resistance

Flex resistance ††

Corrosion resistance ††

Behavior of non-metallic inserts ††

Insulation against cold through outsole **CI**

Insulation against heat through outsole **HI**

Heel energy absorption **E**

Water penetration resistant uppers †† **WRU**

Electrical protection

Conductive **C**

Antistatic **A**

Cleated outsoles

Base thickness

Cleat height

Cleated area

Metatarsal impact protection **M**

Ankle impact protection **AN**

Water resistance (whole footwear) **WR**

Cut resistance **CR**

Refer to pages 22 onwards for further details of additional property testing.

MANDATORY QUALITY AND SAFETY REQUIREMENTS

Design

Five footwear designs are pictured and coded A to E depending on the height of the upper, design A is nominally the only shoe with designs B through E being different leg length boots.

Height of upper

Minimum heights are specified for the leg/ankle of footwear for each of the 5 designs. The heights are measured from the lowest point on the surface of the insole between the heel breast and the back of the footwear to the highest point on the upper.

Euro sizes	Design A (mm)	Design B (mm) minimum height	Design C (mm) minimum height	Design D (mm) minimum height
36 and below	<103	103	162	255
37 and 38	< 105	105	165	260
39 and 40	<109	109	172	270
41 and 42	< 113	113	178	280
43 and 44	<117	117	185	290
45 and above	<121	121	192	300

Note: Design E is a thigh length boot with variable length leg extension that can be adapted to the wearer.

Seat region

The seat region should be closed in all except design A mules (slides)

WHOLE FOOTWEAR

Construction

If an insole is used it must not be possible to remove it without damaging the footwear, if an insole is not used, then an insock that is non-removable must be used in the footwear. Note, in a Gore-Tex construction the 'insole' will be the bootee bottom.

Upper/outsole bond strength (Except stitched sole)

4.0 N/mm width (3.0 N/mm if the sole material tears)

Toe protection

The toecap cannot be removed without damaging the footwear.
For internal toecaps a lining must cover the toecap and in addition the back edge of the toe cap must have a covering that extends at least 5mm onto the toecap and at least 10mm into the footwear.

Internal length of toecap

Minimum internal lengths are depending on size of footwear.
Measured 3 to 10mm above the level of a surface on which the cap is placed for measurement.

Euro sizes	Minimum internal length (mm)
36 and below	34
37 and 38	36
39 and 40	38
41 and 42	39
43 and 44	40
45 and above	42

Impact resistance (200 Joules approximately 147.5 ft. lbf)

Minimum impact clearances depending on size of footwear

Euro sizes	Minimum clearance in impact and compression (mm)
36 and below	12.5
37 and 38	13.0
39 and 40	13.5
41 and 42	14.6
43 and 44	14.5
45 and above	15.0

New - Note: A new test has been specified in a new Annex A for checking that the modeling clay is of the correct quality and has the correct energy absorbing and elastic recovery characteristics.

Compression resistance (15,000 Newtons approximately 1530 kgf)

Minimum compression clearances depending on size of footwear (same as for impact resistance)

Corrosion resistance of metal toecaps (1% sodium chloride exposure)

Caps should have no more than 5 areas of corrosion exceeding 2.5mm² in area

Behavior of non-metallic toecaps

Impact testing after acid, alkali, solvent, low temperature and high temperature exposure as specified in EN 12568:1998

Slip resistance

An amendment to the EN ISO standards that was published in November 2007 and this added mandatory slip testing using EN 13287 and the use of 3 marking codes as shown below.

Marking code	Test surface and contaminant	CoF requirements
SRA	Ceramic tile with sodium lauryl sulphate contaminant	Flat ≥ 0.32 Heel ≥ 0.28
SRB	Smooth stainless steel with glycerine contaminant	Flat ≥ 0.18 Heel ≥ 0.13
SRC	As for both SRA and SRB	Passes both SRA and SRB

Ergonomics

The footwear is tested for correct sizing and that it does not cause discomfort to a wearer or prevent a wearer from carrying out normal functions (walk, climb and descend stairs, kneel and crouch, etc.)

Longitudinal stiffness

The force required to flex the footwear is measured to determine whether outsole flex testing should be conducted – see **Outsole flexing resistance**.

UPPER

Height below which all upper materials requirements apply

All materials in the upper below the heights that are given in the table below must meet ALL the upper material requirements. An exception is the material covering the toe cap and counter stiffener, this material does not need to meet the WVP and WVC requirements. Some certification bodies will allow other areas (e.g. eyestay facings) to incorporate non permeable material and this should be discussed with the certification body.

Euro sizes	Minimum height (mm) measured from the ground surface below which all upper material requirements apply				
	New - Design A	Design B	Design C	Design D	Design E
36 and below	44	64	113	172	265
37 and 38	46	66	115	175	270
39 and 40	48	68	119	182	280
41 and 42	50	70	123	188	290
43 and 44	52	72	127	195	300
45 and above	53	73	131	202	310

Note: When collar materials and inserts are above the heights given in the table above, the materials must meet the requirements defined for lining materials except WVP and WVC

Tear strength

120 Newtons minimum strength for leather, 60 Newtons minimum for non-leather

Tensile properties (Leather splits only)

15N/mm² minimum

Water vapor permeability and coefficient

WVP - 0.8mg/(cm²h) minimum and WVC - 15 mg/cm² minimum

pH value (Leathers only)

pH 3.2 minimum and if pH is below 4 then a 10x dilution must be carried out and the difference between diluted pH and undiluted pH must be less than 0.7

Soluble chrome VI (Leathers only)

Must be absent (i.e.<10ppm)

LININGS (VAMP AND QUARTER LININGS)

Tear strength

30 Newtons minimum for leather, 15 Newtons minimum for coated fabric and textiles

Abrasion resistance

No holes after 25,600 revs dry and 12,800 revs wet

New - For seat region – no holes after 51,200 revs dry and 25,600 revs wet

Water vapor permeability and coefficient

WVP - 2.0 mg/(cm²h) minimum and WVC - 20 mg/cm² minimum

pH value (Leathers only)

3.2 minimum and if pH is below 4 then a 10x dilution must be carried out and the difference between diluted pH and undiluted pH must be less than 0.7

Soluble chrome VI (Leathers only)

Must be absent (i.e.<10ppm)

TONGUE (IF DIFFERENT MATERIAL OR THICKNESS TO UPPER MATERIAL)

Tear strength

36 Newtons minimum for leather

18 Newtons minimum for coated fabric and textiles

pH value (Leathers only)

3.2 minimum and if pH is below 4 then a 10x dilution must be carried out and the difference between diluted pH and undiluted pH must be less than 0.7

Soluble chrome VI (Leathers only)

Must be absent (i.e.<10ppm)

INSOLE (IF PRESENT) AND INSOCKS

Note: In Gore-Tex constructions the 'insole' will be the bootee bottom

Thickness (Insole only)

2 mm minimum

pH value (Leather only)

3.2 minimum and if pH is below 4 then a 10x dilution must be carried out and the difference between diluted pH and undiluted pH must be less than 0.7

Soluble chrome VI (Leathers only)

Must be absent (i.e.<10ppm)

Water absorption and desorption

Note in some constructions insole and insock are tested together – minimum water absorption 70 mg/cm² (reduced to 1 hour test in 2011 standard) and minimum desorption shall be 80% of what was absorbed

Abrasion resistance

Non-leather insole - To and fro abrasion with no damage worse than reference sample after 400 cycles

Insock - Martindale abrasion with no holes after 25,600 revs dry and 12,800 wet

OUTSOLE

Thickness (from lasted margin to street)

6 millimeters minimum for non-cleated outsole

Tear strength (Non-leather)

8 kN/m for materials with a density higher than 0.9 g/cm³

5 kN/m for materials with a density lower or equal to 0.9 g/cm³

Abrasion resistance

150mm³ minimum for materials with a density higher than 0.9 g/cm³

250mm³ minimum for materials with a density lower or equal to 0.9 g/cm³

Flexing resistance

If footwear is not classed as rigid (less than 30N to cause 45 degree flex) then the outsole is cut at its centre and must then withstand 30,000 flexes with no more than 4 millimeters cut growth.

New - Spontaneous cracks are permissible provided they are no deeper than 1.5mm and no longer than 4mm in length

Hydrolysis (PU outsoles only)

Cut growth after hydrolysis treatment shall be less than 6mm before 150,000 flexes

Interlayer bond strength (if the outsole consists of 2 materials)

4.0 N/mm minimum (if there is tearing of any part of the outsole then

3.0 N/mm minimum)

All the test methods, performance standards and the number of specimens required are given in EN ISO 20344.

In addition, all materials must be shown to be free of Azo dyes, PCP, Nickel, and other restricted substances.

MARKING REQUIREMENTS

The footwear must be marked with the following information, in the majority of cases we choose to do this on a tongue label, see example overleaf:

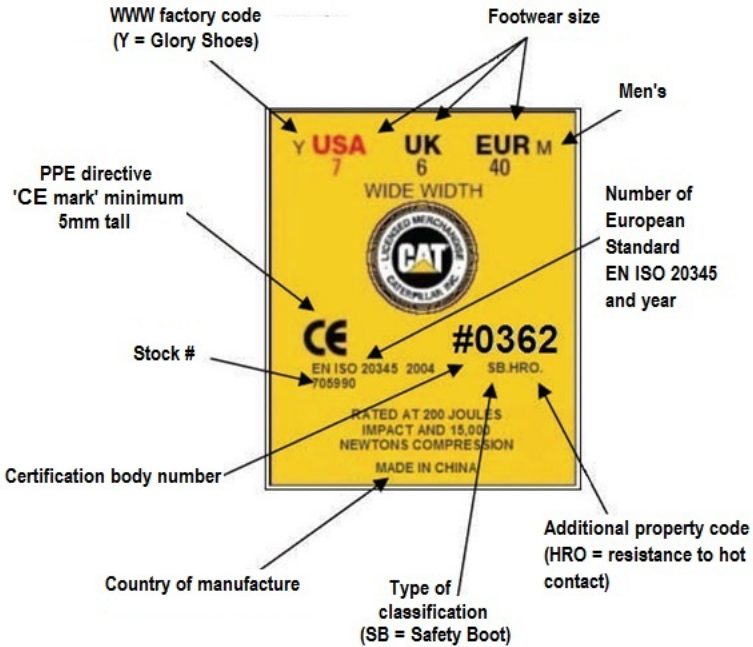
- a) Footwear size
- b) Manufacturers identification mark
- c) Manufacturer's type designation
- d) Year of manufacture and at least quarter
- e) Number and year of the European Standard (EN ISO 20345:2004)
- f) Type classification (example - SB) and additional property code(s) (example - HRO)

Items **e)** and **f)** must appear adjacent to one another.

**In addition, the PPE directive (89/686/EEC) requires
That the product is marked with the 'CE mark'**

**ABBREVIATED CLASSIFICATION MARKINGS
FOR CODE I FOOTWEAR**

Marking	Expanded Marking/requirements (see below for explanation of optional features)
SB	Basic safety boot-no additional properties
S1	Safety boot with closed seat region, anti static, energy absorption in seat region and resistance to fuel oil - expanded marking codes SB A E FO .
S2	As S1 plus water penetration resistant uppers-expanded marking codes SB A E FO WRU
S3	As S2 plus penetration resistance and cleated outsole-expanded marking codes SB A E FO WRU P



OPTIONAL (ADDITIONAL) SAFETY FEATURES

Outsole resistance to hot contact (coding HRO)

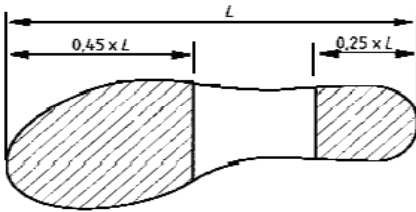
Outsole must withstand 300°C for 60 seconds without melting or cracking when subsequently bent around 10mm diameter mandrel

Resistance to fuel oil

12% maximum increase in volume (swell). If the specimens shrink by more than 0.5% or if there is more than 10 degrees change in Shore A hardness then additional flex testing requirements following oil immersion apply.

Cleated outsoles (no coding but this required for S3)

Cleated area - with the exception of the area beneath the flange of the toecap, the shaded area in the diagram below must be covered by cleats that open to the side of the outsole.



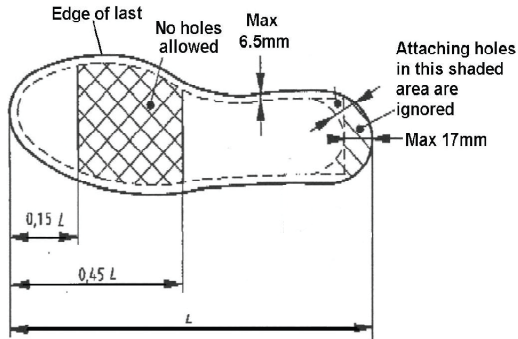
Base thickness – thickness from the lasted margin to the base of the cleats must be at least 4mm

Cleat height – minimum 2.5mm

Penetration resistant inserts (coding P)

It must not be possible to remove the insert without damaging the footwear and in addition, the insert must not sit above the toecap flange or be attached to it.

Dimensional conformity – see diagram below – a maximum of 3 holes of max diameter 3mm are allowed to facilitate attachment to the bottom of the footwear.



Penetration resistance – the finished footwear bottom is tested and the minimum nail penetration force through the outsole should be 1100 N (approximately 112 kgf)

New - If non-metallic penetration resistant materials is used as the insole (strobel) then the nail must not penetrate the material under a load of 1100N.

Flex resistance – high speed flex test and the inserts must show no visible cracking after 1 million flexes

Corrosion resistance of metal inserts (1% sodium chloride exposure) – Inserts should have no more than 5 areas of corrosion exceeding 2.5mm² in area

Behaviour of non-metallic inserts – Nail penetration testing after acid, alkali, solvent, low temperature and high temperature exposure as specified in EN 12568:1998

Resistance to inimical environments

Insulation against cold through outsole (coding CI) – 10°C maximum temperature drop on surface of sock insert (or insole if no insert) in ball region over a 30 minute period with footwear stored at - 20°C on a pre-chilled metal plate. Note footwear is filled with steel shot so upper vents will cause increased temperature drop.

Insulation against heat through outsole (coding HI) - 22°C maximum temperature rise on surface of sock insert (or insole if no insert) in ball region over a 30 minute period with footwear stored in a sandbath heated to 150°C.

New – footwear is now assessed following the heat treatment to ensure it has not degraded.

Heel energy absorption (coding E)

Minimum 20J energy absorption in the seat region when a test punch (heel section of last) is pressed into the bottom of the footwear

Water penetration resistant uppers (coding WRU)

No decorative stitching is allowed in the upper of the footwear and all upper materials must exhibit less than 0.2g water transmission and less than 30% water absorption after 60 minute water resistance flex testing

Electrical protection

Conductive (coding C) – Electrical resistance maximum of 100 kΩ

Antistatic (coding A) – Electrical resistance between 100 kΩ and 1,000 MΩ - Note: the footwear outsole is first painted with conductive lacquer and then footwear is conditioned for 7 days in a dry atmosphere and tested and also conditioned for 7 days in a wet atmosphere and tested.

Metatarsal impact protection (coding M)

Impact testing at the metatarsal position after inserting a wax ‘foot’ inside the footwear. Minimum clearances (thickness of wax foot after impact) are specified depending on footwear size.

Euro sizes	Minimum internal length (mm)
36 and below	37
37 and 38	38
39 and 40	39
41 and 42	40
43 and 44	40.5
45 and above	41

Ankle impact protection (coding AN)

20kN maximum mean value for transmitted energy following a 10J impact, no single value above 30kN.

Water resistance (whole footwear) (coding WR)

Two water resistance tests are specified, walking up and down a trough filled with water for 100 lengths (1000 steps) or ‘carwash’ machine testing for 15 minutes.

Cut resistance (not design A) (Coding CR)

The bottom 30mm up from the feather edge shall be covered with a cut resistant material that extends over the toe cap by at least 10mm. The material shall have a cut resistance Index of not less than 2.5

EXAMPLE USER INFORMATION NOTICE

(All dates for standards have been removed)

Distributor: Wolverine World Wide Inc. 9341 Courtland Dr. Rockford, MI. 49351 USA.
Phone: 616-866-5500

Certification body:

SATRA Technology Centre
Kettering
Northamptonshire
NN16 9JH
UK
(Notified Body No. 0321).

Intertek
Labtest (UK) Ltd.
Centre Court Meridian Business Park
Leicester
LE19 1WR
UK
(Notified Body No. 0362)

This footwear is classed as Personal Protective Equipment (PPE) by the European PPE Directive 89/686/EEC and has been shown to comply with this Directive through the European Standard: EN ISO 20345 Safety footwear, EN ISO 20346 Protective footwear or EN ISO 20347 Occupational footwear – refer to product marking.

CAREFULLY READ THESE INSTRUCTIONS BEFORE USING THIS PRODUCT

This footwear is designed to minimize the risk of injury from the specific hazards as identified by the marking on the particular product (see marking codes below) However, always remember that no item of PPE can provide full protection and care must always be taken while carrying out the risk-related activity.

This footwear must not be modified in any way as this may affect the safety properties.

PERFORMANCE AND LIMITATIONS OF USE – The footwear has been tested in accordance with the EN ISO standards for the types of protection defined on the product by the marking codes explained below. However, always ensure that the footwear is suitable for the intended end use.

FITTING AND SIZING – To put on and take off the product, always fully undo the fastening systems. Only wear footwear of a suitable size. Footwear that is either too loose or too tight will restrict movement and will not provide the optimum level of protection. The size of the products is marked on it.

COMPATIBILITY – To optimize protection, in some instances it may be necessary to use this footwear with additional PPE such as protective trousers or over gaiters. In this case, before carrying out the risk-related activity, consult your supplier to ensure that all your protective products are compatible and suitable for your application.

STORAGE AND TRANSPORT – When not in use, store the footwear in a well-ventilated area away from extremes of temperature. Never store the footwear underneath heavy items or in contact with sharp objects. If the footwear is wet, allow it to dry slowly and naturally away from direct heat sources before placing it into storage.

Use suitable protective packaging to transport the footwear, e.g. the original container.

When stored under normal conditions (temperature, and humidity). the obsolescence date of the footwear is generally:

- 10 years after the date of manufacturing for shoes/boots with rubber soles
- 3 years after the date of manufacturing for shoes/boots with PU soles

REPAIR_– If the footwear becomes damaged, it will NOT provide the optimum level of protection, and therefore should be replaced as soon as is practicable. Never knowingly wear damaged footwear while carrying out a risk related activity. If in doubt about the level of damage consult your supplier before using the footwear.

CLEANING – Clean your footwear regularly using high quality cleaning treatments recommended as suitable for the purpose NEVER use caustic or corrosive cleaning agents.

SLIP RESISTANCE – If no SR marking codes are shown on the footwear then it was certified prior to publication of the November 2007 amendment to the EN ISO standards and one of the following tests and requirements was used:

Test procedure	Test surface (s)	Coefficient of Friction
EN 13287:2004	Ceramic tiles with sodium lauryl sulphate lubricant	Flat > 0.32 and Heel > 0.28
SATRA TM 144:1999	Dry and wet clay tiles plus wet stainless steel	Forepart > 0.4 and heel>0.4

Marking codes on the footwear associated with slip resistance testing have been introduced following the November 2007 amendment and these are:

SRA = Tested and passes on ceramic tile floor with sodium lauryl sulphate lubricant

SRB = Tested and passes on steel floor with glycerine lubricant

SRC = Tested and passes on both ceramic and steel floor with corresponding lubricants

WARNING - The footwear must not be worn without hose (socks).

INSOCKS – If the footwear is supplied with a removable sock insert this would have been in place during testing. The sock insert should remain in place when the footwear is in use. It should be replaced by a comparable sock insert only, as supplied by the original manufacturer. If the footwear is supplied without a sock insert then no sock insert should be fitted otherwise the safety properties of the footwear may be compromised.

WEAR LIFE_– The exact useful life of the footwear will greatly depend on how and where it is worn and cared for. It is therefore very important that you carefully examine the footwear before use and replace as soon as it appears to be unfit for wear. Careful attention should be paid to the condition of the upper stitching, wear in the outsole tread pattern and the condition of the upper/outsole bond

MARKING – The product is marked with information of the following type:



Example of product tongue label

CE	CE mark
8 USA 7 UK 41 UR	Size
Y	Code representing the manufacturing factory
#0075	Certification body number
Stock No. 09911	Product identification
EN ISO 20345	European norm
S1 P SRA	Category of protection offered (including optional features)

The date of manufacture may be marked in the footwear or a fabric ribbon tag is stitched onto the edge of the tongue of the right shoe with a coding that identifies date of manufacture. This tag has four code letters that begin with W. The W denotes Wolverine, the second letter denotes the month of manufacture (A = January through to L = December). The third letter in the sequence denotes the year of manufacture (N = 2004, P = 2005, Q = 2006, etc.). The final letter in the four letter code represents the factory manufacturing the product (Y = Golden Chang, Ab = Right Rich, etc.), contact Wolverine Europe if further information is required.

EXPLANATION OF MARKING CODES USED TO DEFINE LEVEL OF PROTECTION PROVIDED

EN ISO 20345 – SB	Protective toecap fitted and tested with 200 J impact and 15 kN compression force
EN ISO 20346 – PB	Protective toecap fitted and tested with 100 J impact and 10kN compression force
EN ISO 20347 – OB	WARNING - No protective toecap fitted but the footwear must provide one of the 'optional' protective features shown below that is marked with †

Marking codes for optional categories of protection

HRO	Heat resistant outsole compound tested at 300 °C
FO	Fuel oil resistance for outsole
P†	Penetration resistant outsole tested at 1100 newtons
A†	Electrical resistance between foot and ground of between 0.1 and 1000 Mega Ohms *
C†	Electrical resistance between foot and ground of less than 0.1 Mega Ohms *
CI†	Insulation against the cold
HI†	Insulation against heat
E†	Energy absorption of the seat region tested at 20 joules
WRU	Water resistant upper leather
AN†	Ankle protection
WR†	Water resistant footwear
CR	Cut resistant footwear (not applicable to EN ISO 20347 footwear)
M	Metatarsal protection 100J impact energy (not applicable to EN ISO 20347 footwear)
FO	Fuel oil resistance (optional property in EN ISO 20347 footwear only)

* - See additional user instructions below

In addition there are the following short codes for commonly used combinations of EN ISO 20345 optional categories of protection:

S1 =	Upper from material other than all rubber or polymeric + Closed seat region + SB + A +E + FO
S2 =	S1 + WRU
S3 =	S2 + P + Cleated Outsoles

Similar short codes exist for EN ISO 20346 footwear (P1 to P3) and EN ISO 20347 footwear (O1 to O3).

Note: For EN ISO 20347 short code O1 marked footwear features Fuel oil resistance (FO).

*ANTISTATIC FOOTWEAR

Antistatic footwear should be used if it is necessary to minimize electrostatic build up by dissipating electrostatic charges, thus avoiding the risk of spark ignition of for example flammable substances and vapors, and the risk of electric shock from any electrical apparatus or live parts has not been completely eliminated. It should be noted however that antistatic footwear cannot guarantee an adequate protection against electric shock as it introduces only a resistance between foot and floor. If the risk of electric shock has not been completely eliminated, additional measures to avoid the risk are essential. Such measures, as well as the additional tests mentioned below, should be a routine part of the accident prevention program of the workplace.

Experience has shown that, for antistatic purposes, the discharge path through the product should normally have an electrical resistance of less than 1000MΩ at any time throughout its useful life. A Value of 100KΩ is specified as the lowest limit of resistance of a product when new, in order to ensure some limited protection against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective when operating at voltages up to 250V. However, under certain conditions, users should be aware that the footwear might give

inadequate protection and additional provisions to protect the wearer should be taken at all times.

The electrical resistance of this type of footwear can be changed significantly by flexing, contamination or moisture. This footwear will not perform its intended function if worn in wet conditions. It is, therefore, necessary to ensure that the product is capable of fulfilling its designed function in dissipating electrostatic charges and also giving some protection during the whole of its life.

The user is recommended to establish an in-house test for electrical resistance and use it at regular and frequent intervals.

Shoes of Class I can, over a long period of use, absorb moisture and may start to conduct electricity in moist wet conditions.

If the footwear is worn in wet conditions where the soling material becomes contaminated, wearers should always check the electrical properties of the footwear before entering a hazard area.

Where antistatic footwear is in use, the resistance of the flooring surface should be such that it does not invalidate the protection provided by the footwear.

In use, no insulating elements with the exception of normal hose should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties.

***CONDUCTIVE FOOTWEAR**

Electrically conductive footwear should be used if it is necessary to minimize electrostatic charges in the shortest possible time, e.g. when handling explosives. Electrically conductive footwear should not be used if the risk of shock from any electrical apparatus or live parts has not been completely eliminated. In order to ensure that this footwear is conductive, it has been specified to have an upper limit of resistance of 100 k Ω in its new state.

During service, the electrical resistance of footwear made from conducting material can change significantly, due to flexing and contamination, and it is necessary to ensure that the product is capable of fulfilling its designed function of dissipating electrostatic charges during the whole of its life. Where necessary, the user is therefore recommended to establish an in-house test for electrical resistance and use it at regular intervals. This test and those mentioned below should be a routine part of the accident prevention program at the workplace.

If the footwear is worn in conditions where the soling material becomes contaminated with substances that can increase the electrical resistance of the footwear, wearers should always check the electrical properties of their footwear before entering a hazard area.

Where conductive footwear is in use, the resistance of the flooring should be such that it does not invalidate the protection provided by the footwear.

In use, no insulating elements, with the exception of normal hose, should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties.

NOTES

