TECHNICAL REPORT

ISO/TR 18690

Second edition
2012-12-15

Guidance for the selection, use and maintenance of safety and occupational footwear and other personal protective equipment offering foot and leg protection

Lignes directrices pour la sélection, l'utilisation et l'entretien des chaussures de protection et de loisirs ainsi que tout autre équipement de protection personnelle des pieds et des jambes

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ('state of the art', for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 18690 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 161, *Foot and leg protectors*, in collaboration with ISO Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 3, *Foot protection*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TR 18690:2006), which has been technically revised.

Guidance for the selection, use and maintenance of safety and occupational footwear and other personal protective equipment offering foot and leg protection

1 Scope

This Technical Report provides guidance for the selection, use and maintenance of personal protective equipment and safety and occupational footwear. It is intended for footwear manufacturers and suppliers, employers and self-employed people, safety engineers and other users. This Technical Report also provides guidance for preparing national guidance in this area.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20345, *Personal protective equipment — Safety footwear*

ISO 20347, *Personal protective equipment — Occupational footwear*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20345 and ISO 20347 apply.

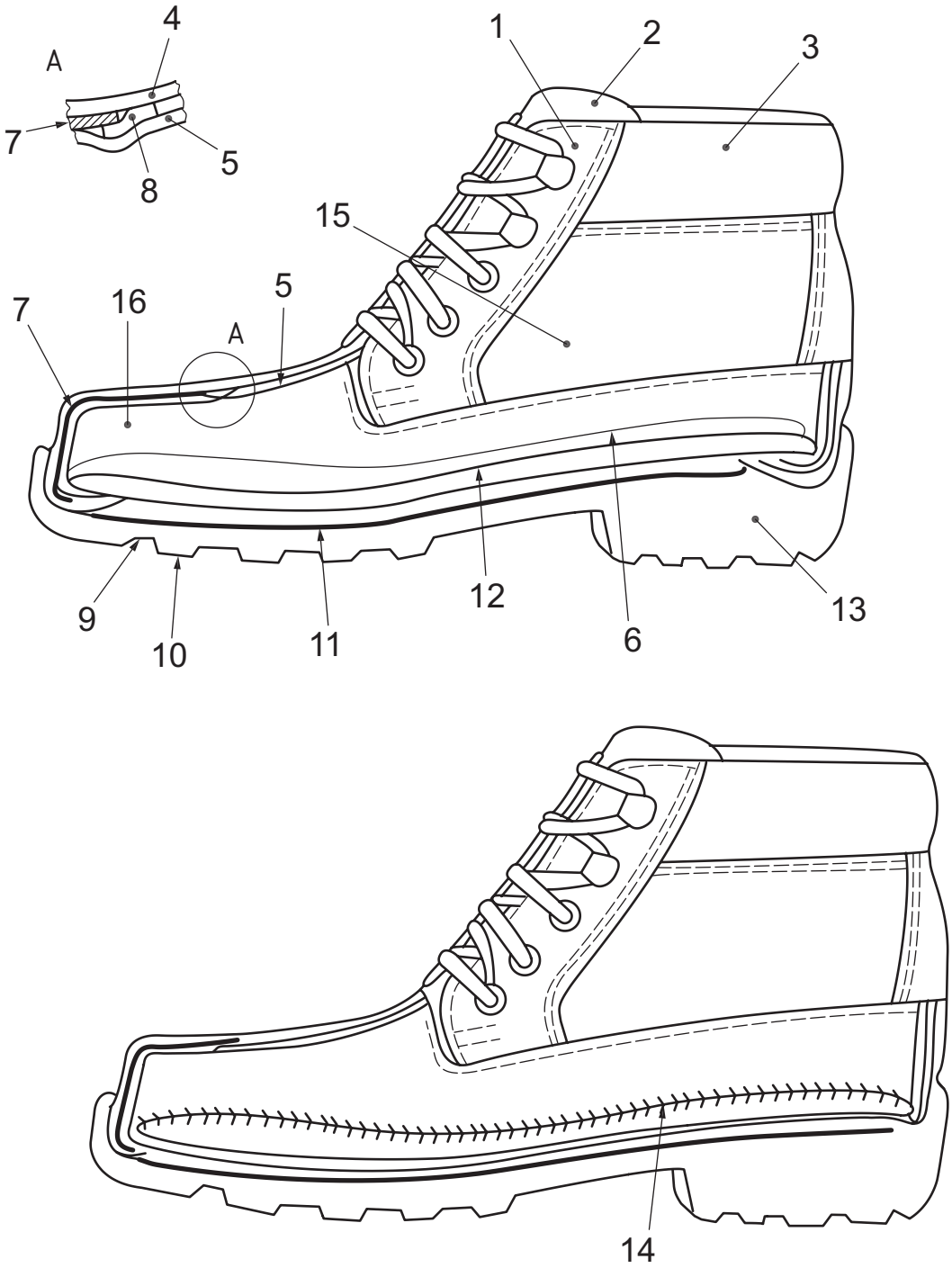
4 Design, construction and classification

Construction of safety and occupational footwear is illustrated in Figure 1. Design and classification are defined in ISO 20345 and ISO 20347. Classification of footwear is presented in Table 1. Designs of footwear are illustrated in Figure 2. Protective elements should be incorporated in the footwear in such a way that they cannot be removed without damaging it.

Table 1 — Classification of footwear

Classification	Description
Class I	Footwear made from leather and other materials, excluding all-rubber or all-polymeric footwear
Class II	All-rubber (i.e. entirely vulcanized) or all-polymeric (i.e. entirely moulded) footwear

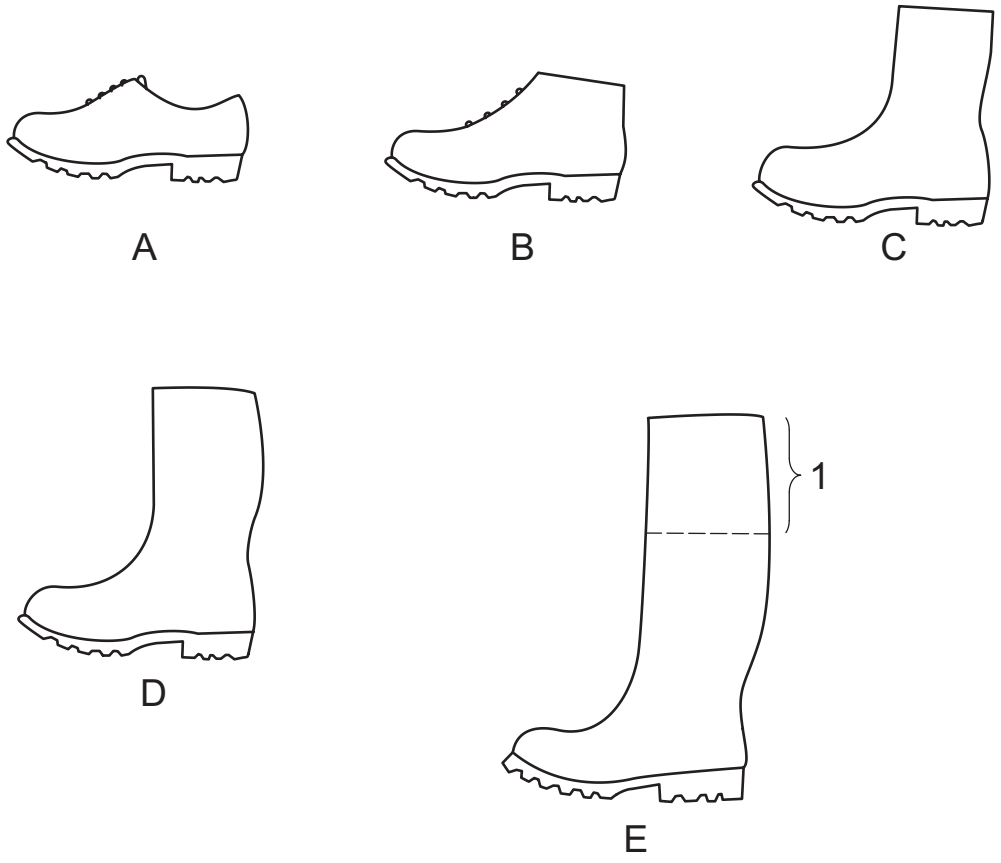
NOTE ISO 20345:2011, Annex A, permits hybrid footwear comprising uppers with both an all rubber or polymeric foot section and a leg shaft area of leather or other materials.



Key

1	facing	9	outsole
2	tongue	10	cleat
3	collar	11	penetration-resistant insert
4	upper	12	insole
5	vamp lining	13	heel
6	insock	14	Strobel stitching
7	toe puff	15	quarter
8	foam strip	16	vamp

Figure 1 — Example of parts of Strobel construction



Key

Type A	low shoe
Type B	ankle boot
Type C	half-knee boot
Type D	knee-height boot
Type E	thigh boot
1	variable extension which can be adapted to the wearer

Figure 2 — Designs of footwear

5 Marking of categories

5.1 Personal protective equipment — Safety footwear

5.1.1 Basic requirements

Safety footwear is fitted with safety toecaps and complies with the basic requirements given in Table 2 of ISO 20345:2011. It can incorporate one or more additional protective features to protect the wearer from injuries that could arise through accidents in the working sectors for which the footwear is designed. Safety toecaps meet the requirements of impact resistance at an energy level of 200 J and the requirements of compression resistance at a compression load of 15 kN.

The marking symbol for basic requirements is SB.

5.1.2 Additional requirements

Additional protective features are presented in Table 2.

Table 2 — Additional symbols for safety footwear

Requirement	Symbol in footwear
Penetration resistance	P
Electrical resistance	
Conductive footwear	C
Antistatic footwear	A
Electrically insulating footwear	See EN 50321
Resistance to inimical environments	
Insulation against heat	HI
Insulation against cold	CI
Energy absorption of seat region	E
Resistance to water (footwear of Classification I)	WR
Metatarsal protection	M
Ankle protection	AN
Water penetration and water absorption of upper (footwear of Classification I)	WRU
Cut resistance	CR
Cleated outsole	
Resistant to hot contact of outsole	HRO
Resistance to fuel oil of outsole	FO

5.1.3 Marking of categories of safety footwear

Tables 3 and 4 categorize safety footwear with the most widely used combinations of basic and additional requirements.

Table 3 — Class I: safety footwear made from leather and other materials

Category	Additional requirements
SB	
S1	Closed seat region Antistatic footwear Energy absorption of seat region Fuel oil resistance
S2	As S1 plus: Water penetration and water absorption
S3	As S2 plus: Penetration resistance Cleated outsole

Table 4 — Class II: all-rubber or all-polymeric safety footwear

Category	Additional requirements
SB	
S4	Antistatic footwear Energy absorption of seat region fuel oil resistance
S5	As S4 plus: Penetration resistance Cleated outsole

5.2 Personal protective equipment — Occupational footwear

5.2.1 Basic requirements

Occupational footwear complies with the basic requirements given in Table 2 of ISO 20347:2012 and it should incorporate one or more protective features to protect the wearer from injuries that could arise through accidents in the working sectors for which the footwear is designed. The additional protective requirements are presented in Table 5. Occupational footwear should provide at least one of the whole footwear additional protective features: penetration resistance, electrical resistance, resistance to inimical environments or energy absorption of the seat region.

NOTE Occupational footwear is not fitted with safety or protective toecaps.

5.2.2 Additional requirements

Additional protective features are presented in Table 5.

Table 5 — Additional symbols for occupational footwear

Requirement	Symbol in footwear
Penetration resistance	P
Electrical resistance	
Conductive footwear	C
Antistatic footwear	A
Electrically insulating footwear	See EN 50321
Resistance to inimical environments	
Insulation against heat	HI
Insulation against cold	CI
Energy absorption of seat region	E
Resistance to water (footwear of Classification I)	WR
Ankle protection	AN
Water penetration and water absorption of upper (footwear of Classification I)	WRU
Cleated outsole	
Resistant to hot contact of outsole	HRO
Resistance to fuel oil of outsole	FO

5.2.3 Marking of categories of occupational footwear

Tables 6 and 7 categorize protective footwear with the most widely used combinations of basic and additional requirements.

Table 6 — Class I: occupational footwear made from leather and other materials

Category	Additional requirements
OB	
O1	Closed seat region Antistatic footwear Energy absorption of seat region
O_2	As O1 plus: Water penetration and water absorption
O3	As O_2 plus: Penetration resistance Cleated outsole

Table 7 — Class II: all-rubber or all-polymeric occupational footwear

Category	Additional requirements
OB	
O4	Antistatic footwear Energy absorption of seat region
O5	As O4 plus: Penetration resistance Cleated outsole

5.3 Other markings

All safety and occupational footwear should be marked with:

a) size;

b) manufacturer's identification mark;

c) manufacturer's type designation;

d) year of manufacture and at least quarter;

e) number of the International Standard, e.g. ISO 20345:2011;

f) symbol(s) from Table 2 appropriate to the protection provided or, where applicable, the appropriate category.

The markings for e) and f) should be adjacent to one another.

6 Selection of PPE footwear

6.1 Risk assessment

6.1.1 General

Statistics show that slip is the most common hazard in most workplaces. Slip resistance should therefore be the first property to be considered when selecting footwear as PPE.

Employers and self-employed people should assess the risks from their work activities. Every effort should be made to reduce risks to a minimum before considering the use of PPE. If the risks cannot be eliminated by other methods, personal protective equipment should be used. It is important to select the correct type of PPE footwear in respect of the risk. The protection required in the work place determines the type of footwear to be chosen. The properties of PPE Footwear can be combined to provide protection against more than one hazard, for example footwear can have a toe cap and be slip resistant.

Prior to the selection and use of PPE footwear or leg protector the employer should assess the working conditions, especially the type and extent of the hazards, duration of the hazard and personal requisites of the wearer.

6.1.2 Risk analysis

Generally, exposure to health and safety risks is always present in work activities. Therefore, the implementation of collective protection systems is required, and when the residual risk cannot be avoided and/or reduced, PPE has to be used.

Before selecting and using safety or occupational footwear, the employer should carefully evaluate the working conditions, including:

— risk type and nature;

— risk duration and frequency;

— individual features of the worker to be protected.

In this context, the human factor-related risk is of particular importance. The term encompasses all risk factors connected with the worker's psycho-physical state, incapacity, recklessness, lack of training and, in general, behaviour that is inappropriate in the work context. The absence of theoretical and practical training, as well as the inability to handle certain work situations, are the most frequent human factor-related causes of accidents. Human factor-related risks at work should be duly analysed so as to be subsequently eliminated and/or reduced.

6.1.3 Types of risk

In his work activities, the worker is exposed to residual risks of various natures, which can be eliminated or reduced to an acceptable level. The elimination or reduction of such risks should be performed through the implementation of suitable safety footwear which should always be correctly used and maintained, according to the manufacturer's instructions, within qualitative limits that do not compromise the protective characteristics of the footwear and in accordance with its intended use, so as not to incur further risks derived from the footwear itself.

Risks covered by the use of safety footwear:

— mechanical;

— electrical;

— thermal;

— chemical.

Risks resulting from the use of inappropriate or damaged safety footwear:

— discomfort, interference with work activities;

— accidents and health risks;

— insufficient protection, etc.

6.1.4 Exposure to risks

Risk assessment should be able to identify the presence, at any time throughout the work day, of serious health risks, that is risks that may incur death or permanent health damage and of which the worker may not be opportunely aware, as well as any other health and safety risks.

The exposure to risks at any time, throughout the work day and in particular to risks incurring death or permanent health damage and of which the worker is not opportunely aware, should be null or limited to the minimum.

The use of suitable safety footwear depends on the expected type of danger. Although the types of risk may be known, it is not always possible to foresee an accident. For this reason, safety footwear should be used as protection in all situations in which risks cannot be excluded.

6.1.5 Risk reduction

In order to reduce risks, priority should be given to technical-organizational actions aimed at the elimination or sufficient reduction of risks at the source and at safeguarding the workers by means of collective protection.

In cases where such collective means do not ensure the prevention and/or reduction of health and safety risks to an acceptable level, suitable safety footwear or, in general, suitable PPE, should be used.

Work activities should be performed by qualified, informed and trained personnel, while the presence of unauthorized individuals should be avoided. Particular attention should be paid to risks connected with the human factor.

Figure 3 shows the methodology of identification, elimination and reduction of specific occupational risks.

Moreover, the PPE should:

— be suitable for the risks to be prevented, without constituting an additional risk itself;

— be suitable for the conditions in the workplace;

— be adequate to the worker's ergonomic or health requirements;

— be adaptable to the user's needs.

In the case of multiple risks requiring a simultaneous use of more PPE, such equipment should be compatible and should maintain its individual efficacy in the face of respective risks.

NOTE 1 The methodological diagram is valid for the assessment of one specific risk only.

NOTE 2 The phrase 'Danger identification and risk analysis' includes the techniques of danger assessment and risk analysis that provide reliable results.

NOTE 3 'Selection and adoption of organizational and/or technical measures' and 'Selection and adoption of collective protection equipment' can be performed both in parallel and in a series, and with an exchange of information.

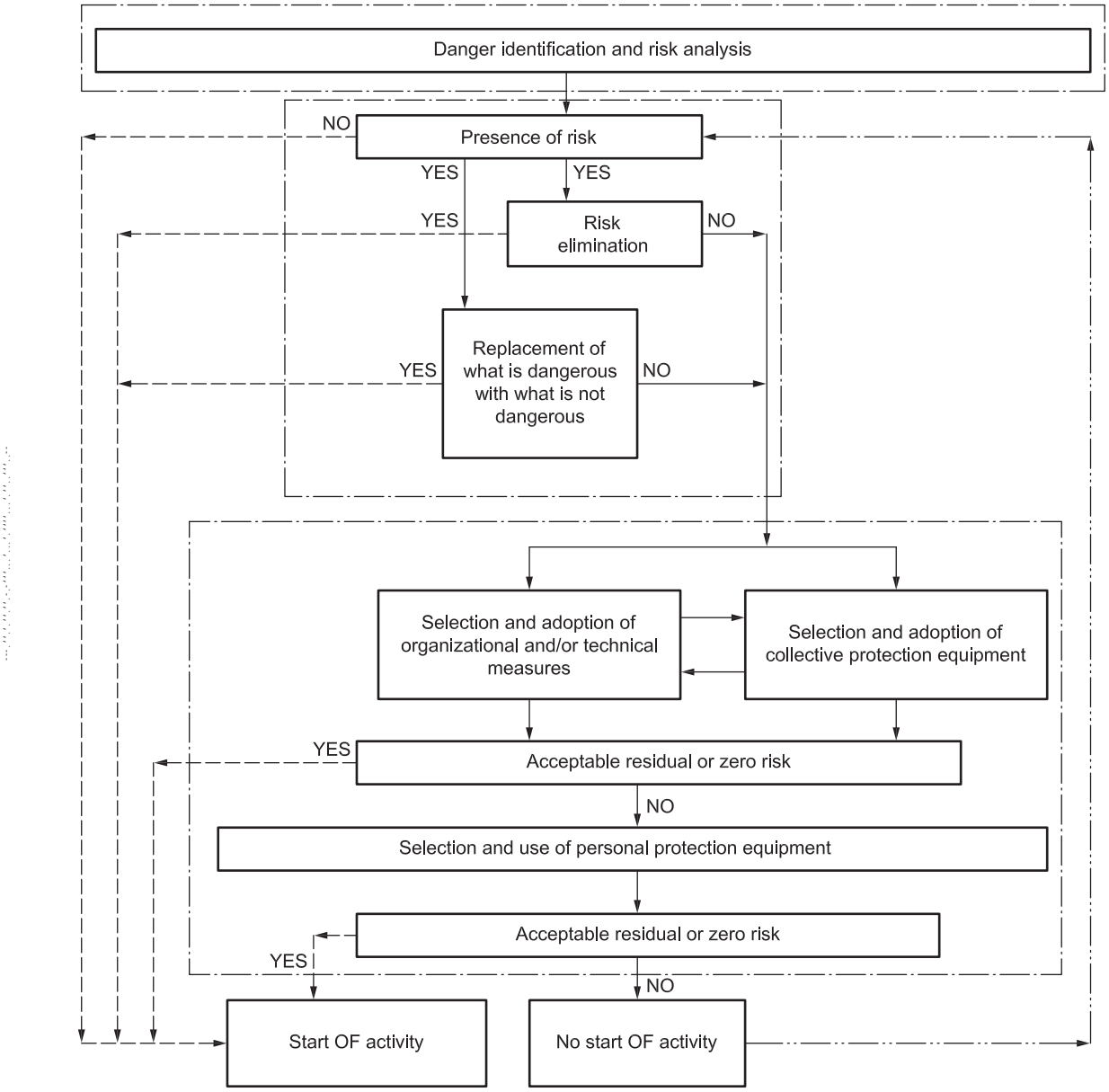


Figure 3 — General methodological diagram indicating the fundamental phases of danger identification, risk analysis, elimination, replacement, selection and adoption of protective measures

6.1.6 Aid for risk assessment

The use of every item of footwear and leg protection should depend on the type of expected hazard (see Table 8). Although the types of hazard are known, it cannot be predicted when they actually occur.

Prior to selection and use the employer should perform an assessment of the foot and leg protection he/she has in mind to determine whether they:

a) are type tested (labelled with the appropriate symbol and other markings);

b) offer protection against the hazards to be averted without inherently presenting a greater hazard;

c) are suitable for the relevant workplace conditions;

d) fulfil the ergonomic requirements and the health requisite of the wearer;

e) can be adapted to the individual wearer.

The employer should ensure that every wearer is provided with his/her personal foot or leg protection for his/her personal use.

Table 8 — Examples of risk assessment

Hazard in the working environment (expected hazard)	Occurrence of the risk				Degree of risk and exposure time (h/day)	Protective feature of the footwear
	None	Rare	Every now and then	Often		
Mechanical hazards — falling objects — compression						toecap metatarsal protection ankle protection
— sharp objects						penetration resistance
— cut (by sharp objects or chain saw)						cut resistance resistance to chain saw cutting
— vibration or shock (long-term walking and standing)						energy absorption of seat region
— slip potential						cleated outsole slip resistance (coefficient of friction)
Electrical hazards — electrical work (electric shock, electric arc)						electrical insulation
— induced electricity (handling fuels or flammable chemicals)						antistatic footwear
— handling explosives						conductive footwear
Heat — environment — hot surfaces						heat insulation heat resistance of outsole
— flame heat						flame resistance insulation against heat resistance to hot contact resistance to radiant heat
Cold — environment — cold surface						cold insulation
Moist or wet conditions — drops — splashes						water penetration and water absorption of upper water resistance
Chemical hazards						
— oil						resistance to fuel oil
— chemicals description of chemicals used:(trade name, chemical formula, report of safe use)						resistance to chemicals impermeability leakproofness

6.2 Ergonomic features

6.2.1 General

While selecting PPE footwear, an optimal protection in respect of ergonomic features should be taken into account. Over-protection should be avoided. Ergonomic features of the footwear for example. mass, rigidity of soling, water-vapour permeability should be considered,

6.2.2 Wearing comfort

Wearing comfort depends to a considerable extent on the individual adaptation of the shoe to the foot and for this reason the shoe that fits should be chosen. Among others, the following influencing factors should be taken into consideration:

a) the used lasts can differ from manufacturer to manufacturer but also within a collection of a manufacturer;

b) if pressure is exerted on the foot by the toecaps, this can frequently be easily remedied by changing to a different shoe model;

c) the padded collar with integrated ankle protection helps to avoid pressure points in the leg and ankle areas;

d) padding of the tongue helps to avoid pressure points on the upper part of the foot;

e) antimicrobial provision helps to avoid athlete's foot developing due to foot perspiration;

f) air-conditioning membrane is especially important for shoes with high uppers; it optimizes the water-vapour diffusion and thereby reduces the formation of perspiration in the shoe;

g) consistent foot hygiene, which includes a daily change of socks and, if possible, a daily change of shoes if the wearer suffers from increased foot perspiration;

h) class I footwear adapts to the user's feet; nobody should wear Class I or II footwear already used by other people.

7 Use of PPE footwear

7.1 Mechanical hazards

7.1.1 Protection against impact and compression of the toes

Safety footwear (Class I or II) should be used. Protective features are given in Table 9.

Table 9 — Protection against impact and compression

Protection and marking	Examples of intended use
Toecaps (SB, S1 to S5)	When there is a risk of falling objects on the feet. Examples: Falling objects, construction industry, metal industry, agricultural work
Metatarsal protection (M)	To protect a more extended foot area than the toecap alone. Example: Mining, working with stones
Ankle protection (AN)	Mining, working with stones

The symbols from Table 2 can be added to this marking, provided that the properties incorporated in the footwear are not included in the categories.

In certain working environments such as security work, metal detector scanners may be in use. Non-metallic toe caps can be useful where there is a risk of falling objects and a metal toe cap is not practical. Non-metallic caps can be found in some footwear but their presence is not identified as part of the marking. Manufacturers may mark their footwear in a location other than the label indicating the presence of non-metallic components but this is not mandatory. Information on the presence of metal components in the footwear should be sought from the manufacturer or the authorised representative. Contact details can be found on the user instruction notice supplied with the footwear.

7.1.2 Protection against cut, penetration and sharp objects

Footwear of Class I or II can be used. Protective features are given in Table 10.

Table 10 — Protection against cut, penetration and sharp objects

Protection	Safety footwear	Occupational footwear	Examples of intended use
Toecaps	Yes (SB, S1 to S5)	No	Construction industry, sharp objects
Penetration resistance (P)	Yes (SB+P, S1+P, S3, S5)	Yes (OB+P, O1+P, O3, O5)	Construction industry, nails
Cut resistance (CR)	Yes	No	Sharp objects

In certain working environments such as security work, metal detector scanners may be in use. Non-metallic penetration resistant devices can be useful when there is a risk of underfoot penetration and a metal protective device is not practical. Non-metallic penetration resistant devices can be found in some footwear but their presence is not identified as part of the marking. Manufacturers may mark their footwear in a location other than the label indicating the presence of non-metallic components but this is not mandatory. Information on the presence of metal components in the footwear should be sought from the manufacturer or the authorised representative. Contact details can be found on the user instruction notice supplied with the footwear.

7.1.3 Protection against shock or vibration

Safety or occupational footwear (Class I or II) can be used depending on other needs of protection. Energy absorption of seat region (E) provides a limited protection against shocks (like falls from ladders) and vibration.

Examples of intended use include long-term walking and standing, and vibration.

7.2 Guidance on the reduction of slip hazards

7.2.1 General

Slips and falls on the level are the single biggest class of accidents at the work place across Europe. In addition, many other types of accidents reported, such as falls from height or workplace transport accidents, are often initiated by a slip.

Slip accidents create a serious social and economic burden on individuals, their employers and health care providers with financial costs running into billions of euros each year.

The slip resistance test defined in ISO 13287 is a significant and valuable contribution to address these accidents. The information given here is intended to help to interpret and to complement the test data generated by ISO 13287 and to ultimately reduce the number of accidents and associated costs.

Footwear should not be assumed to be slip resistant unless demonstrated by laboratory testing. Further information may be gained from field trials.

Slip resistance should be given high priority in the selection of footwear.

Slip resistant footwear is only effective if it is worn; fit and comfort are important considerations.

7.2.2 Limitations of testing

It is not possible to reproduce in the laboratory all possible situations of use. The two combinations of floor and lubricant (ceramic tile wetted with detergent solution and smooth steel with glycerol) are a compromise trying to establish a correlation between laboratory results and use, but they may not be directly transferable to all real-life-situations.

Some generally slip-resistant footwear may not be suitable in specific demanding conditions. For example, footwear that performs well in the wet might not be suitable on oily surfaces or where there are sticky food spillages that clog up the cleats.

Footwear for icy and off-road conditions may require additional/alternative testing.

7.2.3 Explanation of ISO 13287 and marking codes

The safety features of footwear, including slip resistance, are tested according to ISO 20344, ISO 20345 and ISO 20347. Footwear that has passed the test for slip resistance will be marked with one of the following codes: SRA, SRB or SRC.

The codes indicate that the footwear has met the specified requirements (for the heel and flat methods) when tested as follows:

— SRA – tested on ceramic tile wetted with dilute soap solution;

— SRB – tested on smooth steel with glycerol;

— SRC – tested under both the above conditions.

Meeting the specified requirements indicates that the footwear helps to reduce the risk of slip on the specified surfaces.

No footwear will provide complete safety in very demanding conditions, such as oil or glycerol spillage, it will only reduce the risk. The only solution in such circumstances is to clean up the contamination.

Field trials of footwear should be carried out at the work place to assess its effective slip resistance throughout its lifetime. Slip resistance tests may also be carried out under specific work place conditions (floor types/contaminants) following the principle of ISO 13287.

In use, footwear should be checked and replaced before the sole becomes smooth and dangerous. Tread patterns should not become clogged with any waste or debris on the floor; soles should be cleaned regularly.

7.2.4 General guidance/recommendations

Choosing slip-resistant footwear from the whole host of products on the market can be difficult. Sole descriptions are varied, from ‘improving the grip performance’ to ‘excellent multi-directional slip-resistance’. Often, footwear is just described as ‘slip-resistant’ and the brochure does not describe the conditions for which the footwear is most suitable.

Footwear selection has to take account of a number of factors in addition to slip resistance, such as toe caps and protective insoles. These properties are more likely to be prominent in the minds of prospective purchasers. Comfort, fit and durability are other important considerations.

Accidents are expensive; there are many hidden and uninsured costs, such as injury, lost time, lost production, medical costs, costs of replacement staff, which are much greater than the cost of effective footwear that will reduce the risk of accidents occurring.

The measures that can be taken for the users, in consultation with their suppliers, to promote safer conditions at the working place include the following.

a) Buy footwear that will be effective in the given job and ensure that staff wear it.

b) Specify the main surfaces and contaminants, which cause slip risks in the workplace, and seek the supplier’s advice on suitable footwear. It could be advisable to commission additional slip testing through the supplier, e.g. on surfaces/contaminants representative of the workplace.

c) Consider asking the supplier to provide trial pairs to help to make the right choice, and do not select footwear on the basis of brochure descriptions or laboratory test results alone.

d) Footwear trials should involve a representative sample of the workforce and last long enough to produce meaningful results. Workers may not wear footwear if it is uncomfortable or impractical, no matter how effective it is.

e) Tread patterns should not become clogged with any waste or debris on the floor. Soles should be cleaned regularly. If soles clog up, it would be advisable to look for an alternative design of sole, e.g. with a wider space between the cleats and a deeper tread pattern.

f) Have a system for checking and replacing footwear before it becomes worn and dangerous.

7.2.5 Guidance on design and selection of footwear

The sole tread pattern and sole compound are both important for slip resistance. Generally a softer sole and close-packed tread pattern works well with fluid contaminants and indoor environments. A more open pattern works better outdoors or with solid contaminants. It is always best to trial footwear in your environment.

Slip resistance properties are measured on new footwear and can change with wear, especially if the cleats have fine detail, which is quickly worn away in use.

Some underfoot surfaces such as profiled floorings may give the impression of providing slip resistance, however, the correct choice of footwear is important on such floorings when in the wet or contaminated condition.

'Oil-resistant' does not mean 'slip-resistant', the former is just a statement that the soles will not be damaged by oil.

Footwear for specific use on icy surfaces or off-road conditions may require particular design consideration. Work is ongoing to prepare guidance for these conditions.

7.3 Chemical hazards

When working with chemical hazards, it is recommended that footwear tested in accordance with EN 13832 is used.

EN 13832-1 describes two test methods:

Degradation is defined as a deleterious change in one or more properties of a footwear material due to contact with a chemical. This is an aptitude test to assess that the basic physical properties of the footwear (upper and sole) are still functional in a chemical environment.

Permeation is a process by which a chemical moves through a footwear material at a molecular level. This test helps to define the necessary time for a chemical to pass through the footwear in a situation of a full contact with the chemical.

Where the contact with chemicals is unlikely i.e. the contact will be short-term spraying or small spillages, EN 13832-2 should be used. It is important to note that this type of footwear offers no prolonged protection but will prevent ingress of chemicals long enough to escape the contaminated environment.

Where prolonged contact with chemicals is likely, then it is recommended that footwear complying with EN 13832-3 be used.

Chemical-resistant footwear does not provide a protection against all chemicals. The manufacturer's instructions should be followed. Footwear should be selected in accordance with the chemical group against which the footwear has been tested.

Outsoles of safety footwear are resistant to fuel oil when they carry the marking codes: FO, S1, S2, S3, S4 and S5 in accordance with the additional requirements. For occupational footwear, the outsoles will be resistant to fuel oil when the product carries the marking code: FO.

When working with flammable chemicals, it is recommended to wear antistatic footwear or conductive footwear if the risk of explosion is very high.

Some footwear items will be marked with additional claims such as “acid resistant”, “alkali resistant”, “fat resistant” These can often be found moulded into the sole units. Products should be tested in accordance with relevant standards to support these claims. Details of the testing done and the results achieved should be included in the user instructions. In the event that no details of tests or results are included in the user instructions, it should be assumed that no testing has been done and no protection is offered.

7.4 Electrical hazards

7.4.1 Conductive footwear

Conductive footwear (symbol C in Table 2) should be used if it is necessary to minimize electrostatic build-up by dissipating electrostatic charges in the shortest possible time in order to minimize the risk of igniting flammable vapours (or dusts) when working in a potentially explosive atmosphere.

A risk of electric shock should be completely eliminated.

Safety or occupational footwear (Class I or II) can be conductive.

Removable inserts or insocks can decrease electrical conductivity. The wearer should always check the conductivity before entering a working area.

If the soling material becomes contaminated, electrical resistance can increase and minimize the conductivity of the footwear. The resistance of the flooring should not eliminate the protection provided by the footwear.

7.4.2 Antistatic footwear

Antistatic footwear (symbol A in Table 2) should be used if it is necessary to minimize electrostatic build-up by dissipating electrostatic charges thus avoiding the risk of spark ignition, and if a risk of electric shock has not been completely eliminated. This footwear can also be used to increase the user’s comfort and to avoid nuisance to other people or harming equipment.

NOTE 1 Antistatic footwear cannot guarantee adequate protection against electric shock because it is not completely insulating.

Safety or occupational footwear (Class I or II) can be antistatic.

Removable inserts or insocks can decrease electrical conductivity. The wearer should always check the conductivity before entering a working area.

If the soling material becomes contaminated, the electrical resistance can increase and minimize the conductivity of the footwear. The resistance of flooring should not eliminate the protection provided by the footwear.

Examples of intended use include handling fuels or flammable chemicals.

NOTE 2 ESD (electrostatic discharge) footwear can be antistatic footwear, but it is tested according to different standards (e.g. IEC 61340-4-3). The electrical resistance in this case is the summation of the resistance of all parts of the conductive chain from fingertip to floor. Footwear being worn for the primary purpose of protecting products such as sensitive electronic devices would not be considered as personal protective equipment and would not fall within the scope of the European PPE Directive.

7.4.3 Insulating footwear for electrical work

Insulating footwear eliminates electric shock up to a certain voltage. Charts are available that show the probability of fibrillation of the heart with respect to magnitude of the electric current and the time for which it is present. As electric current is directly related to voltage, footwear with a very high electrical

resistance is required to protect the wearer when there is the possibility of a large potential difference (voltage) between e.g. the wearer's hand and the ground that he/she is standing on.

Safety or occupational footwear (Class I or II) can be insulating.

NOTE Insulating footwear cannot solely guarantee complete protection against electric shock.

Examples of intended use include electrical installations and electrochemical work.

This footwear is specified in EN 50321, which has two classes:

— class 00, to be used in installations where the nominal voltage is not higher than 500 V a.c. or 750 V d.c.;

— class 0, to be used in installations where the nominal voltage is not higher than 1 000 V a.c. or 1 500 V d.c.

The marking, added to the symbols from ISO 20345, should be:

— double triangle;

— when colours are used, it should be light brown for "00" and red for "0";

— class.

7.5 Risks of inimical environment (hot and cold)

Safety or occupational footwear (Class I or II) can incorporate heat or cold insulation. Protective features are given in Table 11.

It is also recommended to improve cold insulation with insulating insocks and socks. Footwear incorporating insulation against cold cannot provide adequate protection in ultimate cold conditions. While working in very cold environments, e.g. in freezing rooms, additional protection is necessary.

Table 11 — Protection against hot and cold conditions

Protection	Examples of intended use
Heat insulation of sole complex (HI)	Foundries, road works
Heat resistance of outsole (HRO)	Foundries, welding
Cold insulation of sole complex (CI)	Outdoor work in cold weather, food industry

NOTE For footwear to be used in welding and foundry activities, the additional job related safety features can be found below (see 7.8.3).

7.6 Dry and warm conditions

In dry and warm conditions, it is recommended to wear footwear of categories SB, S1, OB, O1 or clogs. The water vapour permeability of the upper should be as high as possible.

Examples of intended use include work in office and electronic goods manufacture.

7.7 Wet conditions

In wet conditions, it is recommended to wear all-rubber or all-polymerized footwear or alternatively leather footwear that fulfils the requirement of water penetration and water absorption of upper (WRU or categories S2, O_2, S3 or O3) and possibly water resistance (WR) as an additional requirement.

Examples of intended use include outdoor work, building, agricultural work and work in the food industry and catering.

In wet conditions, slip presents a significant risk. The slip resistance properties of footwear for use in such environments should be given a high level of consideration.

7.8 Job-related footwear

7.8.1 Safety footwear with resistance to chain-saw cutting

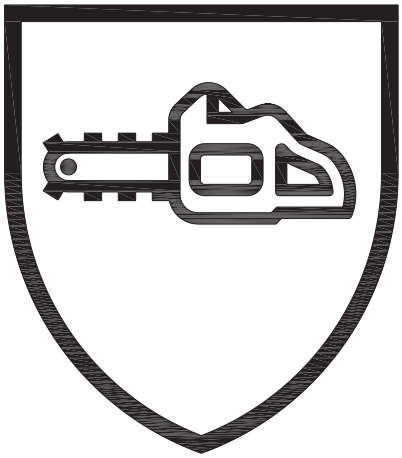
This footwear incorporates protection against cutting by hand-held chain saws according to ISO 17249. It is recommended always to wear this footwear when handling a chain saw (forestry work, construction industry, etc.). The footwear is marked with an additional pictogram representing a chain saw and a level of protection (see Figure 3).

Three levels of protection correspond to the test chain speeds in Table 12.

It is important to know that the level of protection marked next to the pictogram refers to the speed used in the test under the test conditions. It does not mean that the user will be protected at that speed under in-use conditions.

Table 12 — Test chain speeds

Level of protection	Test chain speed m/s
1	20
2	24
3	28



LEVEL X

Key

X level of performance

Figure 4 — Pictogram [ISO 7000-2416] indicating safety footwear with resistance to chain-saw cutting

7.8.2 Safety footwear with resistance to fire-fighting hazards

The types of footwear for firefighters should be as follows.

— Type 1: Outdoor interventions, fire and wildland firefighting; no protection against penetration, no toe protection, no protection against chemical hazards.

— Type 2: All fire suppression and rescue interventions where protection against penetration and toe protection are needed, no protection against chemical hazards.

— Type 3: All fire suppression and rescue interventions where protection against penetration and toe protection are needed, including protection against chemical hazards.

For Type 1 firefighters' footwear only, the presence of a safety toe cap is denoted by the marking T. The marking code R indicates the presence of a rigid toe puff offering protection against compression forces not exceeding 500 N for protection against minor mechanical risks.

Type 3 firefighters' footwear may offer resistance to chemicals and this protection is indicated by the marking code CH

Type 3 firefighters' footwear should be constructed from all-rubber (i.e. entirely vulcanized) or all-polymeric (i.e. entirely moulded) footwear

The level of heat insulation properties of the product is given by the marking codes HI1, HI2 and HI3. The performance of these products will be as described in Table 13.

Table 13 — Insulation against heat: requirements for footwear degradation and thermal insulation

Performance level	Test temperature Thp (°C)	Temperature rise (°C) inside the footwear should be	Degradation should not occur
HI1	150	< 42 after 10 min	20 min exposure
HI2	250	< 42 after 10 min	30 min exposure
HI3	250	< 42 after 10 min	40 min exposure

Other additional protection categories are denoted by the appropriate marking codes as given in EN 15090.

The footwear is marked according to EN 15090 with an additional pictogram (Figure 5).

Figure 5 — Pictogram [ISO 7000-2418] indicating footwear for fire-fighter

On the lower right corner it should be marked with the marking codes for the main protective categories as given in Table 14.

Table 14 — Marking symbols

Footwear type	Symbol	Additional categories of protection
For Type 1:	F1A	Antistatic properties
	F1PA	Penetration resistance and antistatic properties
	F1I	Electrical insulating properties
	F1PI	Penetration resistance and electrical insulating properties
For Type 2:	F2A	Antistatic properties
	F2I	Electrical insulating properties
For Type 3	F3A	Antistatic properties
	F3I	Electrical insulating properties

Marking categories that are not required to be associated with the firefighter pictogram should be marked in the normal manner associated with the standard number.

7.8.3 Footwear protecting against thermal risks and molten metal splashes such as found in foundries, welding and allied processes

Footwear for use in foundries, welding and allied processes should meet the requirements of safety footwear and be resistant against flame and heat and ingress of molten metal. The footwear is marked according to ISO 20349 with an additional pictogram (Figure 6).

Figure 6 — Pictogram [ISO 7000-2417] indicating clothing for protection against heat and flame

In addition to the pictogram, the footwear will also be marked with one of the following, to identify the protection offered to molten metal ingress:

— AL indicates the footwear offers protection under foundry conditions to ingress of molten aluminium;

— FE indicates the footwear offers protection under foundry conditions to ingress of molten iron;

— WG indicates that the footwear complies with the requirements defined for welding footwear.

7.8.4 Footwear for work with hand-held spray devices (liquid-dispensing jets)

Liquid-dispensing jets such as hand-held spray devices (lances) with pressures of more than 25 MPa [250 bar[1)]] are used for cleaning and de-rusting containers, rooms and surfaces.

In practice, such devices are operating with pressures between 80 MPa (800 bar) and 250 MPa (2 500 bar). This involves an increased hazard of foot injuries if the high-pressure jet is inadvertently guided over a foot.

If it is necessary to use hand-held spray devices, the length of the lance should be, if possible, more than 75 mm to exclude contact with a foot. If shorter lances have to be used for reasons caused by the technical nature of the work (confined spaces, narrow scaffolding), it is necessary to wear safety footwear with additional protection in the upper foot area.

It can also be possible to achieve the same protection with an appropriate overshoe worn over a normal safety shoe.

7.9 Orthopaedic footwear

If safety or occupational footwear is to be manufactured with orthopaedic modifications, wherever possible, it should comply with ISO 20345 or ISO 20347. In the event that the modification prevents testing in accordance with ISO 20345 or ISO 20347, the footwear should ensure the health and safety of the user.

8 Maintenance of PPE footwear

8.1 Tests

Prior to use the wearer should inspect the foot and leg guards for visible defects. It should not be permitted to continue wearing worn-out or damaged footwear and leg protection. The employer should be informed of defects.

1) 1 bar = 10^5N/m^2 = 0,1 MPa.

The following list and drawings may be provided to the wearer to assess the performance of his/her footwear. Footwear should be replaced when any signs of wear are found. Some of these criteria can vary according to the type of footwear and materials used:

a) beginning of pronounced and deep cracking affecting half of the upper material thickness [Figure 7(a)];

b) severe abrasion of the upper material, especially if the toe puff is revealed [Figure 7(b)];

c) the upper shows areas with deformations, burns, fusions or bubbles, or split seams in the leg [Figure 7(c)];

d) the outsole shows cracks greater than 10 mm long and 3 mm deep [Figure 7(d)];

e) upper/sole separation of more than 10 mm to 15 mm long and 5mm wide (deep);

f) cleat height in the flexing area lower than 1,5 mm [Figure 7(e)];

g) original insock (if any) showing pronounced deformation and crushing.

It is convenient to check manually the inside of the boot from time to time, aiming at detecting destruction of the lining or sharp borders of the toe protection, which could cause wounds [Figure 7(f)].

The fastening system should be in working order, e.g. zip, laces, eyelets, touch and close system.

The footwear durability depends on the level of use, but in any case, its use should not exceed three years in the case of polyurethane outsoles.

The obsolescence deadline should not be exceeded.

Insulating footwear should be dry when stored. Prior to every use, insulating footwear should be inspected by the wearer for obvious damage. If appropriate, at least every six months the insulation should be checked by a professional electrician as specified in EN 50321:1999, B.2.

The test location and the test time should be entered in the provided label space.

Conductive and antistatic footwear should be tested in the work place in accordance with user's information.

Dimensions in millimetres

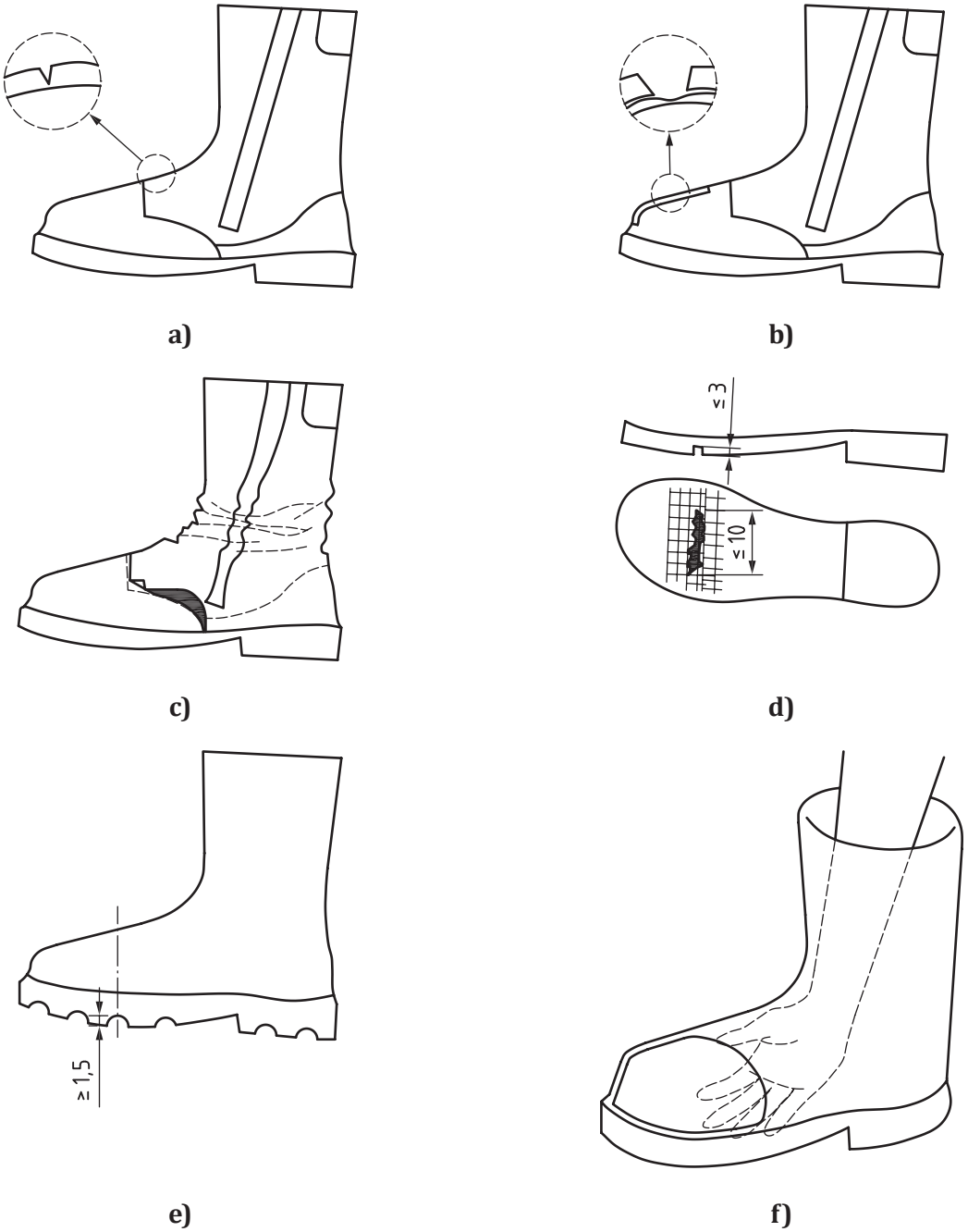


Figure 7 — Criteria for the assessment of the state of footwear

8.2 Cleaning and care

The manufacturer's instructions should be followed.

Footwear and leg protection should be cleaned and given due care. Normal shoe polish is suitable for leather shoes. Caring agents also giving an impregnating effect are recommended for shoes that come into contact with a great deal of moisture, for example in the construction, the quarry and the earth-moving industries. Even the best quality leather keeps its good properties for only a limited time if it is not cared for properly.

For foot hygiene reasons, it is recommended to spray footwear with an antimicrobial solution at the end of every working shift in order to prevent re-infection with fungi and bacteria.

Foot and leg protectors should be stored according to the manufacturer's recommendations.

After work, wet footwear and protectors should be stored such that they are able to dry; however, leather shoes should not be placed too near a heating source in order to avoid them drying out too much and the leather becoming cracked. Packing the footwear with suitable absorbent material is a method of drying.

8.3 Maintenance

The employer is responsible for ensuring that the state of footwear and leg protectors is according to regulations. He/she should ensure the required upkeep and replacement of shoes, permanent protection and good hygienic conditions. Defects should be remedied according to regulations.

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[10] EN 13832-3:2006, *Footwear protecting against chemicals and micro-organisms — Part 3: Footwear highly protective against chemicals*

[11] EN 15090, *Footwear for firefighters*

[12] EN 50321:1999, *Electrically insulating footwear for working on low voltage installations*

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