Kommission
Arbeitsschutz und
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19

Normung von PSA zum Schutz gegen Risiken der Elektrizität

Standardization of PPE for Protection against electrical risks

VFA
Verein zur
Förderung
der Arbeitssicherheit
in Europa

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Standardization in the field of personal protective equipment for protection against electrical risks

Personal protective equipment (PPE) plays an important role in the safety and health of workers at work. Its task is to protect users against health risks during the course of their work. PPE is particularly important when workers are still exposed to a residual risk, despite the fact that all possible technical and organisational protective measures have been taken, or when the health risk of special work, e.g. repairing pylons, cannot be avoided or prevented by technical preventive measures.

Two European Union directives apply to this area. The „Directive for the approximation of laws relating to personal protective equipment (89/686/EEC)", a Single Market Directive in accordance with Article 100a of the EC Treaty, specifies the nature of PPE and has been transposed into German law as the 8th GSGV (Ordinance regulating the distribution of personal protective equipment). The „Directive concerning the minimum safety and health requirements for the use by workers of PPE at the workplace (89/656/EEC)" in accordance with Article 118a of the EC Treaty specifies European minimum requirements for the use of PPE. This 118a directive has been converted into German legislation through the ordinance regulating „Safety and health protection when using personal protective equipment at work" (ordinance regulating PPE use) in conjunction with the Occupational Health and Safety Act.

Since 1989 approx. 240 mandated PPE standards, mainly at European level, have been prepared by CEN/TCs 79, 85, 158, 159, 160, 161, 162 in support of Directive 89/686/EEC. Detailed information on these standards can be found in KAN Report 12.

In support of the same directive, standards specifying requirements concerning PPE for „live working" are prepared by CENELEC/TC 78.

Two kinds of electrical hazard must be considered:

- Current flow through the body, e.g. caused by touching parts which are live under normal operating conditions, by touching conductive parts which may become live in the event of defects or by approaching live parts over 1 kV,
- Electric arc caused by insulation failures, e.g. by operations, especially switching operations under load or short-circuiting, by overvoltage, ageing or dirt collection.

Introduction

A person's health may be damaged by the effects of electric current

- if the current flow through the human body depending on resistance in the electric circuit and source voltage reaches a dangerous level. Current flow through the body can be caused:
  - by coming into direct contact with live parts of varying potential and
  - by approaching a high-voltage area when the clearance within the danger area is bridged by a pre-arc between live part and person.

  This can result in electric marks at points of contact, internal burns, clots in the bloodstream or ventricular fibrillation.
- as a result of electric arc and their thermal, dynamic and toxic effects on people:
  thermal effects: first to fourth-degree burns from heated gases or metal parts,
  dynamic effects: injuries caused by moving parts as a result of a build-up of pressure in closed rooms followed by bursting of the enclosure,
  toxic effect: poisoning by gases or dust, e.g. by ozone,
  luminous effect: electro-ophthalmia.

This study is concerned with the standards for PPE for protection against these hazards. It does not deal with the risks arising from electrostatic charges.

This KAN study

- establishes the current state of standardization,
- evaluates the product-related OH&S level in standards,
- assesses the suitability of standards to serve as a basis for the type examination,
- points out the shortcomings of standards with regard to product-related OH&S.

Furthermore, a survey of experts involved in the field of standardization was carried out on the basis of KAN Report 12.

1.1 Legal principles for PPE

Article 1 of the PPE Directive (89/686/EEC) defines PPE as follows: „(2) For the purposes of this Directive, PPE shall mean any device or appliance designed to be worn or held by an individual for protection against one or more health and safety hazards."

1.1.1 General requirements for all PPE

PPE may only be distributed if it satisfies the essential health and safety requirements of Annex II of Directive 89/686/EEC.

PPE is divided into three categories.

Category I:	PPE designed to protect against minor risks where the user is able to assess for himself how effective it is.
Category II:	PPE used to protect against medium risks to health and safety at the workplace, but which cannot be assigned to Category III.
Category III:	PPE which protects against fatal hazards or irreversible damage to health, and for which it can be assumed that the user is not able to recognize the immediate effect in time.

Depending on category, PPE must satisfy various requirements before it may be distributed on the European single market.

- PPE in Category I simply requires a declaration by the manufacturer that it meets the essential requirements of Annex II of the PPE Directive.

- PPE in Category II is additionally subject to an EC type examination which the manufacturer may only apply for at a single registered body. In the type examination, the registered body checks that technical documentation and the PPE model comply with the essential requirements of the PPE Directive before issuing the EC type certificate.

- PPE in Category III is subject to the same procedure as PPE in Category II. An additional inspection of the finished PPE must also be carried out. According to Article 8.4 of Directive 89/686/EEC, the manufacturer can choose between two alternatives:
  1. EC quality assurance for the end product (according to Article 11A of the PPE Directive),
  2. EC quality assurance system with monitoring (according to article 11B of the PPE Directive).

The task of standards is to supplement the requirements of the PPE Directive. Standards can be consulted as the basis for manufacturing as well as for testing and certification.

1.1.2 Additional requirements for PPE for protection against electrical risks

As well as the general requirements, PPE for protection against electric shock must also meet the following requirements (Directive 89/686/EEC, Annex 2, Section 3.8):

„PPE designed to protect all or part of the body against the effects of electric current must be sufficiently insulated against the voltages to which the user is likely to be exposed under the most unfavourable foreseeable conditions.

To this end, the constituent materials and other components of these PPE classes must be so chosen or designed and incorporated as to ensure that the leakage current measured through the protective integument under test conditions at voltages correlated with those likely to be encountered in situ is minimized and, at all events, below a maximum conventional permissible value which correlates with the tolerance threshold.

Together with their packaging, PPE types intended inclusively for use during work or activities in electrical installations which are or may be under tension must bear markings indicating, in particular, their protection class and (or) corresponding operating voltage, their serial number and their date of manufacture; a space must also be provided outside the protective integument of such PPE for the subsequent inscription of the date of entry into service and those of the periodic tests or inspections to be conducted.

The manufacturer's notes must indicate, in particular, the exclusive use for which these PPE types are intended and the nature and frequency of the dielectric tests to which they are to be subjected during their useful life."

According to Article 8 of Directive 89/686/EEC, all items of PPE „for protection against electrical risks and for live working or PPE for insulation against high voltage" are complex PPE. They must therefore be assigned to Category III and must satisfy the requirements outlined in section 1.1.1 regarding distribution.

The various PPE types for protection against electrical risks are classified in the explanations of categories according to Article 8 of the PPE Directive (prepared by the European Commission working group „Personal Protective Equipment", see table).

Description of PPE	Category
2.4 Eye protection and filters designed and manufactured to provide protection against electrical risks	III
4.3 Helmets designed and manufactured to provide protection against electrical risks	III
5.4 Equipment (face protection) designed and manufactured to provide protection against electrical risks	III
6.2 Clothing and/or accessories (whether or not detachable) designed and manufactured to provide protection against electrical risks	III
8.2 Equipment and/or accessories (whether or not detachable) designed and manufactured to provide protection against electrical risks for work involving dangerous voltages, or used to provide insulation against high voltages.	III
9.2 Equipment and/or accessories (whether or not detachable) designed and manufactured to provide protection against electrical risks for work involving dangerous voltages, or used to provide insulation against high voltages (hand and arm protection)	III
11.1 Equipment for protection against electrical risks is included in the above tables. NB: Dangerous voltages means a voltage equal to or exceeding 50 V alternating current or 75 V direct current.	III

Table: Excerpts from the European Commission „Guide for the categorisation of PPE" (8 January 1996)

According to the explanations of the European Commission, insulating hand tools are not considered personal protective equipment. The same applies to insulating mats and flexible covers.

The following figure illustrates the connection between Directive 89/686/EEC, in particular the requirements in Annex II, and the standards on various types of PPE drafted by CEN/CENELEC.

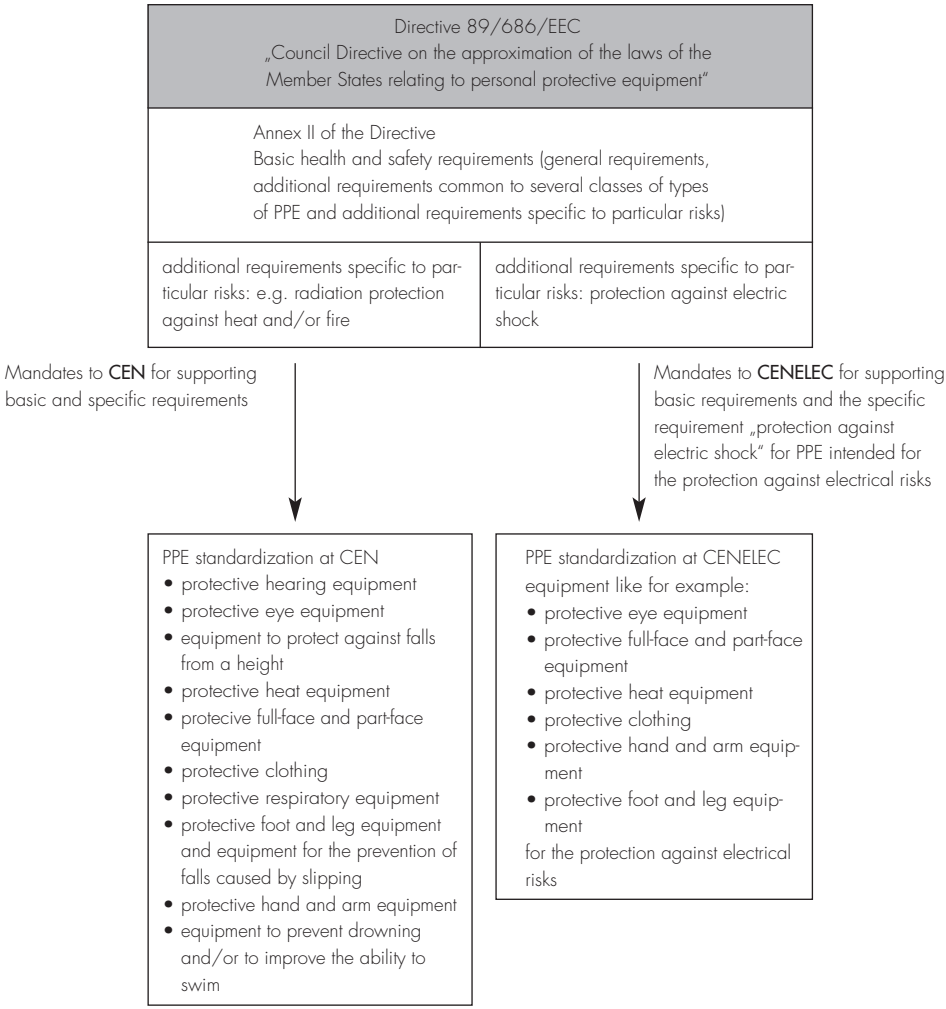

Figure: Requirements of PPE Directive 89/686/EEC

1.2 Fundamental principles of standardization

Single Market Directive 89/686/EEC, which is based on Article 100a of the EC Treaty, provides the legal basis for the distribution of PPE in the European Union. This EC Directive specifies the nature of PPE. In accordance with the „New Approach"[1], it envisages a special link with European standards. While the EC Directive specifies the essential binding safety requirements, these requirements are supplemented by harmonized European standards which are not binding. By virtue of this principle which is firmly established in the „New Approach", standardization has an important role to play in the European single market as an instrument of technical harmonization. Standards must offer quality guarantees with regard to the „essential requirements" specified in the directive (see Annex II of the „New Approach"). Due to the safeguard clause in Article 100a of the EC Treaty and in the EC Directive, the European Commission and the member states have the right to dispute the suitability of a harmonized standard.

The main focus of standardization in the field of electrical engineering is clearly at international level, with the aim of aligning international and European standards. Cooperation between CENELEC and IEC is determined by the „Dresden Agreement" which provides for parallel voting procedures for draft standards at the CDV[2] and FDIS[3] stages.

Since European legislation cannot be applied to international standardization, consideration must be given as to whether documents that should be adopted at European level comply with the requirements of the European directive concerned. Should an international draft standard prove incompatible with European legislation, it is possible to decide on a common European modification.

The European Commission has issued three mandates for PPE for protection against electrical risks (footwear, helmets, gloves) to CENELEC.

1 „Council Resolution of 7 May 1985 on a new approach in the field of technical harmonization and standardization", Official Journal of the EU 1985 No. C 136, p. 1.
2 CDV = committee draft for voting
3 FDIS = final draft international standard

2.1 PPE standards committees and working groups in CENELEC

The following standards committees prepare standards in the field of „PPE for protection against electrical risks“:

- CENELEC/TC 78 „Equipment and tools for live working“

  Chairman: T. Pierce, Great Britain
  German member: Dr. Jühling, BG Feinmechanik und Elektrotechnik
  Task: To prepare a CENELEC standard on equipment and tools and on personal protective equipment for working on or close to electrical systems and installations.

- CENELEC/TC 78/WG 1 „Application guide“

  Convenor: Jacques Lalot, France
  German member:
  Task: To prepare guides to determine electrical limits for the use of tools and equipment for live working on the basis of ENV 50196.

- CENELEC/TC 78/WG 7 „Standard electrical arc“

  Convenor: Mats Sundborn, Sweden
  German members: Dr. Jens Jühling, BG Feinmechanik und Elektrotechnik;

  Erich Brenner, Tempex GmbH
  Task: To prepare a European standard, the purpose of which is to ensure that the consequences for workers of exposure to arc generated by low-voltage installations will not be aggravated by the clothing itself. This standard shall comprise the following parts:
  Part A: Definition of an electrical arc for testing purposes.
  Part B: Methods for testing clothing material and worker's clothing. The test results must illustrate the performance of the clothing material or worker's clothing in terms of burning time and melting resistance.

- CENELEC/TC 78/WG 8 „Helmets“

  Convenor: Dr. Jens Jühling, BG Feinmechanik und Elektrotechnik
  German member: Ms von der Bank, BIA
  Task: To determine the electrical insulating requirements and test method requirements for industrial helmets and high-performance helmets for firefighters.

- CENELEC/TC 78/WG 9 „Insulating gloves“

  Convenor: Robert Michel, France
  German member: –
  Task: To prepare the modifications to EN 60903 needed to comply with the essential requirements of Directive 89/686/EEC.

- CENELEC/TC 78/Ad hoc G1
  „Insulating footwear"

  Convenor: -
  German members: Dr. Jens Jühling, BG Feinmechanik und Elektrotechnik; Erich Brenner, Tempex GmbH
  Task: To prepare a European standard on insulating protective footwear for working on or close to live parts on installations not exceeding 1000 V (AC).

- CENELEC/TC 78/Ad hoc G2
  „Insulating clothing"

  Convenor: Erich Brenner, Tempex GmbH
  German member: Dr. Jühling, BG Feinmechanik und Elektrotechnik
  Task: To prepare a European standard on electrical insulating protective clothing for working on electrical installations not exceeding 500 V (AC).

CENELEC/TC 78 plans to set up a WG whose task it will be to check that the prepared standards for „PPE for protection against electric shock" comply with the directive concerned.

2.2 Cooperation between PPE CEN/TCs and CENELEC/TC 78

CENELEC/TC 78 has called upon the PPE CEN/TCs to participate in the WGs of the CENELEC/TC. CEN/TC 162 has appointed Kim Christensen (Denmark) to act as the contact to CENELEC/TC 78. Several representatives who have not been officially appointed (guest status) also participate in CENELEC or CEN meetings. They are, however, not entitled to vote.

One exception concerns work on the subject of „Gloves and mitts with mechanical protection for electrical purposes" for which a Joint Working Group (JWG) has been set up between CENELEC/TC 78 and CEN/TC 162.

CEN/TC 162 has also been involved in work in the field of protective clothing, e.g. concerning standard DIN EN 50286 „Electrical insulating protective clothing", with the task of preparing sections on non-electrical hazards.

3 Notified bodies

There are the following registered bodies in Germany for „PPE against electrical risks“:

- Deutsche Gesellschaft zur Zertifizierung von Qualitätsmanagementsystemen
  (German society for the certification of quality management systems)
  Equipment against electrical risks
  Authority: Quality assurance in production, Article 11B

- Fachausschuß „Elektrotechnik“
  (Committee of experts on „Electrical engineering“)
  Electrical insulating protective clothing
  Authority:
  Type examination, Article 10
  Type conformity, Article 11A

- Verband Deutscher Elektrotechniker (VDE) e.V.
  PPE for protection against electrical risks and dangerous voltages
  Authority:
  Type examination, Article 10
  Type conformity, Article 11A
  Quality assurance in production, Article 11B

- Berufsgenossenschaftliches Institut für Arbeitssicherheit (BIA)
  (Central research and testing institute of the German accident insurance institutions)
  Protective clothing, Gloves, Boots and shoes, Industrial helmets
  Authority:
  Type examination, Article 10
  Type conformity, Article 11A
  Quality assurance in production, Article 11B

- Sächsisches Textilforschungsinstitut e.V.
  (Saxony textiles research institute)
  Protective clothing against electrical risks
  Authority:
  Type examination, Article 10
  Type conformity, Article 11A
  Quality assurance in production, Article 11B

These bodies are involved in the national coordination group of notified bodies (coordination group 8) and also participate at European level in the vertical groups for the different PPE types. As an organization, CENELEC/TC 78 does not participate in the European Coordination of Notified Bodies.

4 Standards for different PPE types for protection against electrical risks

In addition to a PERINORM database search, interviews with experts active in this field have been carried out (March 1998) in the interest of an extremely careful and up-to-date status review of existing standards.

This section provides just a brief account of the results of this experts' survey on the assessment of standards. Detailed results, including the status of documents, the scope of standards and information as to whether documents are mandated and/or harmonised, can be found in the annex. The table also assigns standards to the individual CENELEC/TC/WGs and lists the shortcomings of each standard.

4.1 Equipment for eye protection

There is no special standard for this PPE for protection against electrical risks. DIN EN 166 contains a section entitled „Protection against electrical arc" prepared by CENELEC/TC 78. The requirements for goggles with face protection are insufficient.

4.2 Equipment for head protection

The European Commission has issued a mandate to CENELEC/TC 78 for the „Standardization of insulating helmets for live working". CENELEC/TC 78/WG 8 is currently preparing a working paper for „Insulating helmets" (1st draft expected at the end of 1998) which will only specify the insulating requirements for safety helmets.

Despite a mandate to CENELEC, CEN/TC 158 „Protective helmets" is preparing the standard E DIN EN 13087 (3/98) „Protective helmets – Test methods", Part 8 of which deals with „Electrical properties". The requirements concerning electrical properties in Part 8 of the standard are insufficient. CENELEC/TC 78/WG 8 is therefore considering submitting the aforementioned working paper to CEN/TC 158 as Part 8 of the standard E DIN EN 13087. The Convenor of CEN/TC 158 is also involved in work on the CENELEC working paper.

4.3 Protective clothing

The following standards/draft standards/working papers exist for this area:

- Standard electric arc for measurement of the thermal strength of individual protection equipment used for low-voltage electrical works (up to and including 1 kV); (French proposal)

- E DIN EN 50286 (VDE 0682 Part 301)(1998-01-00): Electrical insulating protective clothing
- DIN EN 60895 (VDE 0682 Part 304)(1998-02-00): Conductive clothing for live working at a nominal voltage up to 800 kV a.c.
- E DIN IEC 78/230A/CD (VDE 0682 Part 306)(1998-02-00): Live working - Clothing for thermal protection of workers; thermal hazards of an electric arc - Part 1: Test methods
- E DIN VDE 0680 Part 1 (1990-05-00): Personal protective equipment, protective devices and apparatus for work on electrically energized systems up to 1000 V; insulating personal protective equipment and protective insulating devices

CEN/TC 162 has participated in drawing up the requirements concerning non-electrical hazards for standard E DIN EN 50286.

A standard for protective clothing to protect against electric arc is now being prepared at European level.

One problem concerning protective clothing in particular is that the material used (electrical insulating) causes very heavy perspiration. Attempts should be made where possible to develop new materials for this PPE.

4.4 Equipment for leg and/or foot and anti-slip protection

There are currently no special standards for protective footwear to protect against electrical risks. The European Commission has issued a mandate to CENELEC for this PPE. Germany has submitted an initial working paper (withdrawn DIN 4840) to CENELEC:

- Draft XXX 78(SEC)17B „Insulating footwear for electrical work up to 1 kV a.c."

The requirements prepared by CENELEC for protective footwear are to be included in DIN EN 344 Part 1 and 2 during revision. In order to accelerate this procedure, the possibility of specifying requirements in an annex to EN 344 is also being considered.

Users stress that the protective footwear currently available on the market has so far provided sufficient protection.

4.5 Equipment for hand and arm protection

There are the following standards for this area:

- E DIN VDE 0682-313 (1992-09-00): Equipment for live working; Gloves and mitts with mechanical

protection; identical with IEC 78(Sec) 81; predecessor document to E DIN EN 50237

- E DIN EN 50237 (VDE 0682 Part 313/A1)(1996-12-00): Gloves and mitts with mechanical protection for electrical purposes
- DIN EN 60903 (VDE 0682 Part 311)(1994-10-00): Specification for gloves and mitts of insulating material for live working, EN 60903/prAA (1996-03-00)
- IEC 61942 (1997-08-00): Live working – Gloves and mitts with mechanical protection (this standard was rejected as a European standard)
- DIN EN 60984 (VDE 0682 Part 312)(1994-10-00): Sleeves of insulating material for live working, EN 60984/prAA (1996-03-00)
- E DIN IEC 61840 (VDE 0682 Part 315) (1998-08-00): Specification for gloves and mitts of insulating material for live working

In the case of standards for protective hand and arm equipment for live working, it is important to take account of the fact that the product must have special „mechanical properties".

According to users in Germany, sleeves of insulating material are hardly ever used; protective gloves and clothing which overlap provide sufficient protection. In other European countries (e.g. France), such sleeves are part of the standard equipment.

4.6 Other PPE

4.6.1 Hearing protectors

There are no standards for hearing protectors designed to protect against electrical risks. The BIA is currently testing hearing protectors for attaching to helmets. Hearing protectors attached to the outside of a helmet could neutralize the insulating effect of the helmet.

4.6.2 Protection against falls from a height

There are no special standards for this PPE type intended to protect against electrical risks.

4.7 Other standards

CENELEC is preparing its own terminological standard:

- EN 60743 (1996-06): Terminology for tools and equipment to be used in live working (CENELEC/TC 78).

An attempt should be made to bring this standard into line with standards drafted by CEN.

5.1 Evaluation of PPE Directive 89/686/EEC

Several points of the PPE Directive need to be revised or clarified. In April 1998, the PPE Working Group of the European Commission Standing Committee for the Machinery Directive decided to draw up subjects for amendment in the form of a „clarification document". The member states were asked to submit their proposals/required amendments.

The working group accompanying this KAN study made the following proposals for the „clarification document" for the field of „PPE for protection against electrical risks":

- In the German version, the formulation in Annex II, Section 3.8 of Directive 89/686/EEC „Schutz gegen Stromschläge" should be changed to „Schutz gegen Risiken der Elektrizität" so that it also takes account of dangerous voltages.

- Annex II, Section 3.8 of the PPE Directive requires that *„Together with their packaging, PPE types intended exclusively for use during work or activities in electrical installations which are or may be under tension must bear markings indicating, in particular, their protection class and (or) corresponding operating voltage …".* According to experts, specification of the operating voltage alone may result in a hazard as the operating voltage must also take account of the system's insulation coordinators.

5.2 Evaluation of CENELEC PPE standards

The standards listed in section 4 are evaluated with reference to a questionnaire developed for KAN Report 12. The questionnaire was used to interview standard users, e.g. manufacturers, test and certification bodies, statutory accident insurance institutions and authorities.

The evaluation and shortcomings of individual PPE standards are presented in tabular form in the annex. This table of shortcomings should facilitate revision of standards by the standards body.

Question 1: Do the standards comply with the essential safety requirements of Directive 89/686/EEC and therefore allow certification on the basis of the EC type examination? What measures are taken to ensure that EC type examinations performed by European certification bodies are carried out according to a uniform procedure? Does certification of quality assurance systems in accordance

with Article 11B of Directive 89/686/EEC for PPE intended to protect against electrical risks actually involve problems?

The standards prepared by CENELEC are mostly test standards. Requirements concerning the product (non-electrical, electrical ...) have only been included in recent draft standards. The standards do not establish a link between the tests and the requirements of the directive.

In the foreword to the mandated CENELEC standards, no reference is made to the fact that the standards are mandated or to the directive which these standards are in support of. Furthermore, in contrast to CEN standards, the CENELEC standards do not contain an informative annex ZA specifying which sections of the standards support which details of the directive. At the 89th meeting of CENELEC/BT, the Joint President Group decided that an annex ZA should not be included in CENELEC standards.

The standards comply with the safety requirements of the directive. Nevertheless, it is difficult to observe ergonomic principles in the design of PPE when use must be made of those insulating materials for PPE currently available on the market. Users wearing the PPE over longer periods of time continue to complain about heavy perspiration. „Protection against electirc arc" has so far been considered in a draft standard only, since this has become a subject of standardization for CENELEC only recently. Requirements concerning the marking of products are neglected in most standards.

The section on „Packaging" in the standards (e.g. DIN EN 60903) specifies that: „Upon request by the user and in accordance with national regulations, directions for use (see Annex G) and any additional or more comprehensive instructions must accompany the packaging." According to Directive 89/686/EEC, however, it is essential that the manufacturer's notes are enclosed. This will be taken into account during the revision of the standards.

It is interesting to note that, in some cases, large-scale users make special arrangements with manufacturers if they are of the opinion that commercially available protective equipment does not satisfy their special safety requirements.

Articles 11A and B of Directive 89/686/EEC lay down the framework for the quality assurance of the PPE end product or the quality assurance system set up by the manufacturer. The registered body checks that the product complies with the requirements of the directi-

ve and the prototype tested. This examination is based essentially on the test methods described in the standards as this is the only way of confirming that the end product is identical with the prototype, as specified in the directive. Tests according to Article 11A are essentially carried out using the test methods described in the specific PPE standards. Tests according to Article 11 B are based mainly on the standards for quality assurance systems (ISO 9000 series), although the test devices installed by the manufacturer are also tested.

The section on „Quality assurance" in the standards prepared by CENELEC calls upon the manufacturer to use a recognized quality assurance plan in keeping with the provisions of the ISO 9000 standards in order to guarantee the supply of products which comply with the standard. Reference is also made to an acceptance test (maintenance test).

It is important to note that standards should only contain statements concerning the manufacture and properties of a safe product. According to the German Consensus Statement and the EU Memorandum on the role of standardization in relation to Article 118a of the EC Treaty, regulations aimed at the user, such as a product acceptance test performed by the user (see e.g. DIN EN 50286 „Electrical insulating protective clothing"), should not be defined in standards.

The term „quality assurance" used in CENELEC standards can sometimes lead to misunderstandings. Quality assurance at CENELEC means that a product meets the quality standard required in accordance with the hazards identified by CENELEC/TC 78. This quality standard can be checked, e.g. according to ISO 2859.

Finally, it is interesting to note that product standards for PPE are only allowed to contain requirements which support the essential requirements of Annex II of Directive 89/686/EEC, but do not influence quality assurance according to the directive.

Question 2: Are test methods considered suitable with regard to their cost/benefit ratio?

Some manufacturers complain that test costs only pay for themselves after the product has been on the market for a long time and that the test results obtained by different European testing bodies for the same product sometimes vary considerably. Efforts should be made to review the test methods described in standards.

Question 3: In accordance with Directive 89/686/EEC, standards should contain requirements concerning the structure of data sheets and directions for use. Is it possible to make an appropriate choice and to use suitable PPE on the basis of these provisions?

As in KAN Report 12, the lack of uniform requirements concerning directions for use is criticized. Users of PPE in particular would like these directions to be simpler, the number of performance classes to be reduced and easily understandable symbols to be included in standards instead.

Question 4: Do standardization projects pay sufficient attention to the problem of combinable PPE?

Standards do not cover the combined use of PPE. Manufacturers and notified bodies have drawn attention to the problem of combining PPE. The combination of face protection screens and helmets can be considered critical because not every screen can be attached to every helmet. CENELEC/TC 78 should consider the possible combinations in its field and make these results available to the ad hoc group set up by BTS 4 „Combined and combinable PPE". As a rule, European standards bodies should be asked to take better consideration of the concept of freely combinable PPE in accordance with directive 89/686/EEC.

Question 5: How can the level of occupational health and safety in standards be assessed from Germany's point of view? In which standardization projects was or is it not possible to assert occupational health and safety interests in German/European committees?

The essential principles of the safety requirements specified hitherto in DIN VDE standards have been adopted in European standardization. Standards do not take sufficient account of the ergonomic design of products. CENELEC standards, for example, do not contain requirements concerning ergonomic design (e.g. PPE should be as light as possible).

5.3 Suggestions for improvement

Future standards work should take account of the following aspects:

- The responsibilities of the CEN consultant should be extended to include PPE standards developed by CENELEC. An alternative would be to designate a CENELEC consultant for PPE who would have to cooperate with the CEN consultant.
- An attempt should be made to enhance cooperation between CEN and CENELEC and to improve the exchan-

ge of information on current work in order to avoid duplicating work. The CEN consultant should therefore also be kept up to date on current activities at CENELEC.

- Standards on PPE for protection against electrical risks should be prepared in cooperation with PPE experts of CEN. Requirements and tests should be taken over from CEN standards if applicable. In some cases, sections/individual parts on electrical hazards should be drafted to be included in CEN standards.
- With a view to assuring the consistency of PPE standards, an informative annex ZA should be added to CENELEC standards for PPE specifying which sections of the standard comply with which sections of PPE Directive 89/686/EEC.In addition, the annex should include the following text on the basis of EN 414:

  „Relationship of this European Standard with EC Directives:
  This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive(s).

  PPE Directive 89/686/EEC,
  Its amendments 93/95/EEC and 93/68/EEC

  Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

  WARNING: Other requirements and other EC Directives may be applicable to product(s) falling within the scope of this standard."

- Moreover, a note must be provided in the scope of the standard whenever there is a well-founded reason to deviate from the requirements of the directive or not to deal with certain requirements at all.
- Standards prepared by CENELEC should have a uniform structure: scope, normative references, terminology, requirements, tests.
- Every effort should be made to use consistent terminology. In German, for example, the „EG-Baumusterprüfung" of the PPE Directive is called „Typprüfung" in the PPE standards of CENELEC. In general, the terminological standard drafted by CENELEC should be brought into line with the terminology in the Directive and the terminological standards drafted by the PPE CEN/TCs.
- CENELEC and CEN standards should indicate when there is a well-founded

reason to deviate from CEN standards, e.g.:
— The safety helmet according to EN 397 „Industrial safety helmets" is not suitable for live working; the insulating requirements described in this standard are not state of the art.

- There is a need for research to develop new, more comfortable materials for ergonomic products (e.g. to prevent heavy perspiration).
- Standards on PPE for protection against electrical risks should assign PPE to performance levels concerning quality (according to the AQL quality level, for example).

6 Conclusion

The results of the study show that there is a need to review existing standards/ draft standards in some areas. Products standards take sufficient account of safety requirements, the incorporation of requirements concerning ergonomic design is often neglected. The majority of standards developed by CENELEC so far are purely test standards; standards which contain exclusively requirements hardly exist.

The attempt made by CENELEC to adapt its most recent standards to the existing set of standards at CEN can be seen as a positive development. This is reflected by the fact that for the preparation of standards, for example, CENELEC makes use of the experience of CEN experts regarding the consideration of non-electrical hazards.

Efforts must be made in the future to further improve cooperation between CEN and CENELEC/TCs with regard to the preparation/revision of standards/draft standards, and to align the PPE standards prepared by CEN and CENELEC.

7 Bibliography

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(**PSA-Benutzungsverordnung** - PSA-BV) of 4 Dezember 1996 (BGBl. I S. 1841) [Ordinance for the implementation of Directive 89/656/EEC]

List of standards and documents for PPE for protection against electrical risks and dangerous voltages including the results of the questionnaire

General notes:

- The standards make no reference to Directive 89/686/EEC; there is no Annex ZA (connection between the standard and Directive 89/86/EEC).
- Safety aspects are sufficiently considered in standards; some standards contain product requirements in the „tests" section; requirements concerning ergonomic design are neglected in most cases.
- „Protection against electric arc" has not been a subject of standardization so far.
- Problems concerning the combination of face screen/helmet; standards do not cover the combined use of PPE; this is task of CEN.
- The efforts towards a uniform structure of standards (scope, normative references, teminology, requirements, tests) must be continued.
- Requirements concerning directions for use are not consistent. Moreover, directions for use should be simpler: fewer performance classes and more easily understandable symbols.
- There is a need for research to develop ergonomic products (to prevent heavy perspiration).
- Requirements concerning the marking of products are neglected in most standards.

1.) Basic documents

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
EN 60900 EN 60743 1996-06-00 ST*N	CENELEC/TC 78	M: BC/CLC/93-08

2.) Arranged according to PPE types:

a) Equipment for eye protection

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
DIN EN 166 1996-05-00 ST*N	CEN/TC 85	M: Number ? H

Title	Summary/scope from PERINORM	Shortcomings
Terminology for tools and equipment to be used in live working		

Title	Summary/scope from PERINORM	Shortcomings
Personal eye protection – specifications	This document specifies all kinds of requirements for eye protectors.	• Requirements concerning goggles with face protection for live working are insufficient. • There is no Annex ZA.

b) Equipment for head protection

- Existing requirements for protective helmets are insufficient, e.g. the protective helmet could be melted by an electric arc.
- Helmet testing is currently only possible up to a voltage of 1000 V; yet voltage may reach 20 000 V in practice.

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
Working paper of CLC/TC 78	CENELEC/TC 78/WG 8	M: Number ?
E DIN EN 13087-1 1998-03-00 DC*N-E	CEN/TC 158	
E DIN EN 13087-8 1998-07-00 DC*N-E	CEN/TC 158	

- Directions for use do not make a sufficient distinction between different applications.

Title	Summary/scope from PERINORM	Shortcomings
Insulating helmets		
Protective helmets – Test methods – Part 1: Conditions and conditioning	The document describes test methods for protective helmets. It specifies conditions and conditioning to be used when testing protective helmets.	• There are no requirements. • There is no Annex ZA.
Protective helmets – Test methods – Part 8: Electrical properties	The document describes test methods for protective helmets. The purpose of these tests is to enable assessment of the performance of the helmet as specified in the appropriate helmet standard. It specifies the test methods test for electrical properties.	• This part of the series of standards should be prepared by CENELEC or by CEN/CENELEC in cooperation.

c) Protective clothing

- There is no standard specifying requirements for thermal protective clothing (protection against electric arc).

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
French proposal		
DIN EN 50286 VDE 0682 Part 301 1998-01-00 DC*N-E	CENELEC/TC 78 Ad-hoc G2	M: BC/CLC/93-08/AV1

Title	Summary/scope from PERINORM	Shortcomings
Standard electric arc for measurement of the thermal strength of individual protection equipment used for low-voltage electrical works (up to and including 1 kV)		
Electrical insulating protective clothing	The document is applicable to electrical insulating protective clothing used by skilled persons when they are working on or near live parts of low voltage installations at a nominal voltage up to 500 V a.c. or 750 V d.c.	• Definitions. • Some requirements are unclear. • The „old" DIN 57680 demanded protection against 1000 V which was hardly ever achieved by „wearable" protective clothing (protection against up to 500 V). • Quality assurance according to Directive 89/686/EEC, Article 11 • There is no Annex ZA.

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
DIN EN 60895 VDE 0682 Part 304 1998-02-00 ST*N	CENELEC/TC 78/Ad hoc G2	M: BC/CLC/93-08/AV1
DIN IEC 78/230A/CD* VDE 0682 Part 306 1998-02-00 DC*N-E		

Title	Summary/scope from PERINORM	Shortcomings
Conductive clothing for live working at a nominal voltage up to 800 kV a.c.	The document is applicable to conductive clothing worn by electrical workers during live working at a nominal voltage level up to 800 kV a.c. It is applicable to suits, gloves or mitts, hoods, socks and shoes.	• Annex ZA is not correct. • „Requirements" section is not sufficiently elaborated (electrical, non-electrical, marking, directions for use). • The standard only contains technical requirements, no ergonomic requirements. • Take EN 340 into account!
Live working - Clothing for thermal protection of workers; thermal hazards of an electric arc - Part 1: Test methods	The document test present the method to be used to measure the thermal performance value of textile materials use in the fabrication of protective clothing for a worker exposed to an electric arc generating heat flux rates from 2 to 600 cal/cm^2 xs. The test method is applicable for textile materials that are inherently flame resistant or treated with a flame retardant or that pass a standard vertical flame test.	• Pretreatment of samples is not defined precisely enough. • No requirements (electrical, non-electrical, marking, directions for use) are specified for the product. • There is no Annex ZA.

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
DIN VDE 0680 Part 1 1990-05-00 DC*N-E	DKE UK 241.3	

d) Equipment for leg and foot protection

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
Draft XXX 78(SEC)17B	CENELEC/TC 78 Ad hoc G1	M: BC/CLC/93-08/AV1

Title	Summary/scope from PERINORM	Shortcomings
Personal protective equipment, protective devices and apparatus for work on electrically energized systems up to 1000 V; insulating personal protective equipment and protective insulating devices.	This draft standard applies to insulating body protective equipment and insulating protective devices for live linework on equipment up to 1000 V AC (rms) resp. 1500 V DC or in their proximity.	

Title	Summary/scope from PERINORM	Shortcomings
Insulating footwear for electrical work up to 1 kV a.c.		Any existing good protective leather shoe provides adequate protection.

e) Equipment for hand and arm protection

- What is the relationship between standards DIN EN 50237 and IEC 61942, and DIN EN 60903 and IEC 61842 (duplication)?

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
DIN VDE 0682-313 1992-09-00 DC*N-E Predecessor document to E DIN EN 50237	DKE UK 214.3	
DIN EN 50237 VDE 0682 Part 313/A1 1998-09-00 ST*N	CENELEC/TC 78/WG 9	M: BC/CLC/93-08/ AV1

Title	Summary/scope from PERINORM	Shortcomings
Apparatus and equipment for live working; gloves with mechanical protection; identical with IEC 78(Secretariat) 81	The document is applicable to insulating gloves and mitts made of plastic for use without over-gloves for mechanical protection. Unless otherwise stated the use of the term glove only includes gloves and mitts.	• There is no Annex ZA. • Quality assurance according to Directive 89/686/EEC, Article 11.
Gloves and mitts with mechanical protection for electrical purposes	The documentis applicable to insulating gloves and mitts made of plastic or elastomer for use without over-gloves for mechanical protection. The gloves are intended to be used for working on live or close to live parts at a nominal voltage up to 7500 V a.c. (or 11250 V d.c.).	• There are no requirements (electrical, non-electrical, marking, directions for use). • There is no Annex ZA. • Quality assurance according to Directive 89/686/EEC, Article 11.

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
DIN EN 60903 VDE 0682 Part 311 1994-10-00 ST*N EN 60903/prAA 1996-03-00 DC*N-E	CENELEC/TC 78/WG 9	M: BC/CLC/93-08/ AV1
IEC 61942*CEI 61942 1997-08-00 ST*N	IEC/TC 78	

Title	Summary/scope from PERINORM	Shortcomings
Specification for gloves and mitts of insulating material for live working	The document is applicable to insulating gloves and mitts for live working in the low voltage range and the medium voltage range.	• There are no requirements (electrical, non-electrical, marking, directions for use). • There is no Annex ZA. • Quality assurance according to Directive 89/686/EEC, Article 11. • Section on packaging: „Upon request by the user and in accordance with national regulations, directions for use (see Annex G) and any additional or more comprehensive instructions must accompany the packaging." According to Directive 89/686/EEC, however, directions for use must always be enclosed.
Live working - gloves and mitts with mechanical protection	This international standard is applicable to insulation gloves and mitts made of plastic or elastomer with appropriate mechanical protection for use without over-gloves. Unless otherwise stated, the use of the term gloves only includes gloves and mitts. The gloves are intended to be used for working live parts at nominal voltages up to 7500 V a.c. or 11250 V d.c. For other voltages information is not yet available.	• There are no requirements (electrical, non-electrical, marking, directions for use). • There is no Annex ZA.

Standard Publication date Status	• Issuing body • Cooperation with CEN committee	M(andate) H(armonized standard)
IEC 78/228/CD IEC 61840 1998-08-00 DC*N-E	IEC/TC 78	
DIN EN 60984 VDE 0682 Part 312 1994-10-00 ST*N EN 60984/prAA 1996-03-00 DC*N-E	CENELEC/TC 78 WG 9	M: BC/CLC/93-08/AV1

Title	Summary/scope from PERINORM	Shortcomings
Gloves and mitts of insulating material for electrical purposes without protective cover	This standard is applicable to unlined insulating gloves and mitts for use, without overgloves, when working live or close to live parts at a nominal voltage up to 1,000 V a.c. or 1,500 V d.c. This standard does not specify any special properties for gloves to provide particular resistance to acid, oil or ozone.	• There are no requirements (electrical, non-electrical, marking, directions for use). • There is no Annex ZA. • Reference to EN 340.
Sleeves of insulating material for live working	The document is applicable to insulating sleeves for the protection of workers from accidental contact with live electrical conductors, apparatus or circuits in the low voltage range and the medium voltage range.	• Protective sleeves are not used, overlapping protective gloves and pro-tective clothing are sufficient. • There are no requirements (electrical, non-electrical, marking, directions for use). • Annex ZA in this form is not correct.