Kommission
Arbeitsschutz und
Normung

12e

Standardization in the Field of Personal Protective Equipment

2nd, updated edition

VFA
Verein zur
Förderung
der Arbeitssicherheit
in Europa

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KAN Report 12e
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The Commission for Occupational Health and Safety and Standardization (KAN) was founded in 1994 to assert German interests in OH&S matters, especially with regard to European standardization. KAN is composed of representatives of the social partners, the federal state and the Laender, the Hauptverband der gewerblichen Berufsgenossenschaften (HVBG, Federation of the Statutory Accident Insurance Institutions of the Industrial Sector) and the German Standards Institute (DIN). One of KAN´s tasks is to focus the public interests in the field of occupational health and safety and to exert influence on current and future standardization projects by delivering opinions on specific subjects.

KAN procures studies and expert opinions in order to analyse occupational health and safety aspects in standardization and to reveal deficiencies or erroneous developments in standardization work.

This study was based on the following task in hand:

Updating KAN Report 12, "Standardization in the Field of Personal Protective Equipment"

Outcomes of the First Version

The study on "Standardization in the Field of Personal Protective"Equipment" (KAN Report 12) established the progress made in the area of standardization (1996) and analyzed the level of safety provided by European standardization. The deficiencies revealed in the study (the need to improve PPE compatibility and reduce the range of performance stages, assessment of the work carried out by CEN/TC 122/ JWG 9, uncertainties/interpretation of the results) are core elements of the remit of the CEN rapporteur for PPE and the rapporteur's nucleus.

In the course of the CEN rapporteur's work, recommendations were drawn up for more consideration to be given to PPE compatibility and the range of performance stages to be reduced when standards are revised.

A draft, produced at the European level, of a general guide on how to produce information leaflets now exists, along with draft documents for respiratory protection and head protection.

The work of CEN/TC 122 JWG 9 is currently still the target of criticism. The first draft standards on ergonomics have only just been presented and they are viewed critically by the German experts on occupational health and safety ("OH&S"), who consider them of little use.

A PPE Sector Forum (consisting of the chairpersons of the PPE TCs and the sec-

retaries as well as the rapporteur's nucleus) has been founded at the European level as recommended by KAN.

This "stocktake" demonstrates that some fundamental recommendations made in the study have been translated into practice. Since the subject of "Standardization of personal protective equipment" is still of relevance, KAN has decided to update the KAN report in line with the developments of the past four years. In order to avoid unnecessary work, it was decided that the existing structure of the report should be used. Please note that any headings and quotes from the standards may not completely correspond with the content of the English standards since the original standards were not available to the translator.

Objectives

1. To determine and present the current state of play in respect of the principles of PPE standardization and the relevant committees at the national, European and international levels.

2. To list existing standards, draft standards, standardization projects and provisions.

3. To analyze the documents and describe any gaps in the standardization.

4. To compare the recommendations for acting on the findings of KAN Report 12 with the current situation.

KAN would like to thank the authors for conducting the project and presenting the report as well as the following experts, who provided assistance and support in the evaluation of the study:

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The following abstract of the study and recommendations were adopted by KAN on 21 January 2002.

Abstract

This report is an updated version of the study published as KAN Report 12, "Standardization in the Field of Personal Protective Equipment". The study established the progress made in the field of standardization (1996), analyzed the level of safety provided by European standardization and revealed the existing deficiencies, also taking into account the specifications concerning ergonomic design. Detailed lists of each standard's deficiencies were also drawn up as a practical aid for the standards bodies to ensure that the standards were revised in keeping with OH&S interests. Fundamental recommendations made in the study were translated into practice. Since the subject of "Standardization of personal protective equipment" is still of relevance, the KAN Report has been updated in line with the developments of the past four years. The existing structure of the report was reused.

Background

Standardization in the field of personal protective equipment (PPE) supplements the requirements of Directive 89/686/EEC. In Germany, this directive has been converted into national law through the Eighth Ordinance Regulating the Equipment Safety Act (8. GSGV). In order to supplement Directive 89/686/EEC with standards, the EU Commission issued three mandates to CEN which resulted in 316 standards being developed for the field of PPE.

At the national level in Germany, PPE standards are developed mainly in the Standards Committee for Personal Protective Equipment (NPS), the Standards Committee for Precision Engineering and Optics (NAFuO) and the Standards Committee for Sports and Recreational Equipment (NASport). Since 1989, the majority of PPE standards have been drawn up at the European level in CEN/TCs 79, 85, 136, 158, 159, 160, 161 and 162, and at the international level primarily in ISO/TC 94. At the European level, the CEN rapporteur and the Advisory Nucleus established by the rapporteur as well as the PPE Sector Forum supervise the work of the CEN/TCs.

The study has achieved the following:

- ☐ established the progress made in the field of standardization,
- ☐ assessed the level of product-based occupational health and safety in standards,

- ☐ assessed the suitability of the standards as a basis for manufacturing and certifying PPE and
- ☐ revealed the deficiencies in the standards with regard to product-based occupational health and safety.

Relevant sport and leisure PPE used as protection against falls from a height is also covered in this study. The study does not assess PPE for work on live parts of electrical systems.

Procedure

The existing standards, draft standards and standardization projects were compiled using lists of standards kept by the committees, lists from DIN and CEN databases and lists of the references to the harmonized standards published in the Official Journal of the European Communities. This information was used to produce an overview of standards and draft standards in December 2000.

In the second phase of the study, the experts involved in standardization of personal protective equipment were asked to fill in a questionnaire as part of a survey. This questionnaire, based on the questionnaire used in the previous study (1996), was part of the tender specifications and was modified by a working group (PBA) appointed for this study. In order to obtain detailed statements concerning the content of the standards, the method chosen for the questionnaire was such that the experts were able to give a qualitative assessment of the standards and draft standards for specific PPE types in response to specific questions.

The experts participating in the survey were divided into the following two groups:

- ☐ experts who have practical experience of all PPE types and
- ☐ experts on specific PPE types.

In order to present as broad a range of opinion as possible, the choice of experts was such that all groups involved (manufacturers, users, test and certification bodies, authorities and statutory accident insurance institutions) were included. Where the answers to the questions differed, the various opinions are presented in the report.

The PPE types were classified in the same way as in the previous study, i.e.:

- ☐ respiratory protective equipment,
- ☐ equipment for eye protection and full or partial face protection,
- ☐ equipment for head protection,
- ☐ equipment for hearing protection,
- ☐ equipment for protection against falls from a height,

- ☐ equipment for leg and foot protection,
- ☐ protective clothing,
- ☐ equipment for hand and arm protection and
- ☐ equipment designed to prevent drowning and/or for use as buoyancy aids.

The study lists the existing standards, draft standards and standardization projects in these areas, presents the results of the questionnaire for the individual PPE types and analyzes and assesses them, based on the questionnaire, usually according to standard-specific aspects or aspects relating to severan standards ("generic aspects").

The deficiencies in the product-based occupational health and safety specified by individual standards and draft standards are listed in detail in a table in the annex to the study.

General Assessment of PPE Standards

Based on the questions specified, this section summarizes the most important results of the expert survey for PPE types in general.

1. Do European product standards, draft European product standards or still valid national standards cover all of the relevant essential safety requirements of Directive 89/686/EEC and therefore allow certification/the EC type examination?

With a few reservations, the situation is generally considered positive. Where the respondents *did* make critical suggestions, these were mostly suggestions specific to requirements and test crkteria which could supplement or improve individual standards. Some of the proposed changes also refer to adaptation of requirements in standards to actual conditions in practice.

On the subject of ergonomic PPE design, there is apparently still some need for action to ensure that individual standards cover the requirements of the directives (see also question 5).

Generally speaking, it is possible to certify PPE products on the basis of the standards. Nevertheless, there *are* PPE products on the market that do not fulfil the basic requirements of the directive. Based on various studies and talks at the European and national levels concerning the efficiency of market surveillance, measures have been taken to bring about improvement. Nonetheless, the respondents suggested improvements to market surveillance.

2. Are the product requirements specified in standards useful in helping the user select a suitable product?

To a large extent, the product requirements in the standards and draft standards are considered suitable criteria for helping the user make a selection. However, problems can occur if the requirements and test methods specified in the standards and draft standards do not sufficiently reflect actual conditions in practice. The actual conditions in practice should also be used as the basis when specifying the range of performance stages in order to avoid having too many performance stages, which confuse the user.

3. Do the standards contain requirements for products concerning the structure of manufacturers' information leaflets in accordance with Directive 89/686/EEC?

Generally speaking, all of the product standards and draft standards dealt with in this study contain requirements concerning the information leaflet. However, the different standards bodies take different approaches with regard to their structure. In order to improve the structure of information leaflets, the PPE Sector Forum, the co-ordination group on PPE standardization within CEN, assigned a working group the task of listing the key content of the information leaflets as required by the directive and producing sample information leaflets. The Sector Forum also suggested that the individual TCs should use this basis to examine whether additional specifications are needed for specific standards. From the point of view of occupational health and safety, a minimum content must be guaranteed for the information leaflet in order to safeguard the level of occupational health and safety.

4. Do standardization projects take sufficient account of the problem of PPE compatibility (interference between different PPE types)?

Numerous examples show that various possible PPE combinations have already been considered in many standards/draft standards. Having said that, it was repeatedly pointed out across the board that standards cannot cover all possible combinations and they should thus only contain specifications for common PPE combinations. In general, the respondents thought it necessary to strive for more intensive cooperation and co-ordination between the various areas of PPE standardization in order to identify common PPE combinations and carry out standardization, with the involvement of the committees concerned, with the aim of taking into account combinations of different PPE types.

5. How are ergonomic aspects covered in standardization? Does the cooperation between the PPE CEN/TCs and CEN/TC 122 JWG 9 "Ergonomics" take account

of the needs of occupational health and safety?

The increasing consideration given to ergonomic aspects in standards and draft standards is considered positive and beneficial. However, it is repeatedly noted that "exaggerated" ergonomic requirements in the standards would not be of any real benefit because they often cause safety-related criteria to be pushed into the background.

The current ergonomic test methods in the standards and draft standards, however, are frequently criticized because they are usually subjectively influenced by the use of test persons.

In principle, the respondents consider JWG 9's work positive because the working group has created a possibility for offering the PPE TCs assistance in ensuring that even better consideration is given to ergonomic aspects in standards. However, the results of JWG 9's work are presently not always a concrete aid in the development of PPE standards. Since there is also often no experience as yet of ergonomic requirements in use, the respondents are of the opinion that the documents produced by JWG 9 should be issued in the form of technical reports and not European standards.

Due to the criticisms made with regard to JWG 9's draft standards, second drafts are currently being prepared. It should be noted that the European Commission has issued mandates for ergonomic standardization projects and that technical reports do not fulfil the harmonization expectations which the Commission attaches to the mandate since there is no obligation to implement them. The inquiry concerning the second drafts will take place during 2002.

The documents to be prepared by JWG 9 are to take the form of guidelines and contain practical modules, such as "Checklists on consideration of ergonomic aspects", which the different standards bodies can use when developing the product standards.

6. Does the choice of test methods specified in the standards make sense as far as representativeness and reproducibility are concerned? Are the cost/benefit ratios of the test methods appropriate? Can new standards be expected to cause further increases in test costs?

Apart from a few exceptions, the experts questioned considered the cost/benefit ratios appropriate and balanced. The cost/benefit ratios of test methods which depend on subjective judgements are often criticized. In those few cases in which the respondents doubt that the reproducibility and representativeness of the specified test methods justify the cost, the

reason is usually that the results can differ significantly from test institute to test institute even though the same test method is used. The causes of this divergence must be identified and suitable measures taken to avoid excessive divergence.

7. Do the standards on testing methods developed by CEN/TCs or by ISO outside PPE committees (quoted standards) fulfil their purpose as far as occupational health and safety is concerned?

In addition to the standards developed in the PPE committees, there are a number of standards on test methods which are drawn up outside the PPE committees and are quoted in European standards. The majority of the quoted CEN or ISO standards fulfil their purpose as far as occupational health and safety is concerned as well as providing a good basis for testing safety-relevant parameters of PPE products.

8. Is further harmonization of safety and ergonomic requirements and test methods for various PPE types regarding protection against the same hazard (e.g. flammability test) possible and practicable?

In general, the respondents believe that there *are* areas where it would make sense to harmonize safety and ergonomic requirements as well as test methods, particularly since some testing parameters were established some time ago and could be harmonized from at technical point of view. Standardization activities increasingly aim to harmonize the requirements and test methods.

9. How are the results of the European Co-ordination of Notified Bodies for PPE incorporated in the further development of standards and where do the notified bodies see a need for action?

The European Co-ordination, under German chairmanship, enables the notified bodies for PPE to exchange information on issues concerning the testing and certification of PPE. Wherever there are problems, the European Co-ordination looks for a European solution and suggests a common course of action.

The standards bodies are informed of the results of the European Co-ordination on a regular basis. The CEN/WGs responsible for the product standards in question check whether and to what extent the recommendations should be taken into account in the revisions of the standards.

Some of the vertical groups still criticize the fact that the flow of information in this process needs to be improved. In many areas - particularly due to direct contacts between those involved in standardization and those involved in the vertical groups - it has already proven

possible to make improvements to the standards thanks to the suggestions and ideas presented by the vertical groups.

The round robin tests organized in order to improve the reproducibility and comparability of the various testing bodies' test methods often produce results which are of direct benefit for standardization.

10. How do the German experts rate the level of occupational health and safety provided by the individual documents? In which standardization projects was or is Germany not able to assert its occupational health and safety interests? What were or are the reasons?

The respondents' general opinion is that the needs of occupational health and safety (OH&S) are well covered by the standards and draft standards. Cases of Germany not being able to assert its OH&S interests or not being able to do so fully were mainly due to the lack of a majority in the European working group or to compromises which had to be made because of other factors having priority.

However, the respondents are generally anxious that CEN standardization will probably not give OH&S needs the present level of consideration in future. The main reason given for this was the decline in the willingness of the institutions currently working in European standardization to continue providing sufficient human and financial resources in the future. These trends are expected to bring difficulties, particularly in view of the fact that standardization is shifting into the international arena (ISO).

11. How does ISO standardization influence the development of OH&S requirements?

At present, the influence of ISO standardization differs considerably depending on the PPE field. In the PPE fields "Head protection", "Eye protection" and "Respiratory protection" the influence of the ISO standard on CEN standardization and thus the influence on OH&S interests is relatively weak. In the area of hearing protection, the existing influence of ISO standardization is not always deemed helpful. In other PPE areas, particularly protective clothing and foot protection, there is extensive, positive experience in cooperation with the ISO committees.

Irrespective of the current influence of ISO standardization in the various PPE areas, there is general consensus that ISO standardization will continue to gain in significance, especially since trade is globally oriented and does not stop at the boundaries of the European Community. It is feared that ISO standardization will cause the German influence on OH&S require-

ments to decrease in the medium term. The reasons for this fear are the costs involved and the resulting reduction of the participating experts as well the proportionally low number of German representatives with voting rights.

12. In which standardization projects and with what measures should KAN exert influence to promote the position of occupational health and safety?

KAN should back the experts' work in the standards bodies by means of supporting measures. For instance, KAN should make it clear that OH&S representatives must continue to work in standardization if we are to maintain the current level of occupational health and safety provided by standardization. The members of the standards bodies will address any deficiencies or problems of detail in the European standards and draft standards themselves.

Summary

To sum up, standardization in the field of personal protective equipment can still be considered positive. Thanks to the intensive work currently performed by OH&S experts in the individual standards bodies, it proved possible to assert product-based OH&S interests. The deficiencies in the standards are listed in detail in the annex to this study. The comparison presented shows that the deficiencies revealed in the 1996 report have mostly been eliminated.

Recommendations

Overall Assessment

The report provides a good overview of the progress that had been made in the field of standardization by the time of the study. The detailed list of individual standards and their deficiencies provides a practical aid for revising standards.

KAN is of the opinion that standardization has been developed successfully in the field of personal protective equipment. There is, however, need for action in a few cases.

Action to be Taken by DIN

1. DIN is requested to pass on the report to the German mirror committees so that they can pass it on in a suitable form to the European standards bodies. The results of the expert survey will then be available for the development of standards/draft standards and for upcoming routine revision of standards.
2. DIN is requested to ensure that both the requirements and test methods as well as the performance stages are based on actual conditions in practice when drawing up and revising the above-mentioned documents.

3. DIN is requested to present to CEN STAR the case for prenormative and conormative research aimed at improving measuring methods in order to eliminate uncertainties in test results.

Action to be Taken by the German Federal Ministry of Labour and Social Affairs (BMA)

1. The BMA is requested to take action to ensure that the current revision of Directive 89/686/EEC results in clearer wording, in accordance with the requirements of actual practice, in Annex II of the directive.

Action to be Taken by the Statutory Accident Insurance Institutions

1. In accordance with their prevention function as laid down by Part VII of the German Social Security Code (SGB VII), the statutory accident insurance institutions are requested to continue their active involvement, in terms of providing human and financial resources, in European and, in future, international, standardization in order to safeguard the level of occupational health and safety.

Action to be Taken by the Laender

1. The Laender are requested to ensure efficient market surveillance and to make active use of the information system being developed at the German and European levels.

Action to be Taken by KAN

1. The KAN Secretariat is requested to take action to promote the exchange of information between OH&S experts involved in standardization and to use the possibilities offered by the new media to do so. This could be done, for example, by creating discussion forums and compiling lists of experts on certain topics.
2. The KAN Secretariat is requested to publish information concerning standardization projects in the field of personal protective equipment.
3. The KAN Secretariat is requested to make clear to the decision-making bodies why it is necessary for OH&S experts to be involved in standardization in order to safeguard the level of occupational health and safety.

The interested parties represented by KAN, the Federal Ministry of Labour and Social Affairs, the Laender, the statutory accident insurance institutions, the social partners and DIN are requested to voice their support for active participation of OH&S players in European and international standardization too in order to safeguard the level of occupational health and safety.

1 Introduction

Standardization of personal protective equipment gained in importance when the Council Directive on the approximation of the laws of member states relating to personal protective equipment (89/686/EEC) was adopted in 1989. In accordance with the principle of the new approach, the directive only specifies the basic health and safety requirements; specific product requirements are included in European harmonized standards. These European standards replace the corresponding national standards and can be consulted as a basis for the manufacturing, testing and certification of products. In Germany, the PPE Directive has been transposed into national law by means of the Eighth Ordinance Regulating the Equipment Safety Act (8th GSGV) of 10 June 1992.

In order to supplement the general basic health and safety requirements specified in the PPE Directive, the European Commission and the EFTA secretariat have so far issued a total of three standardization mandates for the development of European standards by the European Committee for Standardization (CEN). Numerous representatives of manufacturers, users, test institutes, etc. in the European standards bodies were faced with the task of preparing, as quickly as possible, a large number of European standards which manufacturers can refer to when designing PPE, which serve as a basis for testing and certification and which can also be used by enforcement authorities for market-surveillance purposes.

Although a number of test and product standards or draft standards already exist, standardization work in the field of PPE has not yet been completed. The relevant standards bodies are in fact faced with the task of carrying out further standardization projects, improving existing standards and draft standards and eliminating discrepancies between European and international standards for PPE.

This study has been intended to make suggestions for this process by analyzing and assessing existing standards. The main objectives of the study are as follows:

- ☐ to establish the progress made in the field of standardization,
- ☐ to assess current standards with regard to their suitability as a basis for manufacturing and certifying PPE,
- ☐ to assess current standards with regard to the level of occupational health and safety from Germany's point of view,
- ☐ to indicate deficiencies in the standardization and
- ☐ to specify areas in which the Commission for Occupational Health, Safety

and Standardization (KAN) should exert influence in order to promote occupational health and safety.

In the course of the study, a pre-specified set of questions was used, based on the procedure employed for the previous study carried out in 1996/1997, to ask a number of experts from various fields (manufacturers, test institutes, authorities, "Berufsgenossenschaften" (accident insurance institutions) and users) about their experiences with PPE standards. These expert opinions were then evaluated according to the different types of PPE and the questions asked. However, due to the current scope and constant development of PPE standards, the study does not claim to have dealt with all aspects in full.

In order to maximize the practical benefits of the study, it was particularly important to make sure that it did more than simply present and assess the various aspects of PPE standardization. The deficiencies identified in the individual standards have also been listed in order to provide a basis for further discussion in the relevant standards bodies. The deficiencies identified in the past were also re-examined and a summary of how the problems have been taken into consideration has been included.

The study's discussion of standards covers the majority of personal protective equipment dealt with in the PPE TCs of the CEN. It is, however, not concerned with personal protective equipment for work on live parts of electrical systems. The PPE standards for the areas of sport and recreation have also been excluded, with the exception of a few standards in the field of personal equipment for protection against falls from a height which is also used in industry.

The report starts by presenting certain fundamental principles and background information regarding PPE standardization at the national, European and international levels. This is followed by an explanation of the procedure adopted for this study. The results of the survey are then presented in the form of an analysis and assessment of standards for the different types of PPE. A separate section then assesses PPE standardization in general based on the individual questions asked. The three annexes list the standards, draft standards and standardization projects relevant to the study, give an overview of the deficiencies in the standards and indicate the progress made on the deficiencies identified in the 1997 study.

2 Fundamental Principles of PPE Standardization

PPE standards are prepared by the responsible working committees of national, European and international standardization organizations. From Germany's point of view, the standardization organizations relevant to the PPE standards considered in this study are:

- ☐ DIN (German Standards Institute), Berlin, at national level,
- ☐ CEN (European Committee for Standardization), Brussels, at European level, and
- ☐ ISO (International Standards Organization), Geneva, at international level.

The standardization of PPE in these three organizations is discussed in the following.

2.1 PPE Standardization at DIN

According to the agreement concluded with the Federal Republic of Germany on 5 June 1975, DIN (German Standards Institute) is the institution responsible for standardization work in the Federal Republic of Germany. National standardization and work on European and international standardization for a specific specialist area takes place via a DIN standards committee which can sub-divide into specialist areas.

The following DIN committees are essentially responsible for standardization of PPE:

1) Standards Committee for Personal Protective Equipment (NPS), Berlin office
   - ☐ Specialist area 1 – Head protection
   - ☐ Specialist area 2 – Hearing protection
   - ☐ Specialist area 3 – Protection against falls from a height and working belts
   - ☐ Specialist area 4 – Foot and leg protection
   - ☐ Specialist area 5 – Protective clothing including hand and arm protection
2) Standards Committee for Precision Engineering and Optics (NAFuO), Pforzheim office
   - ☐ Specialist area for medical technology, working committee for respiratory equipment for work and rescue
   - ☐ Specialist area for optics, working committee for eye protection

Other standards committees, e.g. the Standards Committee for Sport and Leisure Equipment, in Cologne, are also called in to prepare standards for special PPE areas, e.g. life jackets.

For a long time, product standards for PPE were developed mostly at national level in the aforementioned committees.

Since 1989 the emphasis has shifted towards European standardization.

2.2 PPE Standardization at CEN

2.2.1 Significance of European Standards

The European Committee for Standardization (CEN) is made up of the national standardization organizations of the 15 EU states and Norway, Iceland, Switzerland and the Czech Republic. In the first 20 years after the formation of CEN in 1961, only around 100 standards were prepared, which were only binding for those member organizations which had voted in favour of them. National standards bodies were able to continue working independently on the development of national standards.

European standardization through CEN was intensified and gained dramatically in importance from 1983. Directive 83/189/EEC of 28 March 1983 (procedure for the provision of information in the field of standards and technical regulations) institutionalized cooperation between CEN and the European Commission, for example. A standing committee, 83/189, for technical laws and standards was set up, consisting of representatives from the Member States under the leadership of the Commission. Representatives from standardization organizations are able to participate in its work. This committee is responsible for the content of mandates (standardization mandates with specified deadlines and generally with financial aid) to CEN. On 13 November 1984 the general guidelines for cooperation between the EC Commission and CEN were agreed in a resolution of the EC Council of Ministers.

According to these guidelines, the following fundamental principles are important:

- ☐ standstill,
- ☐ weighted voting for the acceptance of a European standard and
- ☐ the obligation to implement a European standard as a national standard.

European standardization gained further importance with the resolution of the EC Council of Ministers of 7 May 1985 on a new approach in the field of technical harmonization and standardization. This new approach includes the following four principles:

- ☐ only the basic safety requirements are specified in directives according to Article 95 (formerly Article 100a) of the EC Treaty (e.g. Directive 89/686/EEC);
- ☐ bodies responsible for industrial standardization (e.g. CEN) prepare

European standards to supplement the basic safety requirements, taking account of the state of the art;

- ☐ these European standards remain voluntary, not compulsory; and
- ☐ once the creation of a harmonized European standard has been announced in the Official Journal of the European Communities, products manufactured in accordance with that harmonized European standard can be assumed to conform to the basic safety and health requirements.

Although these standards are still applied on a voluntary basis, widespread use is made of them in practice in order to prove the PPE's conformity with the basic health and safety requirements of Directive 89/686/EEC.

Based on this development, DIN's work has witnessed a clear shift in emphasis in recent years from national to European standardization. This has affected standardization of PPE in particular.

2.2.2 Procedure

The European standardization procedure is specified in Part 2 of CEN's Internal Regulations. The European standard (EN) is the most important of the different types of publication (European standard, harmonization document, prestandard, report, technical specification) for the field of PPE. Most PPE standards are developed according to the TC method. First of all, a European draft standard is developed in a Technical Committee (TC), to which 18 national standardization institutes can send their experts. This draft standard (prEN) is then sent to the CEN members (national standardization organizations) for them to comment on within a period of 6 months. Once the comments received have been examined or taken into account, a revised draft standard is drawn up for a formal vote and submitted to the CEN members for final approval.

The start of work on a standardization project in a Technical Committee involves a "standstill" obligation. This is an obligation accepted by the CEN members not to publish any new or revised national standards which are not fully in line with existing European standards, or those in preparation, on the same subject.

Checks are carried out by the Comité de Lecture both during the enquiry stage and before the standard is accepted. The draft standard is generally checked to make sure that all three language versions (English, French and German) are equivalent and that the presentation rules for European standards have been observed.

The formal vote on the acceptance of a European standard takes the form of a "weighted voting procedure" which only allows a "Yes" or "No" vote (a reason must be given for a negative vote) (see Table 2.1). There are two conditions for the adoption of a standard:

a) simple majority of votes cast (ignoring abstentions);

b) positive result for at least 71 % of the weighted votes cast.

As soon as a European standard has been adopted in the formal vote, CEN members must implement it as a national standard within a period of six months; conflicting national standards must be withdrawn. This means that despite rejection at the national level, a European PPE standard can be adopted at the European level and must then be implemented as a national standard. Before and after the formal vote, the CEN technical consultant for PPE checks mandated drafts to make sure that they supplement the basic health and safety requirements of Directive 89/686/EEC and to establish whether publication as a harmonized standard in the Official

Table 2.1: Weighted voting procedure for a European standard

A) Vote weightings of CEN member countries		
1	Germany	10
2	France	10
3	Great Britain	10
4	Italy	10
5	Spain	8
6	Belgium	5
7	Greece	5
8	Netherlands	5
9	Austria	4
10	Portugal	5
11	Sweden	4
12	Switzerland	5
13	Denmark	3
14	Finland	3
15	Ireland	3
16	Norway	3
17	Luxembourg	2
18	Iceland	1
	Total	96

B) Conditions for adoption

1. Simple majority, excluding abstentions
2. At least 71 % of the weighted "Yes" votes cast, excluding abstentions

If one of the conditions is not satisfied, the votes cast by members of EEA countries (not including Switzerland) are counted separately. If the conditions are then satisfied, the EN is adopted for the EEA countries.

Journal of the European Commissions (OJEC) can be recommended.

2.2.3 Progress in the Field of Standardization for PPE

European standardization in the field of PPE essentially takes place in seven CEN Technical Committees (TCs):

CEN/TC		Secretariat
79	Respiratory protective devices	DIN (D)
85	Eye protection	AFNOR (F)
158	Protective helmets	BSI (UK)
159	Hearing protection	SIS (S)
160	Protection against falls from a height and working belts	DIN (D)
161	Foot and leg protection	BSI (UK)
162	Protective clothing incl. hand and arm protection and life jackets	DIN (D)

With the exception of TC 79 and TC 85, these TCs did not start their work until 1989. Since then the 7 TCs have been under immense pressure of time to complete a huge programme of standardization to supplement Manufacturing Directive 89/686/EEC for PPE. According to CEN, 209 of a total of 316 mandated PPE standards have been ratified so far; in some cases, the standardization work in the other projects has already made considerable progress.

As well as working to complete standardization projects, the PPE TCs improve and revise standards which have already been published. Generally speaking, the revision process involves reviewing each harmonized European standard, which is done at regular five-year intervals in accordance with the CEN rules. The reviewers have to decide whether revision is necessary due, for example, to technical developments. In the field of PPE, numerous standards are currently being revised, which means that the standards are constantly evolving further.

2.3 PPE Standardization at ISO and Cooperation with CEN

International standardization of PPE is mainly carried out by ISO (International Standards Organization), an affiliation of standardization organizations from over 90 countries worldwide. Only the principal national standardization organization in each country can be a member, i.e. Germany is represented by DIN.

Since the aim is for close interlinking of European and international standardization work and uniform implementation of international standards, an agreement on technical cooperation between ISO and CEN (Vienna Agreement) was con-

cluded in 1991 and directions for its implementation drawn up.

The cooperation takes the following forms:

1) cooperation by means of correspondence,
2) cooperation through mutual attendance of meetings,
3) implementation of existing ISO standards by CEN and
4) cooperation through transfer of work and parallel voting:
   standardization work can be passed onto ISO or CEN. If during parallel voting on a draft standard (DIS / prEN) one party (ISO or CEN) rejects the draft, the other party can still publish the standard.

Since increasing use is being made of the possibility for parallel voting in the field of PPE, international standardization of PPE is gaining in importance. Before the Vienna Agreement was concluded, a country was not obliged to implement an international standard as a national standard if it had voted against it; now, as in the case of CEN, there may be an obligation to implement an international PPE standard as a European and national standard even if a national standardization organization votes against it.

German participation in international PPE standards bodies is generally lower than in European bodies. Experience shows that this results in a general loss of direct influence on the specification of requirements. This applies in particular to PPE standardization projects which are managed by ISO in accordance with the Vienna Agreement.

Standardization of PPE at ISO takes place primarily in ISO/TC 94 with a series of subcommittees for different PPE types. Certain other committees, e.g. ISO/TC 83 for sport and leisure equipment and ISO/TC 43/SC 1 for noise, are also of significance for special PPE types. Fig. 2.1 shows a comparison of the important working committees for PPE at ISO, CEN and DIN.

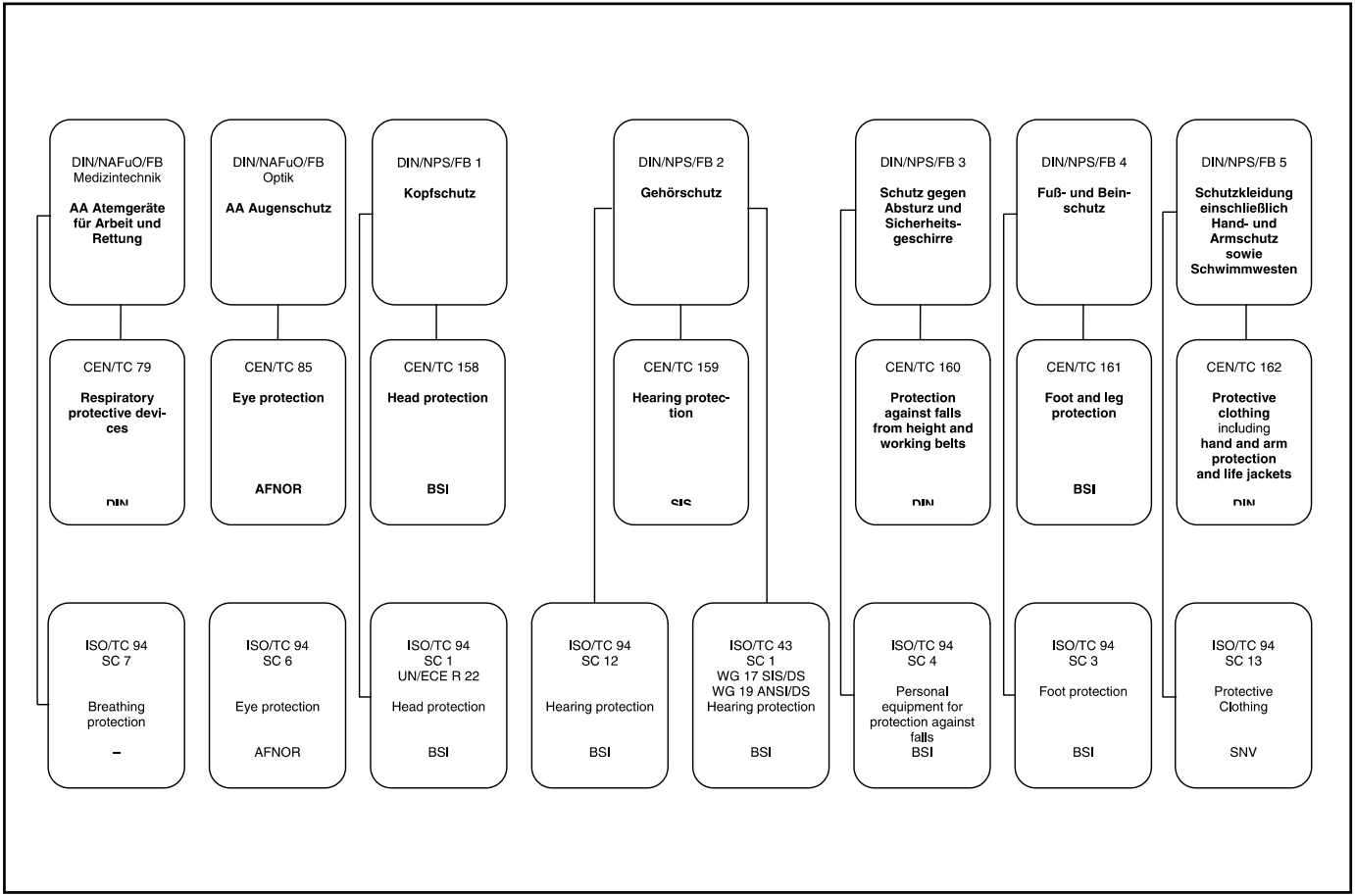

Fig. 2.1 Comparison of important working committees (DIN, CEN, ISO) for personal protective equipment

3 Survey on PPE Standardization

In order to ensure a thorough and up-to-date analysis of the existing standards concerning personal protective equipment, the first step was to compile a list of the current standard documents. This served as the basis for a survey conducted amongst experts involved in standardization. This study is the result of the evaluation of the survey and thus provides an up-to-date description of the situation in the area of PPE standardization.

3.1 Procedure Used to Compile List of Standards

The first step was a "stock-take" of the existing standards, draft standards and standard projects with the aim of providing as up-to-date an overview as possible of the present level of standardization. This information was drawn from sources such as the different standards committees' lists of standards, lists from (e.g. DIN and CEN) databases and lists of the standards published in the Official Journal of the European Communities. In this way, a list of standards and draft standards was drawn up in December 2000. In general, standards and draft standards published thereafter were not taken into account in the survey. In a few cases, however, there was sufficient knowledge of standard documents which have not yet been finally adopted to allow the experts to include as yet unpublished documents in their assessment. Such cases have been marked accordingly in the presentation of the results. Annex A lists standards and draft standards in existence as at 1 June 2001.

Since the study is primarily concerned with issues of safety and ergonomics, it does not consider the CENELEC standards for "PPE for work on live parts of electrical systems" or the standards for "PPE for sport and recreational use", with the exception of a few standards regarding mountaineering which are also relevant to industry.

3.2 Survey Procedure

The second stage took the form of a survey, using a questionnaire (Section 3.4), amongst experts involved in the standardization of personal protective equipment (Section 3.3). The following paragraphs explain the procedure used for the survey, which experts were involved and what questions were included in the questionnaire.

In order to obtain detailed comments on the content of the standards, a procedure was selected which allowed the experts to give a qualitative assessment of the standards and draft standards for specific types of PPE in response to specific questions. The group of experts rep-

resented a variety of institutions and covered all PPE areas. The experts were asked to draw on their knowledge and experience when answering the questions to assess and explain how standards are applied in the production, testing, certifying and use of PPE.

The experts questioned were divided into two groups, as follows:

- ☐ the first group was comprised of experts who had practical experience of all PPE types and were thus asked to assess PPE standards generally. To this end, they were asked to give general answers to the questions and to provide specific examples, where possible, to back up their comments;
- ☐ the experts in the second group were questioned on specific types of PPE. In these special questionnaires, questions 1 to 10 were answered for each and every standard or draft standard. For questions 11 to 14, the experts were asked to comment on the general level of standardization for the PPE type concerned.

In the majority of cases, the questions were answered in writing. In several cases, however, the study's authors also interviewed the experts in person. This made it possible, apart from clarifying important details, to obtain explanations based on practical examples.

The aim of the survey was to gain as broad a range as possible of opinions and information, which then served as the main basis for the analysis of the standards for the different PPE types (Section 4) and the general evaluation of the level of progress in PPE standardization (Section 5).

3.3 Experts Questioned

The OH&S impacts of standardization in the field of personal protective equipment affect many stakeholders. In order to present as broad a range of opinions as possible, the process for selecting experts for the survey was designed to ensure that both manufacturers and users as well as representatives of notified bodies, statutory accident insurance institutions and authorities had their say.

The experts were chosen for the following reasons:

- ☐ experts representing well-known PPE manufacturers were questioned due to their many years of experience in the application of PPE standards in the manufacturing of their products and due to their sector-specific knowledge;
- ☐ experts from notified bodies for PPE were consulted because they have extensive experience concerning the testing methods in PPE standardization;

- ☐ in addition, experts representing the statutory accident insurance institutions, who are involved in the relevant working groups of the "committee of experts for PPE", were questioned. They have experience in standardization work, knowledge of the likelihood and severity of accidents, are familiar with how PPE is used and are often involved in PPE certification; and
- ☐ users were also asked to assess the standards because they select the PPE products that they then use on a day-to-day basis and thus have important experience of the standards in practice.

Furthermore, when selecting the experts, care was taken to ensure that at least one expert for each PPE type from the manufacturers, test institutes and the statutory accident insurance institutions was involved, the intention being to achieve as balanced a reflection as possible of the opinions held.

In general, the experts were either directly or indirectly involved in the work of the European or international standards bodies for their fields. This made it possible to obtain informed comments on the European and the international standards with regard to occupational health and safety.

List of survey participants

Manufacturers

- ☐ Alwit GMBH, Emmerich-Elten
- ☐ Bartels & Rieper GmbH & CO., Cologne
- ☐ Bernhardt Apparatebau GmbH & Co., Wedel
- ☐ Dalloz Safety GmbH, Lübeck
- ☐ Dräger Sicherheitstechnik GmbH, Lübeck
- ☐ Fachverband Berufs-, Sport- und Freizeitbekleidungsindustrie e.V., Cologne
- ☐ Interessenverbund PSA – IVPS e. V., Berlin
- ☐ Kächele-Cama Latex GmbH, Eichenzell
- ☐ Marquardt & Schulz work wear GmbH, Hanover
- ☐ Schuberth Helme GmbH, Braunschweig
- ☐ Söll GmbH Steigschutztechnik, Hof/Saale
- ☐ Stihl AG & Co., Waiblingen
- ☐ 3M Deutschland GmbH, Neuss
- ☐ Hauptverband der Deutschen Schuhindustrie e.V., Offenbach

Test institutes

☐ Berufsgenossenschaftliches Institut für Arbeitssicherheit (BIA), Sankt Augustin

☐ Kuratorium für Waldarbeit und Forsttechnik e.V. (KWF), Groß-Umstadt

☐ DMT – Gesellschaft für Forschung und Prüfung mbH, Bochum

☐ Prüf- und Zertifizierungsstelle des Fachausschusses "PSA", Erkrath

Statutory accident insurance institutions

☐ Bau-Berufsgenossenschaft Rheinland und Westfalen, Wuppertal

☐ Bau-BG Frankfurt, Frankfurt/M

☐ Bergbau-Berufsgenossenschaft, Bochum

☐ Berufsgenossenschaft der chemischen Industrie, Heidelberg

☐ Berufsgenossenschaft Nahrungsmittel und Gaststätten, Mannheim

☐ Binnenschiffahrts-Berufsgenossenschaft, Duisburg

☐ Fleischerei-Berufsgenossenschaft, Mainz

☐ Bundesverband der Unfallkassen, Munich

☐ Süddeutsche Metall-BG, Nuremberg

Users

☐ Henkel KG, Düsseldorf

☐ Hochtief, Essen

☐ Philipp Holzmann AG, Neu-Isenburg

☐ Polizeitechnisches Institut, Münster

☐ STRABAG AG, Cologne

☐ Thyssen Krupp Stahl AG, Kreuztal

☐ VTH, Düsseldorf

Authorities

☐ Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA), Dortmund

☐ Bundesministerium für Arbeit und Sozialordnung, Bonn

☐ Ministerium für Umwelt und Verkehr Baden-Württemberg, Stuttgart

☐ Staatliches Amt für Arbeitsschutz Wuppertal, Wuppertal

☐ Landesanstalt für Arbeitsschutz Nordrhein-Westfalen, Düsseldorf

3.4 Questionnaire

The standards and draft standards were analysed on the basis of a questionnaire containing fourteen questions. The questions were based on those in the questionnaire used for the previous study in 1997 and were adapted, in cooperation with the project working group, to the topics currently of key importance in standardization. The following questions were put to the experts:

3 Survey on PPE Standardization

1. Do European product standards, draft European product standards or still valid national standards cover all of the relevant basic safety requirements of Directive 89/686/EEC and therefore allow certification/the EC type examination?
2. Are the product requirements specified in standards useful in helping the user select a suitable product?
3. Do the standards contain requirements for products concerning the structure of manufacturers' information leaflets in accordance with Directive 89/686/EEC?
4. Do standardization projects take sufficient account of the problem of PPE compatibility (interference between different PPE types)?
5. How are ergonomic aspects covered in standardization? Does the cooperation between the PPE CEN/TCs and CEN/TC 122 JWG 9 "Ergonomics" take account of the needs of occupational health and safety?
6. Does the choice of test methods specified in the standards make sense as far as representativeness and reproducibility are concerned?
7. Are the cost/benefit ratios of the test methods appropriate? Can new standards be expected to cause further increases in test costs?
8. Do the standards on testing methods developed by CEN/TCs or by ISO outside PPE committees (quoted standards) fulfil their purpose as far as occupational health and safety is concerned?
9. Is further harmonization of safety and ergonomic requirements and test methods for various PPE types regarding protection against the same hazard (e.g. flammability test) possible and practicable?
10. How are the results of the European Co-ordination of Notified Bodies for PPE incorporated in the further development of standards and where do the notified bodies see a need for action?
11. How do the German experts rate the level of occupational health and safety provided by the individual documents?
12. In which standardization projects was or is Germany not able to assert its occupational health and safety interests? What were or are the reasons?
13. How does ISO standardization influence the development of OH&S requirements?
14. In which standardization projects and with what measures should KAN exert influence to promote the position of occupational health and safety?

Based on the questions discussed kn Section 3, this section presents the survey results for each specialist area and each standard.

The personal protective equipment is divided into nine categories (4.1 – 4.9), as in the PPE categorization guide[1]. Consequently, the terms used do not always correspond to the names of the standards bodies. The current state of play with regard to standardization is presented in general for each PPE type. To this end, the CEN, ISO and, where appropriate, DIN standards plus any draft standards used in the basis for this study are listed.

Depending on the nature and form of the survey answers, the standard-specific and generic aspects of each PPE type were evaluated and presented either separately or together.

In the evaluation of the comments, efforts were made to present group opinions. Any opinions differing from the group opinion are also mentioned.

4.1 Respiratory Protective Equipment

Safety requirements and test methods for respiratory protective equipment are specified in the following European standards and draft standards, drawn up in CEN/TC 79 "Respiratory Protective Devices".

For the sake of clarity, the standards and draft standards are listed under the subcommittees (SCs) responsible.

SC 1
Terminology, Definitions, Classification and Senection

- ☐ EN 132:1998 "Respiratory protective devices – Definitions of terms and pictograms"
- ☐ EN 133:1990 "Respiratory protective devices – Classification"
- ☐ EN 134:1998 "Respiratory protective devices – Nomenclature of components"
- ☐ EN 12021:1998 "Respiratory protective devices – Compressed air for breathing apparatus"

SC 2
Physiological Requirements

No standards

SC 3
Facepieces

- ☐ EN 136:1997+AC1:1998 "Respiratory protective devices – Full face masks – Requirements, testing, marking"

[1] A document produced by the European Commission's working group on "Personal Protective Equipment" as an aid to users of the PPE Directive

- ☐ EN 140:1998+AC 1:1999 "Respiratory protective devices – Half masks and quarter masks – Requirements, testing, marking "
- ☐ prEN 142:2001 "Respiratory protective devices – Mouthpiece assemblies – Requirements, testing, marking"
- ☐ EN 148-1:1999 "Respiratory protective devices – Threads for facepieces – Part 1: Standard thread connection"
- ☐ EN 148-2:1999 "Respiratory protective devices – Threads for facepieces – Part 2: Centre thread connection"
- ☐ EN 148-3:1999 "Respiratory protective devices – Threads for facepieces – Part 3: Thread connection M 45 x 3"
- ☐ prEN 149:1998 "Respiratory protective devices – Filtering half masks to protect against particles – Requirements, testing, marking"
- ☐ prEN 405:1998 "Respiratory protective devices – Valved filtering half masks to protect against gases or gases and particles – Requirements, testing, marking"
- ☐ EN 1827:1999 "Respiratory protective devices – Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only – Requirements, testing, marking"
- ☐ prEN 13105:1997 "Respiratory protective devices – Full face masks connected with fire fighters head protection for use as a part of a respiratory protective device – Requirements, testing, marking"

SC 4
Filters and Absorption Devices

- ☐ EN 141:2000 "Respiratory protective devices – Gas filters and combined filters – Requirements, testing, marking"
- ☐ EN 143:2000 "Respiratory protective devices – Particle filters – Requirements, testing, marking"
- ☐ EN 371:1992 "Respiratory protective devices – AX gas filters and combined filters against low boiling organic compounds – Requirements, testing, marking"
- ☐ EN 372:1992 "Respiratory protective devices – SX gas filters and combined filters against specific named compounds – Requirements, testing, marking"
- ☐ EN 403:1993 "Respiratory protective devices for self-rescue – Filtering devices with hood for self-rescue from fire – Requirements, testing, marking"
- ☐ EN 404:1993 "Respiratory protective devices for self-rescue – Filter self-rescuer – Requirements, testing, marking"
- ☐ EN 12083:1998 "Respiratory protective devices – Filters with breathing

hoses, (Non-mask mounted filters) – Particle filters, gas filters, and combined filters – Requirements, testing, marking"

SC 5
Fresh Air Hose and Compressed Air Line Breathing Apparatus

☐ EN 138:1994 "Respiratory protective devices – Fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly – Requirements, testing, marking"

☐ EN 139:1993 "Respiratory protective devices – Compressed air line breathing apparatus for use with a full face mask, half mask or a mouthpiece assembly – Requirements, testing, marking" in conjunction with EN 139/A1:1999

☐ EN 269:1994 "Respiratory protective devices – Powered fresh air hose breathing apparatus incorporating a hood – Requirements, testing, marking"

☐ EN 270:1994 "Respiratory protective devices – Compressed air line breathing apparatus incorporating a hood – Requirement, testing, marking" in conjunction with EN 270/A1:2000

☐ EN 271:1995 "Respiratory protective devices – Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations – Requirements, testing, marking" in conjunction with EN 271/A1:2000

☐ EN 1835:1999 "Respiratory protective devices – Light duty construction compressed air line breathing apparatus incorporating a helmet or a hood – Requirements, testing, marking"

☐ EN 12419:1999 "Respiratory protective devices – Light duty construction compressed air line breathing apparatus incorporating a full face mask, half mask or quarter mask – Requirements, testing, marking"

SC 6
Self-Contained Breathing Apparatus

☐ EN 137:1993 "Respiratory protective devices – Self-contained open-circuit compressed air breathing apparatus – Requirements, testing, marking"

☐ prEN 144-1:1998 "Respiratory protective devices – Gas cylinder valves – Part 1: Thread connections for insert connector"

☐ EN 144-2:1998 "Respiratory protective devices – Gas cylinder valves – Part 2: Outlet connections"

☐ EN 145:1997 "Respiratory protective devices – Self-contained closed-circuit breathing apparatus compressed oxygen or compressed oxygen-nitrogen type – Requirements, testing, marking" in conjunction with EN 145/A1:2000

☐ EN 400:1993 "Respiratory protective devices for self-rescue – Self-contained closed-circuit breathing apparatus – Compressed oxygen escape apparatus – Requirements, testing, marking"

☐ EN 401:1993 "Respiratory protective devices for self-rescue – Self-contained closed-circuit breathing apparatus – Chemical oxygen (KO2) escape apparatus – Requirements, testing, marking"

☐ EN 402:1993 "Respiratory protective devices for escape – Self-contained open-circuit compressed air breathing apparatus with full face mask or mouthpiece assembly – Requirements, testing, marking"

☐ EN 1061:1996 "Respiratory protective devices for self-rescue – Self-contained closed-circuit breathing apparatus – Chemical oxygen (NaClO3) escape apparatus – Requirements, testing, marking"

☐ EN 1146:1997 "Respiratory protective devices for self-rescue – Self-contained open-circuit compressed air breathing apparatus incorporating a hood (compressed air escape apparatus with hood) – Requirements, testing, marking" in conjunction with EN 1146/A1:1998 and EN 1146/A2: 1999

☐ prEN 13794:1999 "Self-contained closed-circuit breathing apparatus for self-rescue – Requirements, testing marking"

SC 7
Diving Apparatus

☐ EN 250:2000 "Respiratory equipment – Open-circuit self-contained compressed air diving apparatus – Requirements, testing, marking"

SC 8
Powered Respirators

☐ EN 12941:1998 "Respiratory protective devices – Powered filtering devices incorporating a helmet or a hood – Requirements, testing, marking"

☐ EN 12942:1998 "Respiratory protective devices – Power assisted filtering devices incorporating full face masks, half masks or quarter masks – Requirements, testing, marking"

SC 9
Interpretation of CEN/TC-79 Standards

☐ prEN 13274-1:2001 "Respiratory protective devices – Methods of test – Part 1: Determination of inward leakage and total inward leakage"

☐ EN 13274-2:2001 "- Part 2: Practical performance tests"

☐ prEN 13274-3:1998 "- Part 3: Determination of breathing resistance"

- ☐ prEN 13274-4:1998 "- Part 4: Flame tests"
- ☐ prEN 13274-5:2001 "- Part 5: Climatic conditions"
- ☐ prEN 13274-6:2000 "- Part 6: Determination of carbon dioxide content of the inhalation air"
- ☐ prEN 13274-7:2000 "- Part 7: Determination of particle filter penetration"
- ☐ prEN 13274-8:2000 "- Part 8: Determination of dolomite dust clogging"

Some of the draft standards listed under the sub-committees (SCs) are revisions of existing European standards intended to adapt them to current developments in standardization and the state of the art. This applies to the following valid European standards:

- ☐ EN 144-1:1991 "Respiratory protective devices - Gas cylinder valves - Part 1: Thread connections for insert connector"
- ☐ EN 149:1991 "Respiratory protective devices – Filtering half masks to protect against particles – Requirements, testing, marking"
- ☐ EN 405:1992 "Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking"
- ☐ EN 142:1989 "Respiratory protective devices – Mouthpiece assemblies – Requirements, testing, marking"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

Assessment of Standard-Specific and Generic Aspects

The first European standards for respiratory protective devices were prepared by CEN/TC 79 back in 1986. This meant that this TC had more time for developing standards and, in particular, for prenormative research. Furthermore, many standards have already been revised in the past as a result of the new findings and experiences of notified bodies and as a result of product innovations. It can therefore be assumed that there are fewer deficiencies in these standards compared with other PPE types. The fact that the answers provided by the experts are more general than detailed is further indication of this. For this reason, this analysis is not divided into standard-specific and generic aspects. The deficiencies in the standards and draft standards mentioned by the respondents are supplied as examples.

prEN 13105:1997 was excluded from the analysis because it was rejected in the formal voting process. The fact that the draft standard specified that the full face mask should be attached to the helmet at two points was considered problematic. This attachment method was deemed insufficient since, if the helmet or the mask were subject to an impact, leaks could develop around the facepiece or, at worst, an adapter could come loose and the mask could fall off. It remains to be seen what will happen with this draft standard.

Generally speaking, the experts feen that the existing European standards and the draft European standards do cover the basic health and safety requirements of Directive 89/686/EEC. This means that, in principle, respiratory protective products can be certified on the basis of these standards.

The experts suggest the following improvements and additions to the standards:

- ☐ due to special international requirements for firefighter equipment, EN 137:1993, which is currently being revised, is to introduce a flash-over test for self-contained apparatus for special applications. In this respect, it is suggested that Class 3 facepieces (as described in EN 136:1997 + AC1:1998) should always be tested using the same flame-resistance requirements;
- ☐ in EN 137:1993 and the draft amendment, the permissible total weight of the device when ready for use is still given as 18 kg. With the introduction of the lighter composite compressed-air cylinders, the permissible device weight should be considerably reduced, e.g. to 15 kg. This would significantly decrease the load carried by the wearer;
- ☐ in accordance with EN 250:2000, divers can currently use either a pressure gauge or a warning device. In the experts' opinion, it would be more useful to specify in the standard that both devices should be used during dives so as to ensure redundancy in hazardous situations;
- ☐ EN 372:1992 specifies a fixed test-gas concentration of 0.5 Vol% for filter-testing. However, where SX filters are used the gas concentration can be below this value because the gas evaporates before. Testing SX filters using small concentrations of gases is thus considered problematic. Consequently, requirements for retaining various SX gases should be incorporated in the standard. EN 372:1992 should specify which materials and which test-gas concentration should be used for testing since the breakthrough time recorded with the special

test gases is longer when the concentrations are lower. Presently, systems consisting of several materials cannot be tested at all;

- ☐ it was pointed out that there was a translation error in EN 1835:1999. The German version distinguishes between "light" and "heavy" work. This distinction does not exist in the English version. The term "light duty" in the English document refers only to the mechanical stress which the device can withstand.

In addition, the experts point out that electronic components are increasingly being used as display or warning elements in devices. They consider it necessary to introduce additional requirements for such electronic components because the temperature range used for testing respiratory protective equipment differs from that specified in the "Directive for electrical equipment for potentially explosive atmospheres" (ATEX).

Opinion is divided when it comes to PPE compatibility. According to the manufacturers, this issue is given sufficient consideration, the only exception being EN 136:1997+AC1:1998. This standard fails to cover combined use of a full face mask with a protective helmet.

Different requirements apply to helmets and full face masks although both PPE types are used in the same hazardous situations. One example of this is the test for resistance to radiant heat. In this test, a radiation level of 7 kW/m^2 is used for helmets and a radiation level of 8 kW/m^2 for full face masks.

In the testers' opinion, the standards do not give sufficient consideration to PPE compatibility. A combination comprising eye protectors, protective helmet and chemical protective clothing is just as much an everyday phenomenon as, for example, helmet and mask combinations. Nonetheless, there is currently no standard to specify the requirements to be met by such combinations. In the view of the testers, cooperation between the various PPE committees in this area could be closer and thus the harmonization better.

The respondents report that the standards for respiratory protective equipment take account of ergonomic aspects to a large extent. Some additions should be made when standards, e.g. EN 138: 1994, are revised. Some of the ergonomic requirements are basic requirements, e.g. concerning the mass of the respiratory protective device as ready for use or effects on the skin. The standards also specify wearer tests. However, these aspects are currently not dealt with under the heading "Ergonomics" in the standards. The

respondents would like to see better structuring with more systematic integration of ergonomic aspects in the standards.

The testers comment that it is not possible to judge the cooperation between the CEN/TCs and JWG 9 of CEN/TC 122 for "Ergonomics" at the moment because there are no concrete guidelines for such cooperation as yet. Methods and strategies developed by JWG 9 are currently being discussed. The manufacturers view JWG 9's work as useful in principle. At present, however, JWG 9's documents contain too few concrete details that could be incorporated into the standards. They should thus only be published as technical reports and not as European standards.

The reproducibility and representativeness of the test methods used in the standards are generally assessed as positive. However, the testers express reservations in the case of EN 141: 2000 since it does not take into account that the filter performance can diminish once the filters have been stored after use. The relevant bodies are aware of this problem and it will be taken into consideration in the next revision of the standard.

In general, the experts consider the cost/benefit ratio of the test methods to be balanced. Although certain standards may entail increased testing costs, a substantial rise in testing costs is not expected. The testers cite the "paraffin oil test" as an example of a new test but even here the costs are expected to increase by a reasonable amount. In the manufacturers' opinion, however, the tests for EN 137:1993 will cause costs to rise because the devices used and all firefighting equipment have to undergo a flashover test. This can be expected to raise costs significantly but, with the protection of the user in mind, the increase is still considered reasonable.

The respondents feel that harmonization of safety and ergonomic requirements and test methods is both necessary and desirable. They argue that various PPE types are used in the same hazardous situations and that they should thus fulfil the same requirements.

The need for the test methods to be harmonized has been recognized and is already taken into account in numerous draft standards. prEN 13274-1:2001 has already harmonized test methods by using the same test (to determine the inward leakage) as is used for anti-dust suits (prEN ISO 13982-2:1999).

The CO test for CO filters is also to be harmonized. It can be assumed that the requirements for the mining industry will

be copied in the standards for respiratory protection, thus harmonizing the requirements at a high level.

In the area of respiratory protection, many members of the VG 2 vertical group of the European Coordination of Notified Bodies for PPE are also active in the field of standardization. This means that there is a direct flow of information between the European Coordination of Notified Bodies and the standards bodies, enabling round-robin tests to be initiated on the basis of the recommendations and permitting direct influence on standardization.

In the experts' view, there is a need for the testing bodies to take action to harmonize the particle size distribution for solid and liquid test aerosoles. Furthermore, the notified bodies' interpretation of the standards must be harmonized to a greater extent.

It is not yet possible to comment on the influence of ISO standardization in the area of respiratory protection because European and ISO standardization currently deal with different issues. Nonetheless, it can be expected that ISO will deal with respiratory protection in future. The manufacturers view the ISO standards positively because they harmonize requirements for all countries – beyond the boundaries of the EU.

Overall, the extent to which occupational health and safety (OH&S) is considered in the standards prepared by CEN/TC 79 "Respiratory protective devices" is viewed positively. From the point of view of OH&S, the present standards are absolutely suitable for producing high-quality and safe respiratory protective equipment. However, the respondents fear that the level of OH&S could be reduced or called into question in the future if OH&S experts' participation in standardization is restricted for reasons of cost. The respondents report that it was not always possible to assert German OH&S requirements in the standardiztion projects because, on the one hand, the different EU states had different experiences and rules for use and, on the other, they attached different degrees of importance to safety requirements.

4.2 Equipment for Eye Protection and Full or Partial Face Protection

Safety requirements and test methods for equipment for eye protection, full and partial face protection are specified in the following European standards and draft standards, drawn up in CEN/TC 85 "Eye protective equipment:"

- ☐ prEN 166:1998 "Personal eye-protection – Specifications"

- ☐ prEN 167:1998 "Personal eye-protection – Optical test methods"
- ☐ prEN 168:1998 "Personal eye-protection – Non-optical test methods"
- ☐ prEN 169:2000 "Personal eye-protection – Filters for welding and related techniques – Transmittance requirements and recommended utilisation"
- ☐ prEN 170:1999 "Personal eye-protection – Ultraviolet filters – Transmittance requirements and recommended use"
- ☐ prEN 171:1999 "Personal eye-protection – Infrared filters – Transmittance requirements and recommended use"
- ☐ EN 175:1997 "Equipment for eye and face protection during welding and allied processes"
- ☐ EN 207:1998 "Personal eye-protection – Filters and eye-protectors against laser radiation (laser eye-protectors)"
- ☐ EN 208:1998 "Personal eye-protection – Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors)"
- ☐ EN 379:1994 "Specification for welding filters with switchable luminous transmittance and welding filters with dual luminous transmittance" in conjunction with EN 379/A1:1998
- ☐ EN 1731:1997 "Mesh type eye and face protectors for industrial and non-industrial use against mechanical hazards and/or heat" in conjunction with EN 1731/A1:1997
- ☐ EN 12254:1998 "Screens for laser working places – Safety requirements and testing"
- ☐ CR 13464 "Guide to selection, use and maintenance of occupational eye and face protectors"

Several of the draft standards listed above are draft revisions of existing European standards intended to adapt them to current developments in standardization and the state of the art. This applies to the following valid European standards:

- ☐ EN 166:1995 "Personal eye-protection – Specifications"
- ☐ EN 167:1995 "Personal eye-protection – Optical test methods"
- ☐ EN 168:1995 "Personal eye-protection – Non-optical test methods"
- ☐ EN 169:1992 "Personal eye-protection – Filters for welding and related techniques – Transmittance requirements and recommended utilisation"
- ☐ EN 170:1992 "Personal eye-protection – Ultraviolet filters – Transmittance requirements and recommended use"

☐ EN 171:1992 "Personal eye-protection – Infrared filters – Transmittance requirements and recommended use"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

Assessment of Standard-Specific and Generic Aspects

The analysis of the standards is not divided into standard-specific and generic aspects since the answers provided by the experts were more of a general nature. Deficiencies in the standards and draft standards are supplied as examples.

EN 1731:1997 "Mesh type eye and face protectors for industrial and non-industrial use against mechanical hazards and/or heat" is currently being revised. The revision process has identified some points requiring improvement. For example, although the standard does describe mesh-type face protectors, which provide protection against heat amongst other things, it does not define any test requirements with regard to protection against heat or heat radiation. It is also still perfectly possible that EN 1731 will be integrated into EN 166 by adding requirements to EN 166:1995 or that the aspect of protection against heat will be removed from EN 1731 as a result of ISO standardization. EN 1731 is therefore not assessed in this study as it remains to be seen how the situation develops.

By and large, the respondents feel that the product requirements in the standards and draft standards in the field of eye protection are useful and suitable for helping users select appropriate products. Reservations were expressed with regard to prEN 166:1998 since, though the strength requirements in the impacting test and the shooting test can be checked with a good degree of reproducibility, they are difficult to implement in practice and can thus only be interpreted to a restricted extent. Improvements also need to be made to the filter categories in prEN 169:2000. It was argued that many of the filter categories listed in the tables played no role in practice since industry did not offer them.

PPE compatibility has been the subject of discussion for all of the standards on eye protection for some time. At present, these matters are covered by standards and draft standards for different types of PPE. The example of the overlap between respiratory protection and eye protection was cited. The standards for res-

piratory protection contain some requirements pertaining to eye protection. A comparison of the standards shows that requirements, e.g. for the field of vision, specified in the EN 166 standard, which deals specifically with eye protection, are not included in the standards on respiratory protection. Consequently, these PPE products are not always suitable for prolonged use, from the point of view of eye protection, since the optical quality can be poor. In the respondents' view, cooperation between the various PPE committees in this area could be closer and thus the harmonization better.

Ergonomic aspects are being given increasing consideration in the standards regarding eye protection. EN 175:1997, for example, contains ergonomic requirements for the mass or width of headbands. It is often difficult to translate ergonomic requirements into testing requirements. The definition of the field of vision, the head form, fundamental optical requirements and the effects on the skin were quoted as examples of this. The suggestion was made that a project be initiated to draw up a list of findings. This list of findings could be used, for example, to ascertain whether the effects on the skin really always have to be tested.

The work of JWG 9 of CEN/TC 122 "Ergonomics" was criticized because its proposals are felt to be too abstract and general. It does not provide concrete specifications which could be implemented in line with actual conditions.

All in all, the experts give a positive assessment of the reproducibility and representativeness of the test methods in the field of eye protection. In prEN 168: 1998, problems are caused by the test method to determine the protection against coarse dust, the optional fogging test method and the optional test method to establish scratch resistance, which are outlined below.

- ☐ Test method to determine protection against coarse dust

  The standard specifies that "pulverized coal" should be used as the test dust in this method. This specification is too general because it is difficult to obtain coal dust with similar granular structures. Moreover, the granular structure alters during the test. A further difficulty is posed by the position of the goggles, which rest on a fabric cloth and have to be removed after the test. When the goggles are removed, additional dust could fall from them onto the cloth and thus have a negative influence on the reflection measurement.

- ☐ Test method to establish the fogging resistance of the oculars

In this test method, a temperature-adjusted ocular is held over steam to ascertain when it beings to fog. This method is very subjective because the tester judges when an ocular can be considered fogged. A round-robin test of this test method indicated a large dispersion of test results. It is therefore extremely difficult to define a limit above which an ocular is deemed fogged. A further point of criticism relates to the requirement that the ocular should remain unfogged for at least 8 s. This requirement is considered unrealistic. Consequently, the experts consider it imperative that the test be carried out on a wearer.

- Test method to establish surface resistance to damage caused by fine particles

  In the sand-trickling test, there is a problem with regard to the granular structure of the sand. Even when the test is carried out several times, it is difficult to reproduce the granular structure of the sand exactly.

  A further problem is that this test method does not permit a comparison between different types of glass. For example, the result of a test on synthetic glass can be better than that for mineral glass even though the latter is harder.

  At present, it is only possible to determine which product is best suited to a certain purpose on the basis of experience with the products in practical use. For instance, mineral glass would be more suitable for coal mining than synthetic glass even though its test results might be poorer. Thus, in objective terms, this test method only establishes whether the tested glass fulfils the requirements of the standard.

The respondents take a very critical stance on the cost/benefit ratio of these test methods. For example, extensive test series have to be carried out for prescription protective lenses although the spot checks can only provide a representative assessment. This leads to significant test costs which are very difficult for small and medium-sized companies to bear because the cost pressure in the field of PPE means that these test costs can only be compensated for by large-scale production. The relevant standards should thus also accept small test series in view of the cost/benefit aspects. One possibility mentioned was a "worst-case test". For example, an extremely convex, an extremely concave and an average-strength lens could be used for testing purposes to determine a range within which the products' values must fall.

Ergonomic requirements could increase test costs because it would often only be possible to ascertain ergonomic charac-

teristics of PPE by using wearer tests.

The respondents feel that it is both necessary and desirable to harmonize safety requirements and test methods for the different types of PPE. In their opinion, it would be perfectly possible to harmonize, for example, the flaming test with those tests used in the fields of respiratory protection and protective clothing. It is difficult to understand why the flaming test for protective clothing should be different to that for a visor, for instance, although both are worn in the same hazardous situation.

Another example cited as a possible area for harmonization was the test to establish the protection provided by welders' protective hoods against penetration by hot solid bodies (EN 175:1997) as compared to the test on the effects of small splashes of molten metal on welders' protective clothing (EN 470-1:1995). Both tests cover the same risk but their methods are different. It would also be possible to harmonize the normal temperature of test samples for the different PPE types.

The respondents make an urgent request that decisions should be taken more swiftly in the European Coordination of Notified Bodies, particularly since its results are also supposed to be discussed in the standard-revision process and, here too, acted upon as quickly as possible.

In the experts' opinion, it would also be useful if the VG 3 vertical group of the European Coordination of Notified Bodies for PPE were also to handle secondary eye-protection areas, such as sunbed goggles, and issue appropriate recommendations on them. Presently, testers and, particularly, certifiers repeatedly have to determine test criteria to establish that the requirements of the directive have been fulfilled, and then carry out the testing, wherever PPE for eye protection which does not fit into the customary classification structure is to be tested.

It would also be desirable if the recommendations issued by the European Coordination of the Notified Bodies for PPE were to be binding upon the notified bodies.

In the respondents' view, OH&S is taken into consideration to a good extent in the standards and the test-method standards developed outside the PPE committees. From the German point of view, the level of OH&S in the European standards on eye protection has at least been maintained. So far, it has always proven possible in CEN/TC 85 to give sufficient consideration to important German OH&S requirements –

sometimes by means of compromise. This has not impaired the protection provided by eye-protection products in practical use.

ISO standardization does not yet have a significant influence in the field of eye protection. However, it is foreseeable that it will play an increasingly important role in this area of standardization in future. This trend is being pushed by some European countries, e.g. the United Kingdom, in order to ensure uniform standards worldwide. Consideration is currently being given to how the international standards could be categorized and structured in a clear, modern form. A systematic concept of this kind would have the advantage of less effort being required to revise standards. This international approach would imply the following rules:

- ☐ one basic standard would contain all of the definitions used in the field of eye protection;
- ☐ one basic standard would contain all requirements for eye-protection products although very specific requirements for certain products would be dealt with in special standards, not in this standard;
- ☐ one basic standard would contain all test methods for the field of eye protection;
- ☐ a guideline would be introduced for selecting and using eye-protection products; and
- ☐ a standard for manufacturers would specify a type of template for producing user information.

Since ISO standardization is gaining in significance, it is particularly important that the Berufsgenossenschaften (statutory accident insurance institutions) do not withdraw from standardization but become even more active in order to ensure that the existing expertise benefits the member companies and is not lost. Financial support models would be desirable to enable Berufsgenossenschaft representatives and experts to attend ISO meetings. The respondents believe it would be useful if KAN were to publicly express its opinion on the development of ISO standardization in order to make its standpoint clear. They would also like to see KAN take action to ensure that the interests of the insured persons and business managers are given even more consideration in standardization. KAN should also explore how these groups could be more intensively involved in standardization.

Another suggestion was that better use should be made of the possibilities offered by the new media. Here too, KAN could play a supporting role. For example, standardization projects could be

published on the Internet or discussion forums could be created to discuss, for instance, problems in a certain standard. This would facilitate a very quick and direct exchange of information between the experts.

4.3 Equipment for Head Protection

Safety requirements and test methods for helmets for industrial use are specified in the following European standards and draft standards, drawn up in CEN/TC 158 "Head protection":

- ☐ EN 397:1995 "Industrial safety helmets" in conjunction with EN 397/A1:2000
- ☐ EN 443:1997 "Helmets for firefighters"
- ☐ EN 812:1997 "Industrial bump caps"
- ☐ EN 960:1994 "Headforms for use in the testing of protective helmets" in conjunction with EN 960/A1:1998
- ☐ EN 13087-1:2000 "Protective helmets – Test methods – Part 1: Conditions and conditioning"
- ☐ EN 13087-2:2000 "- Part 2: Shock absorption"
- ☐ EN 13087-3:2000 "- Part 3: Resistance to penetration"
- ☐ EN 13087-4:2000 "- Part 4: Retention system effectiveness"
- ☐ EN 13087-5:2000 "- Part 5: Retention system strength"
- ☐ EN 13087-6:2000 "- Part 6: Field of vision"
- ☐ EN 13087-7:2000 "- Part 7: Flame resistance"
- ☐ EN 13087-8:2000 "- Part 8: Electrical properties"
- ☐ prEN 13087-9:1998 "- Part 9: Mechanical rigidity"
- ☐ EN 13087-10:2000 "-Part 10: Resistance to radiant heat"
- ☐ prEN 14052:2001 "Specifications for high performance industrial safety helmets"

4.3.1 Assessment of Standard-Specific Aspects

EN 397:1995 "Industrial safety helmets" including Amendment A1:2000

EN 397 including Amendment A1 specifies general requirements and requirements for the protective function, test methods and marking requirements for industrial safety helmets.

The basic health and safety requirements in Directive 89/686/EEC specify that PPE

designs should strive for and ensure an optimum level of protection, referred to as the "highest level of protection possible". Currently, only the following is required for the protected area: "The helmet shell should cover the top part of the head and extend at least to the upper edge of the head strap at the front of the helmet (Annex A, normative)". In accordance with this wording, it would be possible to manufacture a helmet which does not offer adequate protection for the sides of the head. The respondents would thus like to see more specific details in the standard (as in EN 443:1997, Clause 5.1 "Protected Area"), e.g. with regard to the absorption characteristics of the helmet inner.

In the respondents' opinion, EN 397 including Amendment A1 gives sufficient consideration to PPE compatibility. Clause 4.10 of the standard mentions that the manufacturer supplies the parts necessary for attaching the helmet accessories or attach the necessary parts to the helmet shell. The helmets are then tested without additional PPE being attached but with any necessary holes or attachment parts. This is deemed adequate since the additional PPE attached does not influence the helmet's test results. The manufacturers comment that the relevant specifications in the standard could be worded more specifically. Additional references in the standard could indicate the standards to be used for testing, for example, a safety helmet's slide-out visor.

The experts criticize the fact that there is no weight limit for the helmet including the accessories. Although this issue has been discussed in the past, it has not yet proven possible to have a weight limit introduced. In particular, the reasons given for this were the desire to give the manufacturers design freedom and the fact that the weight is not the sole factor when it comes to comfort. Other factors, such as the position of the helmet's centre of gravity, also play a role. The respondents point out that, depending on the design, a user might consider a heavy helmet more comfortable than a relatively lighter helmet. They also refer to normative Annex A of the standard, which stipulates that the helmet should be as light as possible without detracting from its rigidity and efficiency.

The "General Requirements" (Clause 4) in EN 397 including Amendment A1 take ergonomic aspects into account. They cover, for example, the minimum distance between the helmet and the wearer's head, which is important for ventilation reasons, and the minimum width of the belt straps. Further details can be found in normative Annex A. The experts would like to see tests for special sizes. Furthermore, in order to improve

comfort, a sweatband, which is currently only recommended, should be required.

EN 443:1997 "Helmets for firefighters"

EN 443:1997 replaces DIN 14940: 1990. The standard specifies the key requirements pertaining to the level of protection, comfort and durability of helmets for firefighters.

The basic requirement for radiation of 7 KW/m^2 in the test for resistance to radiant heat was criticized for not being strict enough. It is recommended that the optional requirement of 14 KW/m^2 be laid down as the basic requirement in the standard because even the simplest materials, such as polyethylene, can comply with the required resistance to radiant heat at a radiation level of 7 KW/m^2.

EN 443 takes PPE compatibility into account by listing possible additional equipment (e.g. neck protection, eye and/or face protection) though it stipulates that the attachment fittings must be provided for the additional equipment if they are not a permanent part of the helmet. The standard also specifies that the helmet must not interfere with the wearing of an independent respiratory device or spectacles/protective goggles. However, the experts consider it problematic that although the helmet with the attached additional equipment must meet the requirements of EN 443, it only has to be tested in the condition in which it is sold. This makes it possible to test a firefighter's helmet without the additional equipment. The example given was that the respiratory protective equipment can slip in the test conducted to establish the shock absorption of a firefighter's helmet. As with EN 397 including Amendment A1, the manufacturers criticize the lack of concrete normative references to test methods.

The respondents also criticize the fact that EN 443 contains only a small number of ergonomic requirements. There are currently only a few general ergonomic aspects in Clause 4 "General Characteristics" and in Clause 5 "Requirements" (specification of the field of vision).

EN 443:1997 is currently being revised.

EN 812:1997 "Industrial bump caps"

EN 812:1997 specifies physical requirements and performance requirements, test methods and marking requirements for industrial bump caps.

As with EN 397 including Amendment A1, EN 812 poses the problem that it does not include a clause which defines in detail the area to be protected. How-

ever, this is now to be remedied in an amendment. The amendment will define the area to be protected but it will only refer to the longitudinal axis of the helmet, not the transverse.

As concerns the consideration given to PPE combinability, the comments were the same as for EN 397 including Amendment A1.

In general, the respondents feel that the cost/benefit ratio of the test methods specified in EN 397 including Amendment A1, EN 443 and EN 812 are mainly balanced. One suggestion for a way to reduce test costs concerns the UV ageing. It was proposed that a 500 Watt Xenon high-intensity lamp should be used instead of a 450 Watt lamp since the former is available ex stock whilst the latter, being a customized product, is much more expensive.

EN 960:1994 including Amendment A1:1998 "Headforms for use in the testing of protective helmets"

EN 960:1994 specifies the size and design details of head forms used for testing protective helmets. The specified dimensions were determined on the basis of anthropological data and thus make for an almost life-like imitation of the human head. The standard is currently being revised. Dimensions for child head sizes will be added in the revised version. These dimensions were determined using linear regression. This means, however, that the new data does not reflect real child head shapes since children's heads grow at a different rate than adults'; anthropological indicators should be used to determine the dimensions of the head forms instead.

The revision process also revealed that the existing data contained inconsistencies which manifested themselves in the form, for example, of dents or peaks on the surface of the head form when it was built exactly in accordance with the dimensions. It was therefore decided that the inconsistencies should be remedied in order to obtain a smooth surface. This is welcomed by the German experts.

EN 13087-1:2000 to EN 13087-8:2000, prEN 13087-9:1998, EN 13087-10:2000 "Protective helmets – Test methods"

These European standards and the draft standard are intended to supplement the product standards specific to protective helmets. They describe various test methods which can be used for complete helmets or parts thereof. The product standards, e.g. for firefighters' helmets, industrial safety helmets or bicycle helmets, can refer to these standards as a basis for

testing. The EN 13087 series of standards was drawn up because of the desire to harmonize the existing test methods in the different standards for protective helmets. Since neither the test scope nor the requirements have been increased, the test costs are not expected to rise.

However, where certain head-form sizes are used, test costs *may* increase. For example, EN 13087-4, Clause 5.3.2 "Head Forms" reads: "The head forms must comply with EN 960:1994, Clause 2 and Clause 4. The sizes to be used are specified in the helmet standard and must be selected from among the sizes A, C, E, G, J, K, M and O". Some standards for helmets specify different head-form sizes, e.g. the standard for industrial safety helmets, in which Clause 6.4.2 "Selection of Sizes" stipulates sizes D, G and K. In isolated cases, such differences can create additional costs because the testing bodies have to purchase new head forms.

Overall, the test methods in the various parts of the standard (EN 13087-1 to -8 and -10) were given a good rating.

However, the testers point out problems with the following standards:

☐ EN 13087-2:2000 "Protective helmets – Test methods – Part 2: Shock absorption"

This standard describes test methods for establishing protective helmets' shock-absorption levels. Round-robin tests have shown that there can be a very large dispersion of test results across test institutes. This is linked to whether the helmet is correctly fixed to the head form. Clause 5.1 "General Information" specifies that the helmet must be fixed in accordance with the manufacturer's instructions or, where there are no such instructions, in a way which is typical for the intended use. This wording is deemed inadequate. It would be useful if the standard were to define a specific pressure for the action of placing the helmet on the head form.

☐ EN 13087-5:2000 "Protective helmets – Test methods – Part 5: Retention system strength"

This standard specifies the method for testing the strength and length adjustment of the retention system. The experts criticize the fact that the test concerning the length adjustment of the retention system, in accordance with Clause 5.2.3.2 (method B), also measures the deformation of the shock-absorbing elements. This can put helmets that offer a good level of shock absorption and are pleasant to wear at a disadvantage.

EN 13087-8 "Protective helmets – Test methods – Part 8: Electrical properties" specifies methods for measuring helmets' electrical properties. CENELEC/TC 78 has prepared a draft standard, prEN 50365 "Electrically insulating helmets for use on low voltage installations", for this area. However, the two standards specify different requirements and test methods. According to CENELEC, EN 13087-8 is considered insufficient.

prEN 13087-9 "Protective helmets – Test methods – Part 9: Mechanical rigidity" specifies the method for testing mechanical rigidity. The respondents complain that the test method holds too many unpredictabilities and does not always deliver reproducible results, which was confirmed by a round-robin test. Another point of criticism is that, although the helmet deformation is measured, no requirements are specified for the effects which the helmet inner's behaviour has on the human head. The German experts rejected this draft as it now stands. As a consequence of this state of affairs, CEN/TC 158 has postponed further work on the standard.

In addition to the problems mentioned in connection with prEN 13087-9, the manufacturers are also critical of the representativeness and reproducibility of the test method stipulated by EN 13087-7 since the burner is not precisely described and no burner temperature is specified.

EN 13087-1 causes manufacturers problems with regard to the cost/benefit ratio because, in their opinion, the artificial ageing procedure is too expensive.

prEN 14052:2001 "Specifications for high performance industrial safety helmets"

prEN 14052 specifies requirements for the physical design, performance, testing and marking of high-performance industrial safety helmets. Such helmets are intended to give the user a significantly higher level of protection that an industrial safety helmet manufactured in accordance with EN 397. Their purpose is to protect the wearer against falling objects and side impacts. This new type of high-performance safety helmet was demanded by representatives of standardization bodies, particularly from the United Kingdom. Germany's OH&S representatives are sceptical about the document. They believe and request that the scope section of the standard should explain more clearly in which cases the user should select a safety helmet in accordance with EN 397 or prEN 14052, since this is presently not clear for the user. They also point out that there are not yet any products on the market that are manufactured in accordance with prEN 14052. It is thus

unclear what form such a product would take and whether there is actually any user demand for it.

prEN 14052 stipulates that comprehensive information concerning use and warnings must be given on a label permanently adhered to the helmet. The font size must be at least 8 points. The respondents doubt that it is possible to accommodate such a large amount of information on a label.

Compared to EN 397 including Amendment A1, major changes have been made to give better consideration to PPE compatibility. If the helmet comes with additional fittings or accessories, the helmet must also fulfil the standard's requirements when the additional fittings or accessories are attached. This development is generally considered positive.

The respondents criticize the method for testing the efficiency of the fastening system (shell, chin strap, etc.). In this test method, ten test persons have to select a sample helmet of an appropriate size, with the helmet adjusted and fitted in accordance with the manufacturer's instructions so that it sits as securely and comfortably as possible. Then the test is carried out. Each test person has to make certain movements. The tester must record whether the helmet falls from the head during the movement. This method cannot deliver reproducible and representative results as it is very subjective. It is therefore rejected by the German experts.

Due to the additional protection against side impacts, more testing is necessary than for EN 397 including Amendment A1. Special test rigs are necessary because the shock-absorption test and the penetration-resistance test are performed at an angle of 80° from the perpendicular. The measuring equipment is more expensive too because the braking deceleration has to be measured in the shock-absorption test due to the need for the test rig to be positioned eccentrically. This requires a new impactor with an integrated accelerometer. Because of these points, the tests can be expected to be more costly than the tests for EN 397 including Amendment A1. From an economic point of view, these cost increases are difficult to justify. The experts are thus generally dubious about the cost/benefit ratio because the potential sales figures are out of all proportion to the high costs of the tests.

4.3.2 Assessment of Generic Aspects

In the opinion of the respondents, harmonization of the test methods in the standards drawn up by CEN/TC 158 – including those for the areas of sport

and recreation – is possible and practicable. For example, helmets manufactured in accordance with EN 443 or EN 812 could be conditioned using the same method as for EN 397 (including Amendment A1). In accordance with EN 397, one to two helmets are tested and subjected to ultraviolet radiation. Harmonizing this test requirement would reduce the number of samples, e.g. for the tests on the firefighters' helmets and the bump caps.

The results of the European Coordination of the Notified Bodies are directly incorporated into the standardization because the employees of the notified bodies are also actively involved in the working groups.

The notified bodies see a need for action with regard to the following issues:

- ☐ uniform interpretation by the notified bodies of Annex II, Clause 1.4, "Information supplied by the manufacturer" of Directive 89/686/EEC;
- ☐ uniform procedure concerning the normative annex "Test Results – Measurement Uncertainty".This annex stipulates that an uncertainty estimate must be given for each measurement. Such uncertainty can be caused, for example, by the calibration of the measuring equipment, imprecise readings, the testers' work, the differences in the materials used in the samples (or the climatic conditions in the laboratory. It is therefore not possible to give a reliable estimate. Consequently, an indication of the uncertainty cannot help the user of the test report assess the reliability of the data;
- ☐ incorporation of an objective method for testing the efficiency of the fastening systems in draft standard prEN 14052:2001 "Specifications for high performance industrial safety helmets", the argument being that similar tests are completely normal in other standards.

According to the respondents, ISO standardization only has a minor influence on the area of head protection at the moment. In the manufacturers' opinion, there are too many committees involved in ISO standardization, with the risk that it is almost impossible to achieve results within a reasonable time frame.

4.4 Equipment for Hearing Protection

Safety requirements and test methods for equipment for hearing protection are specified in the following European standards and draft standards, drawn up in CEN/TC 159 "Hearing protectors":

- ☐ prEN 352-1:2000 "Hearing protectors – General requirements – Part 1: Ear muffs"

- ☐ prEN 352-2:2000 "Hearing protectors – General requirements – Part 2: Ear-plugs"
- ☐ prEN 352-3:2000 "Hearing protectors – Safety requirements and testing – Part 3: Ear-muffs attached to an industrial safety helmet"
- ☐ EN 352-4:2001 "Hearing protectors – Safety requirements and testing – Part 4: Level-dependent ear-muffs"
- ☐ prEN 352-5:2000 "Hearing protectors – Safety requirements and testing – Part 5: Active noise reduction ear-muffs"
- ☐ prEN 352-6:2000 "Hearing protectors – Safety requirements and testing – Part 6: Ear-muffs with electrical audio input"
- ☐ prEN 352-7:2000 "Hearing protectors – Safety requirements and testing – Part 7: Level-dependent ear-plugs"
- ☐ prEN 458:2001 "Hearing protectors – Recommendations for selection, use, care and maintenance – Guidance document"
- ☐ ISO 4869-1:1990 "Acoustics — Hearing protectors — Part 1: Subjective method for the measurement of sound attenuation"
- ☐ ISO 4869-2:1994 "Acoustics — Hearing protectors — Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn"
- ☐ prEN 13819-1:2000 "Hearing protectors – Testing – Part 1: Physical test methods"
- ☐ prEN 13819-2:2000 "Hearing protectors – Testing – Part 2: Acoustic test methods"
- ☐ EN 24869-3:1993 "Acoustics – Hearing protectors – Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes"

Several of the draft standards listed above are draft revisions of existing European standards intended to adapt them to current developments in standardization and the state of the art. This applies to the following valid European standards:

- ☐ EN 352-1:1993 "Hearing protectors – Safety requirements and testing – Part 1: Ear muffs"
- ☐ EN 352-2:1993 "Hearing protectors – Safety requirements and testing – Part 2: Ear plugs"
- ☐ EN 352-3:1996 "Hearing protectors – Safety requirements and testing – Part 3: Ear-muffs attached to an industrial safety helmet"
- ☐ EN 458:1993 "Hearing protectors – Recommendations for selection, use,

care and maintenance – Guidance document"

The new draft standards have introduced changes to the structure of the standards. prEN 352-1:2000 to prEN 352-3:2000 are concerned with general requirements. Part 1 deals with requirements for ear-muffs, Part 2 with requirements for ear-plugs and Part 3 with ear-muffs attached to industrial safety helmets.

prEN 13819:2000 includes the test methods, which are used in the same way for all types of hearing protectors covered by prEN 352-1 to -3. As a distinction is made between two types of test, the standard is divided into two parts. The first part covers the physical test methods, the second part the acoustic test methods.

Additional safety requirements and the related test methods are dealt with in EN 352-4 and draft standards prEN 352-5 to -7. Part 4 is concerned with level-dependent ear-muffs, Part 5 with active noise-reduction ear-muffs, Part 6 with ear-muffs with electrical audio input and Part 7 with level-dependent ear-plugs.

prEN 458:2001 deals with selection, use, care and maintenance of hearing protectors.

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

4.4.1 Assessment of Standard-Specific Aspects

prEN 352-1:2000 to 3:2000, EN 352-4:2001, prEN 352-5:2000, prEN 352-6:2000 to 7:2000 "Safety requirements and testing for various ear-muffs and ear-plugs"

In the respondents' opinion, prEN 352-1:2000 to -3:2000 cover the basic health and safety requirements of Directive 89/686/EEC to a large extent. In their view, fulfilling the requirement in Clause 3.5, Paragraph 2 of Annex II of Directive 89/686/EEC causes problems. The requirement is as follows: "All PPE must bear labelling indicating the noise attenuation level and the value of the comfort index provided by the PPE; should this not be possible, the labelling must be fixed to the packaging".

The requirement that a comfort index be defined is not considered helpful. It can only be met subjectively because such a value depends greatly on the product, duration of work and persons involved. Since it is not possible to give an objective and reproducible assessment, the experts do not consider the definition of a comfort index to be of importance.

In the respondents' view, parts 4 to 7 of the standard also meet the basic health and safety requirements of Directive 89/686/EEC to a large extent. There are reservations concerning the following points:

- ☐ EN 352-4 and prEN 352-5 do not include a test for sufficient protection against impulse noise (e.g. gunfire);
- ☐ the following improvements are suggested for draft standard prEN 352-6: items c and f/3 of Clause 6.1 "Wearer information" should be more specific. For example, the current wording in Clause 6.1/c is not sufficient to help the user avoid excessive noise exposure;
- ☐ Clause B.4/b of Annex B is criticized because the stipulated daily limit can be exceeded if several sound sources are present.

The method for acoustic measurement of level-dependent ear-plugs, as specified in prEN 352-7, is still being developed. The experts point out that it is very difficult to develop a sophisticated test method for such a product because experience of testing "level-dependent ear-plugs" is scarce.

The alternative method specified in ISO/TR 4869-4:1998, presented in Annex B, is considered unsuitable for fulfilling the requirements of Directive 89/686/EEC because it can cause the actual protective effect to be rated too highly. Furthermore, the representativeness and reproducibility of the results of the test method described in prEN 352-7 are questioned.

The experts give draft standards prEN 352-1 to -3 a good rating with regard to their ability to help the user select an appropriate product. However, they criticize standard EN 352-4 and draft standards prEN 352-5 and -6 because the lack of an impulse-noise test in EN 352-4 and prEN 352-5 makes it difficult for, e.g. shooting-club members, to select a suitable product. prEN 352-6 is criticized because it can only be applied to a portion of the products on the market although its scope covers all ear-muffs with electrical audio input.

As concerns the information brochure, the respondents feel that all of the necessary information required by Directive 89/686/EEC is contained in the standards. In their opinion, however, item 6.1/f/3 of EN 352-4:2001 needs improvement. The item in question requires a warning that the sound emitted by the sound-restoration circuit can exceed the external sound level. This warning relates to a hazard which does not exist in practice and thus only confuses the user. The requirement should therefore be abandoned in future.

With regard to PPE compatibility, the opinion is that prEN 352-3:2000 gives sufficient consideration to hearing pro-

tectors worn in combination with protective helmets. Positive effects could be generated, for example, by linking different types of PPE. For instance, where hearing protectors are worn in combination with respiratory protection, accoustic warning signals could be generated in the hearing protector if the respiratory protection equipment malfunctions.

prEN 458:2001 "Hearing protectors – Recommendations for selection, use, care and maintenance – Guidance document"

This standard gives recommendations for selection, use, care and maintenance of hearing protectors.

In principle, prEN 458 is rated positively because information concerning selection is essential for the user and the standard largely corresponds with the Berufsgenossenschaft rules for use.

From the German point of view, however, this document should definitely not be a standard. Instead, it should be published as a technical report because it contains rules for use (regarding health and safety of workers at work), which can differ from country to country.

ISO 4869-1:1990 "Acoustics – Hearing protectors – Part 1: Subjective method for the measurement of sound attenuation"

ISO 4869-2:1994 "Acoustics – Hearing protectors – Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn"

ISO 4869-1 describes a subjective method for measuring the sound attenuation of hearing protectors. 16 test participants and third-octave band noise in 8 different centre frequencies are used to measure hearing thresholds with and without the use of hearing protectors and to calculate sound attenuation. This method supplies measurements which are close to the maximum possible sound attenuation. The measurements are used as the base values for the various calculations described in ISO 4869-2 in order to estimate the effective A-weighted sound pressure level when hearing protectors are worn. The calculation methods are the very accurate octave-band computation method, the HML method and the SNR method.

The overall assessment of the standards was positive.

prEN 13819-1:2000 "Hearing protectors – Testing – Part 1: Physical test methods"

prEN 13819-2:2000 "Hearing protectors – Testing – Part 2: Acoustic test methods"

With regard to prEN 13819-1, it is felt that the measurement of the pressure ex-

erted by the headband and the cushion is not absolutely necessary for all size ranges. Past measurements have shown that the results differ only slightly because the dimensions change when the size range changes. One single test for an average size range is considered adequate.

In the respondents' opinion, the drop test for ear-plugs is also not necessary because most ear-plugs are made of foam or cotton-wool, the exception being those made of, for example, acrylic. A drop test could be required for such "special cases". However, such ear-plugs are rather rare in Germany.

The respondents are not aware of any fundamental problems concerning draft standard prEN 13819-2.

EN 24869-3:1993
"Acoustics – Hearing protectors – Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes"

This standard describes a method for the "measurement of insertion loss of ear-muff type protectors for quality inspection purposes". This test uses a special imitation head, known as a "dummy head", which is used for quality control. The overall assessment of the standard was positive.

4.4.2 Assessment of Generic Aspects

In the respondents' view, the standards and draft standards give sufficient consideration to ergonomics. For example, the user is supplied with information concerning the various size ranges offered by hearing protectors, the materials used or the pressure exerted by the headband or the cushion.

In general, the respondents criticize the fact that the work of JWG 9 of CEN/TC 122 "Ergonomics" does not produce enough OH&S recommendations in line with practice. One example quoted was the recommended permissible residual sound level when the hearing protectors are worn. The drafts prepared by JWG 9 give a maximum limit of 55 dB(A). This is a high requirement, which is currently not technically possible. In practice, a residual sound level of 70 to 85 dB(A) when the hearing protectors are worn is considered sufficient.

The test-method standards drawn up outside the PPE committees largely fulfil their purpose as far as occupational health and safety is concerned.

With regard to EN 352-4:2001, the experts point out that ISO 11904-1:2000 is only worthy of a good rating in terms of occupational health and safety if combined with the specifications in Annex B of

EN 352-4. prEN 352-7:2000 refers to ISO/TR 4869-4:1998 but the latter is problematic because the protective effect can be overestimated. Consequently, it is not used by any test institute in Europe and is rejected by OH&S experts.

The experts see no need to harmonize the safety and ergonomic requirements and test methods with those of other PPE because there are significant differences between the different PPE products. The flammability test was quoted as an example. In the case of equipment for hearing protection, this test is performed using an incandescent iron rod. A test using a naked flame, as is performed for other types of PPE, is considered not very realistic because the hearing protection is worn on the head and it is more likely that a hazard would come from, for example, welding spatter (molten metal) than from contact with a naked flame.

A further example cited was the harmonization of the conditioning and test atmosphere. At best, such harmonization would lead to an increase in testing for the test institutes. But it would not bring about a marked improvement in the measurement of the properties.

From Germany's point of view, the standards on equipment for hearing protection take the OH&S requirements into consideration to a positive extent. The OH&S benefits of EN 352-4 and prEN 352-5 could be improved still further by introducing an impulse-noise test. The level of consideration given to OH&S requirements in prEN 352-6 is felt to be a problem because, for example, the scope of the standard does cover all products on the market but the test method described in the standard is not suitable for all products.

In the main, the reasons given by the respondents for the fact that German OH&S requirements were not incorporated into some standards, e.g. prEN 352-6, were of a procedural nature.

4.5 Equipment for Protection against Falls from a Height

Safety requirements and tests for equipment for protection against falls from a height are specified in European standards and draft standards, drawn up by CEN/TC 160 "Protection against falls from a height including working belts" and WG 5 "Mountaineering equipment" of CEN/TC 136 "Sports, playground and other recreational equipment". This analysis is based on the following standardization documents:

CEN/TC 160:

- ☐ EN 341:1992 "Personal protective equipment against falls from a height

– Descender devices" in conjunction with Amendment EN 341/A1:1996

- ☐ EN 353-1:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Guided type fall arresters on a rigid anchorage line"
- ☐ EN 353-2:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Guided type fall arresters on a flexible anchorage line"
- ☐ EN 354:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Lanyards"
- ☐ EN 355:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Energy absorbers"
- ☐ EN 358:1999 "Personal protective equipment for work positioning and prevention of falls from a height – Belts for work positioning and restraint and work positioning lanyards"
- ☐ EN 360:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Retractable type fall arresters"
- ☐ EN 361:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Full body harnesses"
- ☐ EN 362:1992 "Personal protective equipment against falls from a height – Connectors"
- ☐ EN 363:1992 taking into account Amendment A1, 2001 (final draft) "Personal protective equipment against falls from a height – Fall arrest systems"
- ☐ EN 364:1992+AC:1993 "Personal protective equipment against falls from a height – Test methods"
- ☐ prEN 365:2001 "Personal protective equipment and other equipment for protection against falls from a height – General requirements for instructions for use, maintenance, periodical examination, repair, marking and packaging"
- ☐ EN 795:1996 "Protection against falls from a height – Anchor devices – Requirements and testing" in conjunction with EN 795/A1:2001
- ☐ EN 813:1997 "Personal protective equipment for prevention of falls from a height – Sit harnesses"
- ☐ EN 1496:1996 "Rescue equipment – Rescue lifting devices"
- ☐ EN 1497:1996 "Rescue equipment – Rescue harnesses"

- ☐ EN 1498:1996 "Rescue equipment – Rescue loops"
- ☐ EN 1891:1998 "Personal protective equipment for the prevention of falls from a height – Low stretch kernmantel ropes"
- ☐ prEN 12841:1997 "Personal protective equipment for prevention of falls from a height – Work positioning systems – Rope adjustment devices"

CEN/TC 136:

- ☐ EN 567:1997 "Mountaineering equipment – Rope clamps – Safety requirements and test methods"
- ☐ EN 892:1996 "Mountaineering equipment – Dynamic mountaineering ropes – Safety requirements and test methods"
- ☐ EN 12275:1998 "Mountaineering equipment – Connectors – Safety requirements and test methods"
- ☐ EN 12277:1998 "Mountaineering equipment – Harnesses – Safety requirements and test methods"

prEN 365:2001 is a draft revision of the European standard, intended to adapt it to current developments in standardization and the state of the art. The valid European standard is:

- ☐ EN 365:1992 "Personal protective equipment against falls from a height – General requirements for instructions for use and for marking"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standard; the valid standard was used to show the developments.

The amendments to standards EN 353-1, EN 353-2, EN 354, EN 355, EN 360, EN 361 and EN 363 were included in the study because they provide some corrections and improvements, particularly with regard to the information to be provided by the manufacturer. Due to administrative problems, the official voting on the amendments has been considerably delayed and, consequently, they have not yet been published. However, the documents considered here, in the versions applicable in 2001, are generally recognised.

In addition to the amendments, some weak spots in the standards have been identified and these are being discussed both at the national and, in some cases, the European level. Since some of these points have yet to be examined, they have not been incorporated into the amendments but will be taken into account when the standards are revised. The aspects which German OH&S representatives would like to see dealt with in the revisions have been included in the assessment of the standards.

4.5.1 Assessment of Standard-Specific Aspects

EN 341:1992 including Amendment A1:1996
"Personal protective equipment against falls from a height – Descender devices"

This standard specifies requirements, test methods, marking and instructions for use for descender devices intended for rescue purposes.

In the respondents' view, the basic health and safety requirements of Directive 89/686/EWG are largely complied with, which means that it is possible to certify or issue an EC type certificate on the basis of the standard. However, the following points should be incorporated into the standard in the future:

- ☐ in practice there are situations in which it is not possible to descend totally vertically in the rescue operation due to the surrounding conditions. The standard should thus also take into account that the direction of descent may not be vertical;
- ☐ a dynamic test of the type stipulated in the standard for rescue equipment (EN 1496:1996) should also be introduced. This test would take into account the potential impact load which can arise due to the sudden load reduction when the person rescued is unhooked;
- ☐ when a person is being rescued, it may well be the case that the rescuer has to descend to the victim. In such cases, both persons then often have to be brought down using one descender device. It is therefore recommended that requirements be specified for descender devices which could carry the load of two persons at the same time.

Generally speaking, the respondents give the reproducibility of the test methods a good rating. However, the wording concerning the interval between the descending processes in the test of the descending operation could be improved. Clause 5.6 "Testing the Descending Operation" stipulates the following: "The descending processes must follow on from each other immediately". This wording is not sufficiently precise, with the result that the intervals between the descending processes can vary from test institute to test institute. Defining the intervals would help harmonize the test results because the cooling of the descender device would be taken into consideration.

In their assessment of the product requirements' ability to enable the user to select a suitable product, the experts point out that the standard was written for rescue operations. Clause 5.6 "Testing the Descending Operation" gives details of the number of descending processes in the various classes. For rescue work, this in-

formation is sufficient because the descender device is checked after each operation to determine whether it can be used again. However, the standard is presently also used for rope-supported work. In this area, the product requirements in the standard do not provide sufficient information for the user to select a suitable product. It can be assumed that industrial climbers do not keep a record of the stress cycles during their work, which means that it is not possible to assess the descender device's performance capability. In order to prevent the risk of, for example, the brake or the rope failing due to wear, the testers propose that either the upcoming revision of the standard should cater for the possibility of the standard being used for rope-supported work or a new standard specifically for this field should be drawn up.

In their assessment of the test methods, the respondents consider the cost/benefit ratio balanced. The only criticism refers to the functional test, specified in 5.7, for descents of more than 100 m. This test is considered very cost-intensive and the costs are deemed completely out of proportion with the meaningfulness of the test results.

EN 353-1:1992 "Personal protective equipment against falls from a height – Guided type fall arresters on a rigid anchorage line"

EN 353-2:1992 "Personal protective equipment against falls from a height – Guided type fall arresters on a flexible anchorage line"

EN 353-1 specifies requirements, test methods, information to be provided by the manufacturer and packaging for guided-type fall arresters on a rigid anchorage line attached to or integrated in vertical ladders or manhole steps. EN 353-2 refers to guided-type fall arresters on a flexible anchorage line. As explained earlier, the assessment of the standards also took into account the final drafts for Amendment A1, 2001.

According to the respondents, standards EN 353-1 and -2 and the amendments thereto (issued in 2001) accommodate the basic health and safety requirements of Directive 89/686/EEC. Nonetheless, there are a few additions that should be discussed for the revision of the standards.

EN 353-1

- ☐ This standard should include testing of further components of the equipment, e.g. a crossing bar. These components facilitate safe crossing, e.g. from manhole steps to a horizontal working plane. When crossing, there is a risk that the user might, for instance, slip and the crossing bar might be subjected to a dynamic load.

- ☐ In practice, guided-type fall arresters are often transferred from a rigid vertical anchorage line to a horizontal anchor device by means of a swivel plate. The change from vertical to horizontal use causes different stresses on the guided-type fall arrester. The standard should thus also consider the possibility of a guided-type fall arrester with a rigid anchorage line being used in combination with an anchor device.
- ☐ There are cases, such as in the upper part of a chimney, where a rigid anchorage line is attached in a position inclined from the perpendicular. A test for an inclined rigid anchorage line should thus be incorporated into the standard. The requirements, e.g. for the impact force or the falling distance, would remain unchanged.
- ☐ With some devices, the arresting process is triggered by a spring. The risk here is that the fall arrester might malfunction if the spring is broken, causing the user to fall. The possibility of spring failure should thus be taken into account in the standard and in the safety features.
- ☐ The standard does not include any requirements regarding how to attach a fall arrester to a rigid anchorage line safely. There are devices on the market which only function in one direction. With these devices, the risk is that the user might deploy them incorrectly and the fall arrester might malfunction in a hazardous situation. The standard should therefore specify more precisely the measures which can ensure that a fall arrester is attached in the proper manner and that user errors are prevented.
- ☐ In some versions of guided-type fall arresters with a rigid anchorage line a taught wire rope is used as the rigid line. With such systems, the testers believe that test criteria need to be defined for the upper termination. A reference to such a test should thus be included in Clause 4.4 "Static strength". The standard should also describe in more detail the type of upper termination. One example suggested was that the use of screw clamps should be ruled out since they would have to be retightened at regular intervals.

EN 353-2

- ☐ This standard assumes that the fall arrester is used in a vertical position. However, in practice there are cases where the device is used in an inclined or horizontal position, e.g. on a gable roof or flat roof. This makes additional dynamic tests and functional tests necessary, e.g. to check that the arresting function works in an inclined position or to determine the stress exerted on the arrester's anchorage line by an edge.

- With some fall arresters, the arresting mechanism is deactivated by clasping the arrester with one's hand, i.e. it can then be slid along the anchorage line. There is cause for concern that users might hold on to the fall arrester with their hand in a hazardous situation and thus simultaneously deactivate the arresting mechanism and fall. Therefore, the standard should take "panic gripping" into account and requirements should be specified for a safe upward and downward movement. It is suggested that approval should now only be given to arresters which do not necessitate manual operation or which do not completely deactivate the arresting mechanism when operated manually.
- The standard should contain requirements to ensure that detachable fall arresters are attached in the proper manner so that they can only be attached in the specified direction of effect.

The testing experts criticize the reproducibility of the arresting force measured in the dynamic-performance test as specified in EN 353-1:1992 with Amendment 1 (2001) and prEN 353-1 with Amendment A1 (2001). In their opinion, the testing equipment and the testing itself are not described in sufficient detail.

The standard specifies that the test must be carried out using a sandbag, which is only described in bare detail, weighing 100 kg and the resulting braking force must not exceed F_{max} = 6 kN. The maximum arrest distance "H" is specified as 1 m. This makes an additional energy absorber necessary. But this also increases the length of the connection between the fall arrester and the user's safety harness and thus the arrest distance. It is suggested that the permissible arrest distance "H" be restricted to, for example, 0.4 m. This makes the connection between the arrester and the user very short. The advantage is that the user is supported in the pelvic area by the safety harness whilst climbing and the actual climbing is only done by the legs. There is no strain on the arms, making it possible to climb without considerable fatigue even at great heights (50 m or more). Another reason for limiting the arrest distance is that there are no known instances in Germany of accidents which point to excessive strain on the human body during an arrest process when the arrest distance is shorter and no energy absorber is used. It would thus be possible to reduce the arrest distance and abandon the requirement for a maximum braking force of 6 kN. This would make it possible for drop tests to be carried out as part of the system function test without having to measure the braking force.

The experts also point out that the tests specified in EN 353-1:1992 taking into account Amendment A1, 2001 (final

draft), are not extensive enough. The following examples were cited:

- ☐ test methods A and B each only include one drop test. They do not examine what happens when a lanyard is stretched horizontally. It is a known fact that such a situation is dangerous because the fall arrester might begin to function at too late a stage;
- ☐ in the drop test, the system is only tested with the drop mass in one position on the track. It is, however, possible that the system might fail if the drop mass is in another position;
- ☐ changeovers from one track to the next are not tested.

In their assessment of EN 353-2:1992 taking into account Amendment A1 (2001), the experts generally rate the cost/benefit ratio as balanced. However, it can be assumed that additional tests will be incorporated into the standard in future, which means that the test costs can be expected to increase though the experts believe the increase will be appropriate. Finally, the suggestion was made that the locking test could be abandoned since users can generally check themselves whether a guided-type fall arrester has locked.

EN 354:1992 "Personal protective equipment against falls from a height – Lanyards"

EN 354 specifies requirements, test methods, marking, information to be provided by the manufacturer and packaging for adjustable and non-adjustable lanyards. As explained above, the assessment of the standard took into account the final draft of Amendment A1, 2001.

In the experts' opinion, EN 354 should include a requirement for the minimum number of circular stitches for spliced rope terminations. Clause 5, "Safety Requirements", of DIN 83319:1999 requires the eye splice on manmade-fibre ropes to have five circular stitches because the user's safety cannot be guaranteed otherwise. There is a general risk with splices that the strand ends can retract when the rope is used. This decreases the number of circular stitches and – if there are not enough reserve circular stitches – reduces the rope's breaking force.

The test experts also request that the standard should provide a more precise description of the requirements for the terminations and the different types thereof. There is a risk, for example, that snap connectors can loosen with time if they are not designed properly.

Clause 4.2.2 was also criticized. It stipulates that ropes, straps and sewing yarn for lanyards must be made of unused filament or multi-filament manmade fi-

bres and be suitable for the intended use. This stipulation is deemed inadequate. In the test experts' opinion, requirements regarding the lanyard's resistance to foul weather should be added since, for example, polypropylene lanyards which do not have any ultraviolet stabilizers quickly loose a substantial amount of their rigidity. This issue is currently being discussed and, if appropriate, the results will be taken into account in the revision of the standard.

EN 355:1992
"Personal protective equipment against falls from a height – Energy absorbers"

This standard contains requirements, test methods, marking, information to be provided by the manufacturer and packaging for energy absorbers. Energy absorbers, in the form of separate or constituent parts, are either integrated in a lanyard, an anchorage line or a safety harness or used in combination with them. As explained above, the assessment of the standard took into account the final draft of Amendment A1 (2001).

The experts are not aware of any fundamental problems concerning this standard.

EN 358:1999
"Personal protective equipment for work positioning and prevention of falls from a height – Belts for work positioning and restraint and work positioning lanyards"

EN 358:1999 specifies safety requirements and test methods for belts for work positioning and work-positioning lanyards. In the respondents' opinion, it covers the basic health and safety requirements of Directive 89/686/EEC to a large extent.

However, a few suggestions were made with regard to the test methods, as follows:

- ☐ Clause 4.1.3.4 contains the following sentence: "The materials used in the manufacture of lanyards for belts for work positioning and restraint must have a demonstrable minimum breaking force of 22 kN". The term "materials" is not correct in this instance. According to the respondents, "ropes or straps" would be better;
- ☐ flammability tests are carried out for equipment used in high temperatures, e.g. in firefighting. The specified flame is criticized because its intensity is not sufficiently high to introduce enough heat into the strap to reach the ignition point of the material. The practical value of the test is thus questionable since any lanyard or belt can pass the test without having been especially designed for the purpose. The respondents also feel

that it would make sense to divide the test into a heat-radiation test (because the lanyard's rigidity decreases when subject to heat radiation) and a test to establish resistance to flying sparks (flammability). It is suggested that existing tests, e.g. as used for firefighter helmets, should be used as the basis. This would enable test methods for various PPE types to be harmonized.

With the exception of the flammability test, the cost/benefit ratio of the test methods is considered balanced. Additional costs may be incurred if changes are made to the flammability test.

EN 360:1992 "Personal protective equipment against falls from a height – Retractable type fall arresters"

EN 360 specifies requirements, test methods, information to be provided by the manufacturer and packaging for retractable-type fall arresters. As explained above, the assessment of the standard took into account the final draft of Amendment A1, 2001.

In the respondents' opinion, EN 360 does not fully cover the basic health and safety requirements of Directive 89/686/EEC. The following points should be added when the standard is revised:

- retractable-type fall arresters usually have a drum with an integrated centrifugal brake. When a secured user falls, the centrifugal brake is triggered and the user's fall is safely arrested. However, if such a retractable-type fall arrester is used on inclined surfaces, there is a risk that the centrifugal brake might not be activated because of the slow slipping speed and the user's fall might not be arrested. This has also been established in research done by the national French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases, "INRS" for short.

  There is also a risk if the fall arresters are used on horizontal planes and the user falls over an edge. Due, for example, to longer falling distances or higher stress on the casing and the lanyard, the arrester is subjected to a different stress than provided for in the standard if the edge is sharp. Additional drop tests should therefore be incorporated into the standard to ensure the functioning and strength of the arrester in a horizontal or inclined position as well when subject to stress caused by edges;

- in accordance with the standard, drop tests are presently only carried out at a normal ambient temperature. If a retractable-type fall arrester is subjected to cold temperatures,

there is a risk that the maximum permissible arrest distance of 2 m might be exceeded. In order to examine this risk, additional drop tests after exposure to cold temperatures should be incorporated into the standard. Temperature categories could also be included in order to enable the user to make a better choice when selecting equipment;

- ☐ some retractable-type fall arresters have relatively wide feed-in and feed-out holes for the lanyard. The components inside the casing can become soiled because of the presence of these holes and this can impair their functioning. Consequently, the experts believe it would be helpful to add functional-reliability test criteria to the standard so that, for example, retractable-type fall arresters could be subjected to an appropriate dusty environment in advance.

Another point of criticism is the locking test. The test rig consists of an anchor device and a test mass of at least 5 kg. The arrester is hung from its upper end, with the lanyard retracted, and activated using a suitable test mass and a maximum speed of 2.5 m/s. Depending on the weight selected, a type of resilience can kick in when the centrifugal brake locks, which deactivates the brake's locking mechanism and sets the test mass falling again. Thus, from the point of view of reproducibility and representativeness, the locking test does not deliver very meaningful results and is therefore unsuitable. It was suggested that the locking test be completely abandoned and the retractable-type fall arrester be tested directly at the permissible temperature for use with 100 kg, in line with practice.

Clause 4.6 specifies requirements pertaining to endurance but this test is currently merely optional. In the testers' opinion, the standard should make it compulsory. However, the actual test criteria should be simplified and redefined in order to optimize the cost/benefit ratio.

EN 361:1992 "Personal protective equipment against falls from a height – Full body harnesses"

EN 361 specifies safety requirements and test methods for full body harnesses. As explained above, the assessment of the standard took into account the final draft of Amendment A1, 2001.

The respondents feel that it is difficult to give maximum consideration to ergonomics in this standard. For example, Clause 4.1 "Design and Ergonomics" states that the general design and ergonomic requirements are specified in

Clause 5.1 of EN 363:1992 with Amendment A1. They criticize the fact that the standard simply repeats the wording of the directive. There are no additional suggestions concerning how ergonomics should be taken into account in accordance with the standard. The respondents propose that this fault be corrected by introducing suspension tests, e.g. conducted by the tester. However, the representativeness and reproducibility of such tests are problematic since the human anatomy can differ greatly.

More precise, practicable ergonomic specifications in the standard should be discussed in detail as part of a revision of the standard.

The respondents also point out that the standard does not specify precisely whether an attachment element should be tested as a fall-arrest attachment element or as a normal attachment element. A clear specification should be given when the standard is revised.

EN 362:1992 "Personal protective equipment against falls from a height – Connectors"

This standard specifies safety requirements and test methods for connectors used, for example, in work-positioning and fall-arrest systems.

In order to meet the basic health and safety requirements of Directive 89/686/EEC, the following points could be improved further:

- ☐ according to Clause 4.2, "Materials and Construction, the connectors must not have any sharp or rough edges that could cut into or roughen the ropes or webbing or damage them in any other way or injure the user. The respondents feel that it would be useful to stipulate a minimum edge radius for the connectors in order to improve the test results;
- ☐ the different methods of using different connectors should be taken into account in the standard because stress can develop lengthways and sideways. The respondents also think that it would be useful to have different names for the various connectors.

The cost/benefit ratio of the test methods specified in EN 362 is considered balanced. Additional test costs may arise if new requirements and tests, e.g. a test to determine the transverse load on a connector, are added when the standard is revised. It can be assumed that these cost increases will be appropriate.

EN 363:1992 "Personal protective equipment against falls from a height – Fall arrest systems"

EN 363 specifies the terminology and general requirements for fall-arrest systems which are used as personal protective equipment against falls from a height. The standard also illustrates examples of how components or component assemblies can be used to form a fall-arrest system. As explained above, the assessment of the standard took into account the final draft of Amendment A1, 2001.

In the respondents' opinion, further examples of alternative systems should be added to the standard in order to give even more consideration to the various possible ways of using equipment against falls from a height in practice. These examples should show from which point of inclination the system is vertical and from which point the system is horizontal or inclined. The additional requirements for inclined and horizontal systems should be covered in the respective product standards.

EN 364:1992+AC:1993 "Personal protective equipment against falls from a height – Test methods"

EN 364:1992+AC:1993 specifies test methods for materials, components and systems in combination with personal protective equipment against falls from a height. It specifies test equipment and test methods for static tests, dynamic tests, dynamic performance and dynamic strength, corrosion tests for metal components and test equipment and test methods for testing after conditioning and endurance testing. Problems relating to test methods are described in the individual product standards.

The respondents are not aware of any further problems concerning the other test methods which are not referred to in the product standards.

prEN 365:2001 "Personal protective equipment and other equipment for protection against falls from a height – General requirements for instructions for use, maintenance, periodical examination, repair, marking and packaging"

This draft standard specifies general requirements concerning instructions for use, maintenance, periodical examination, repair, packaging and marking for equipment providing protection against falls from a height. Compared to EN 365:1992, key additions have been made to ensure better compliance with the PPE directive requirements regarding the information leaflet to be provided by the manufacturer.

In addition to the improvements made in prEN 365:2001, the respondents recommend that additional marking for attachment elements and fall-arrest attachment

elements be included in the standard. This would prevent attachment elements being used as fall-arrest attachment elements. Safety problems could be caused if attachment elements were mistaken for fall-arrest attachment elements or vice versa because the requirements for testing the strength of attachment elements are lower than those for fall-arrest attachment elements.

EN 567:1997 "Mountaineering equipment – Rope clamps – Safety requirements and test methods"

This standard applies to rope clamps used in mountaineering, including climbing.

The respondents criticize the fact that this standard does not require a dynamic test (drop test). Such a test could determine whether the rope clamps destroy the rope in an arrest process. The results of the existing static test are not considered to be sufficiently meaningful.

EN 795:1996 including Amendment EN 795/A1:2001 "Protection against falls from a height – Anchor devices – Requirements and testing"

This standard specifies requirements and test methods for anchor devices which are designed only for use with personal protective equipment against falls from a height.

In the respondents' opinion, increased or additional requirements are needed in the standard in order to comply with the basic health and safety requirements of Directive 89/686/EEC. For example, the standard does not include any requirements which take into account the possibility that several persons might by secured on one anchor device.

The standard only specifies a dynamic test for class E anchor devices (anchor devices held by their own weight, e.g. a water cushion). The respondents believe that an additional, static test is necessary to examine and specify the required static friction for the situation following the arrest process.

The respondents criticize the unclear wording concerning class C in Clause 4.3.3.1. It might be possible, for example to derive from the wording that the general requirements for this type of anchor device are based on the manufacture's design methods and criteria.

With regard to the dynamic test, it is also pointed out that it is difficult to reach the test forces stipulated in the standard straight away. Consequently, pre-tests are often necessary in order to get as close as possible to the target peak arrest force, making the test more expensive.

The design of class C horizontal flexible anchorage lines (textile anchorage lines) is also considered to be a problem. Some horizontal flexible anchorage lines have energy-absorbing fall arresters. When the line is under stress, the rope runs through the fall arrester slowly. This increases the sag in the anchorage line and thus the falling distance. In the respondents' opinion, it would therefore be useful to incorporate a permissible sag limit into the standard.

EN 813:1997 "Personal protective equipment for prevention of falls from a height – Sit harnesses"

This standard specifies requirements and test methods for sit harnesses for use in safety and restraint systems though sit harnesses are generally not suitable for fall-arresting purposes.

The respondents are not aware of any significant problems concerning this standard.

EN 892:1996 "Mountaineering equipment – Dynamic mountaineering ropes – Safety requirements and test methods"

EN 892 specifies safety requirements and test methods for dynamic kernmantel mountaineering ropes (single, double and twin ropes).

The respondents criticize the reproducibility of the results of the drop test because the standard does not describe the test equipment precisely enough. The steel pin's centre of gravity and the dimensions of the drop mass were cited as examples. According to the respondents, the fact that the drop mass is slowed down further by frictional forces in the anchorage line as soon as the rope is subjected to a tensile force is another reason for the difficulty in reproducing test results.

They also criticize the test used to determine whether a rope can withstand a certain number of falls. The test is of no use to industrial users because the result provides no information about the period which it takes for the number of falls withstood to be reduced, i.e. how long the user can use such a rope.

EN 1496:1996 "Rescue equipment – Rescue lifting devices"

EN 1497:1996 "Rescue equipment – Rescue harnesses"

EN 1498:1996 "Rescue equipment – Rescue loops"

Standards EN 1496 to 1498 specify requirements and test methods for rescue lifting devices, rescue harnesses and rescue loops.

The respondents criticize the fact that EN 1496 does not take into account combined use of a rescue lifting device and a retractable-type fall arrester.

With regard to EN 1497 and 1498, the testers point out that it would be both possible and beneficial to harmonize the static test for rescue harnesses and rescue loops with the static test for full body harnesses.

It is also suggested that the standards for rescue harnesses (EN 1497) and rescue loops (EN 1498) should describe the main characteristics of the respective devices more clearly in order to make the differences between them more transparent for the user.

EN 1891:1998 "Personal protective equipment for the prevention of falls from a height – Low stretch kernmantel rope"

This standard specifies requirements and test methods for low-stretch kernmantel ropes. These ropes are used, for example, when rescuing cave explorers or carrying out rope-supported work.

The respondents are not aware of any significant problems concerning this standard.

prEN 12841:1997 "Personal protective equipment for prevention of falls from a height – Work positioning systems – Rope adjustment devices"

A wide variety of rope adjustment devices, combined with different rope types, are used for work-positioning. prEN 12841 contains requirements and test methods for the rope-adjustment devices.

The German experts reject this draft standard because it does not take account of the essential safety factor that the arrester and the rope must interact correctly. The draft standard would allow a guided-type fall arrester to be approved without the correct rope. Furthermore, it is not clear which ropes with which properties are allowed to be used; at the moment, the standard only specifies a diameter.

Since the draft standard was rejected by many parties involved in standardization, a decision was made to wait for the results of a research project in the United Kingdom, which was examining a range of rope-adjustment devices. prEN 12841 would then be revised on the basis of the project findings. The revision work will begin in Autumn 2001. Consequently, since there is presently no draft standard which is accepted throughout Europe, this draft will not be assessed in detail here.

EN 12275:1998
"Mountaineering equipment – Connectors – Safety requirements and test method"

This standard specifies safety requirements and the test method for connectors used in mountaineering, including climbing.

The respondents did not mention any fundamental problems concerning this standard.

The revision of EN 362:1992 will also consider the specifications of EN 12275 in order to harmonize as much as possible the requirements for connectors for industrial use and those for use in mountaineering and to minimize the risk of the two being confused.

EN 12277:1998
"Mountaineering equipment – Harnesses – Safety requirements and test methods"

This standard specifies safety requirements and test methods for harnesses used in mountaineering, including climbing. It applies to full-body harnesses, small-body harnesses, sit harnesses and chest harnesses.

The respondents criticize the fact that this standard does not contain a requirement for the marking to include the year of manufacture. The basic health and safety requirements of Directive 89/686/EEC stipulate that the year of manufacture must be given for products which are subject to ageing.

4.5.2 Assessment of Generic Aspects

prEN 365:2001 and the amendments to the product standards for fall-arrest systems (EN 353-1, EN 354, EN 355, EN 360, EN 361, EN 363) cover the requirements specified in Directive 89/686/EEC pertaining to the information leaflet to be provided by the manufacturer.

In the respondents' view, action needs to be taken to ensure that sufficient consideration is given to PPE compatibility in the standards and draft standards. For example, combined use of safety harnesses with the appopriate fall-arrest systems or of rescue lifting devices with retractable-type fall arresters (see EN 1496:1996) should be tested.

There are also still gaps when it comes to the compatibility of PPE against falls from a height with other types of PPE. Studies have shown that, for example, when PPE against falls from a height is used in combination with respiratory protective equipment, there is a risk that, in the event of a fall, the arrest process and the safety-harness straps can cause an

impact load on the respiratory protective equipment. This can cause damage to the respiratory protective equipment, which can impair its functioning or cause it to fail.

As far as possible, ergonomic aspects are taken into account in the standards.

They *can* be considered in the case of components worn on the body, e.g. safety harnesses, or components operated by hand, e.g. karabiners. However, this consideration has been insufficient so far. One example cited was the full body harness test using a dummy torso. It is not possible to determine the comfort of the harness for the wearer if a dummy torso is used. It is also not possible to ascertain whether the fall-arrest attachment elements on the back can hit the head in the arrest process.

The respondents therefore suggest that the standard should, at least, stipulate suspension tests by the tester in order to make it easier to assess ergonomic aspects.

Discussion and development by JWG 9 of CEN/TC 122 "Ergonomics" of solutions to the problem of the wearer comfort provided by safety harnesses would be welcomed.

In the respondents' opinion, the possibilities for harmonizing safety and ergonomic requirements and the relevant test methods are very limited since there are many different products. They believe that the standards currently give sufficient consideration to the possibilities for harmonization. The following examples were cited:

- ☐ the corrosion test is the same for all products incorporating metal parts;
- ☐ the same dummy is used for the test on harnesses for mountaineers and the test on safety harnesses for industrial use; and
- ☐ the different test methods specified for karabiners in EN 362:1992 and EN 12275:1998 will be harmonized during the revision process.

The respondents do not see any further need for action at the present.

The communication and coordination between all parties involved is key to ensuring that European standards are developed further in line with practice. Most of the coordination takes place in vertical group VG 11 of the European Coordination of Notified Bodies for PPE, where experts from the testing bodies collaborate to harmonize testing procedures. In the case of standards which, for example, have shortcomings or imprecise details, the vertical group issues recommendations in the form of "technical sheets" and forwards them to TC 160. The TC's working groups explore

how the recommendations should be taken into account when the standards are revised or whether tests should be added or requirements altered.

The vertical group has complained that there is no feedback on the extent to which these proposals have been taken into consideration.

Generally speaking, the respondents feel that occupational health and safety is covered to a good extent in the standards. They see a problem in that the products are often not used in accordance with the standard in practice. One example of this is that the standards relating to fall-arrest systems only cover use in a vertical position. However, there are situations in which a system is used not only vertically, but also in an inclined or horizontal position. As a result, the user's safety is no longer guaranteed because the system is "not used as intended". The standards should therefore constantly be adapted to the situation in practice in order to improve user protection.

ISO standardization currently still has only a relatively weak influence on CEN standardization. The two sides are not yet collaborating in accordance with the Vienna Agreement because there are still huge differences between the safety philosophy in European and international standardization. Some ISO requirements are very difficult to harmonize with the European regulations, i.e. Directive 89/686/EEC. One example cited was that the ISO requirements pertaining to the sturdiness of products providing protection against falls from a height, e.g. harnesses, are higher. Although this offers the advantage that the harnesses are safer, it is also disadvantageous because they become heavier. An increase in weight is not in keeping with the Directive, which stipulates that equipment must be light and efficient. Generally, the respondents are in favour of and are striving for closer cooperation between the ISO and CEN bodies in order to harmonize the two sides' positions and to obtain uniform standards.

In the respondents' view, KAN can promote the position of occupational health and safety in Europe by supporting OH&S representatives at the DIN, CEN and ISO levels. The respondents also see a particular need to attempt to make research more practice-oriented, e.g. with regard to horizontal positioning of PPE against falls from a height, and to integrate even more users in the standardization work.

4.6 Equipment for Leg and Foot Protection

Safety requirements and test methods for equipment for leg and foot protection

are specified in the following European standards and draft standards, drawn up by CEN/TC 161 "Foot and leg protectors":

- ☐ EN 381-3:1996 "Protective clothing for users of hand-held chain-saws – Part 3: Test methods for footwear"
- ☐ EN 12568:1998 "Foot and leg protectors – Requirements and test methods for toecaps and metal penetration resistant inserts"
- ☐ ENV 13287:2000 "Safety, protective and occupational footwear for professional use. Test method and specifications for the determination of slip resistance"
- ☐ prEN 13832:2000 "Footwear protecting against chemicals and micro-organisms"
- ☐ prEN ISO 17249:2000 "Safety footwear with resistance to chain saw cutting"
- ☐ prEN ISO 17250:2000 "Safety footwear with resistance to fire-fighting hazards"
- ☐ prEN ISO 20344:2000 "Test methods for safety, protective, occupational and specific job related footwear for professional use"
- ☐ prEN ISO 20345:2000 "Safety footwear for professional use – Specifications"
- ☐ prEN ISO 20346:2000 "Protective footwear for professional use – Specifications"
- ☐ prEN ISO 20347:2000 "Occupational footwear for professional use – Specifications"

Several of the draft standards listed above are draft revisions of existing European standards intended to adapt them to current developments in standardization and the state of the art. This applies to the following valid European standards:

- ☐ EN 344:1992 "Requirements and test methods for safety, protective and occupational footwear for professional use" in conjunction with Amendment EN 344/A1:1997
- ☐ EN 344-2:1996 "Safety, protective and occupational footwear for professional use – Part 2: Additional requirements and test methods"
- ☐ EN 345:1992 "Specification for safety footwear for professional use" in conjunction with Amendment EN 345/A1:1997
- ☐ EN 345-2:1996 "Safety footwear for professional use – Part 2: Additional specifications"
- ☐ EN 346:1992 "Specification for protective footwear for professional use" in conjunction with Amendment EN 346/A1:1997

- ☐ EN 346-2:1996 "Protective footwear for professional use – Part 2: Additional specifications"
- ☐ EN 347:1992 "Specification for occupational footwear for professional use" in conjunction with Amendment EN 347/A1:1997
- ☐ EN 347-2:1996 "Occupational footwear for professional use – Part 2: Additional specifications"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

4.6.1 Assessment of Standard-Specific Aspects

EN 381-3:1996 "Protective clothing for users of hand-held chain-saws – Part 3: Test methods for footwear"

This standard describes test methods for determining footwear's resistance to cutting by hand-held chain-saws. Since prEN ISO 17249:2000 also uses this method, the test methods are the same for shoes and protective clothing.

EN 12568:1998 "Foot and leg protectors – Requirements and test methods for toecaps and metal penetration resistant inserts"

This standard specifies requirements and test methods for toecaps and metal penetration-resistant inserts. This enables the manufacturers to provide evidence of the performance level of the toecaps and the penetration-resistant inserts before they are incorporated into the shoes. Thus, the standard enables purely qualitative evidence to be recorded regarding the toecaps and the inserts.

In the respondents' opinion, a requirement for non-metallic penetration-resistant inserts should be added to the standard. This is necessary because shoemakers have started selling shoes with non-metallic "200 J toecaps" and it can be assumed that non-metallic materials will also be used for penetration-resistant inserts in the future. New test requirements would be needed for non-metal materials, e.g. to determine ageing or protection against heat or cold.

ENV 13287:2000 "Safety, protective and occupational footwear for professional use. Test method and specifications for the determination of slip resistance"

This European prestandard contains test methods and specifications concerning the slip resistance of safety, protective

and occupational shoes for professional use. The specified test method is as follows: the test shoe is placed on a floor surface, a specified normal force is applied to it and it is moved horizontally across the floor surface or the floor surface is moved across the shoe. The frictional force is measured and the dynamic coefficient of friction calculated.

Various test parameters, e.g. the lubricant and permissible limits, should be specified for the slip-resistance test. There are also still some problems with the test method. For example, since the microstructure of the sole is not destroyed, new shoes have a better coefficient of friction than used shoes. Thus, a good level of reproducibility and representativeness does not yet exist.

These problems are to be solved before a European standard is adopted. DIN 4843-100:1993, which comprises the "ramp-test" method, shall continue to apply at the national level until a European standard is adopted.

prEN 13832:2000 "Footwear protecting against chemicals and micro-organisms"

prEN 13832 contains requirements for footwear protecting against chemicals and micro-organisms. The respondents consider this draft standard unacceptable and refer to an EU research project which has been initiated due to the difficulties encountered in the standardization work.

The draft standard is criticized, for example, because the basic health and safety requirements of Directive 89/686/EWG regarding protection against hazardous substances are only tested for selected substances and then only under defined conditions. In practice, however, products/combinations of substances are used in the majority of cases and the conditions are different and vary considerably.

The Directive also stipulates that the period of wear must be restricted if the permeability is limited. This is not taken into consideration in the draft standard since it contains neither requirements relating to resistance to products nor details on reusability and period of wear.

Furthermore, the specified test methods are not likely to deliver representative or reproducible results.

prEN ISO 17249:2000 "Safety footwear with resistance to chain saw cutting"

prEN ISO 17249 specifies requirements for safety footwear with resistance to chain saw cutting. In this draft standard,

the height of the footwear upper, which had also been criticized in the past, is specified in line with practical conditions and taking into account the wearing characteristics. The minimum protected area for shape C is now 172 mm and for shapes D and E 195 mm. The respondents are not aware of any fundamental problems concerning this draft standard.

prEN ISO 17250:2000 "Safety footwear with resistance to fire-fighting hazards"

prEN ISO 17250 specifies requirements and test methods for safety footwear with resistance to fire-fighting hazards. prEN ISO 17250 is considered outmoded because a separate working group has drawn up a new draft standard due to the problems known to exist in the former draft standard. The new draft makes substantial changes and is deemed far more likely to achieve a consensus. Consequently, prEN ISO 17250:2000 will not be discussed in detail here.

prEN ISO 20344:2000, prEN ISO 20345:2000, prEN ISO 20346:2000 and prEN ISO 20347:2000 "Specifications and test methods for safety, protective, occupational and specific job related footwear for professional use"

As a result of the revision process, the structure of the standardization for the area of foot and leg protection has changed significantly. The existing standard parts concerning safety, protective and occupational footwear (e.g. EN 345:1992, Amendment A1:1997, EN 345-2:1996) have been grouped together and separate product standards have been created for specific areas of use, e.g. foresters' footwear.

The draft standards have also been designed in such a way that prEN ISO 20344 now only contains test methods and no more requirements. The requirements are now to be found in prEN ISO 20345 (safety shoes), prEN ISO 20346 (protective shoes) and prEN ISO 20347 (occupational shoes). These draft standards exclude job-related safety, protective and occupational shoes. Instead, requirements for firefighters' boots are contained in prEN ISO 17249 and requirements for foresters' boots are in prEN ISO 17250.

The respondents are positive in their assessment of how ergonomic aspects have been taken into consideration in the draft standards. In addition to the existing ergonomic aspects, prEN ISO 20345 to 20347 specify special ergonomic wearer tests. Even more ergonomic aspects could be incorporated when the standards and draft standards are developed further. For example, vamp

lining is required in all shoe designs but quarter lining does not necessarily have to be used. However, from an ergonomic point of view, quarter lining would be extremely desirable. The requirement for determining lining's abrasion resistance is also considered too low.

According to the statistics, foot injuries account for the lion's share of new accident pensions in industry, the most common injury being calcaneum fractures. Consequently, the working group on foot protection is currently initiating a research project with the aim of revising the requirement concerning energy absorption in the heel area.

4.6.2 Assessment of Generic Aspects

With regard to the information leaflet to be provided by the manufacturer, a different approach is being taken in the field of foot and leg protection. The manufacturer is given a relatively large amount of freedom when it comes to what information has to be supplied with the shoes and the way in which that information is presented. The standards only stipulate that the shoes must be marked permanently, e.g. by means of punching or embossing, with the following information:

- ☐ size,
- ☐ CE mark,
- ☐ manufacturer's type designation,
- ☐ year of manufacture,
- ☐ number and year of publication of the relevant European standard and
- ☐ symbols indicating the protective function.

In some areas, the standards stipulate that a leaflet must be enclosed with footwear that has to fulfil additional requirements. This includes, for example, conductive footwear, antistatic footwear or footwear providing protection against chain saw cutting. The certification process then tests whether the requirements of Directive 89/686/EEC have been met and whether the intended protection has been achieved. Since all of the respondents consider this procedure sufficient, there is no further need to revise the standards in order to improve the information leaflet.

The respondents currently see no problems as far as compatibility of footwear and other types of PPE is concerned. However, there is a deficiency with regard to the use of overshoes as protection against foul weather. In such cases, the water-vapour permeability may be reduced and the slip resistance may change. When overshoes are used in clean-room conditions, manufacturing problems may occur due to a decrease in the electrical resistance. In rooms with a potentially explosive atmosphere, a build-

up of electrostatic charges cannot always be safely ruled out. These problems cannot be solved in the standards because the properties, including the comfort characteristics, of the actual footwear are always changed when overshoes are worn.

In the respondents' opinion, the standards give sufficient consideration to ergonomic aspects. For example, there is a test to determine the water-vapour permeability, which also enables a sweat-absorption function to be created, thus indirectly generating a good microclimate in the shoe and preventing athlete's foot. Apart from such tests, the standards also include a variety of ergonomic requirements, e.g. pertaining to the shoe shape and design, or requirements for the insole, e.g. concerning resistance to abrasion.

Opinions differ on the work of JWG 9 of CEN/TC 122 "Ergonomics". In the manufacturers' view, exaggerated ergonomic requirements are leading to over-regulation in the standards, which is actually more likely to be an obstacle to standardization. Ergonomics should, in their view, be taken into account to an extent that does not negatively influence safety-related criteria, e.g. wearer acceptance. Any further ergonomic aspects would be regulated by the market itself. The testers, on the other hand, believe that the cooperation between CEN/TC 161 and JWG 9 has had a positive influence on matters concerning occupational health and safety, particularly as far as revising standards is concerned. For example, draft standards prEN ISO 20345 to 20347 call for special ergonomic tests, which, in their opinion, increase wearer acceptance (cf. 4.6.1).

All in all, the respondents take a positive view of the representativeness and reproducibility of the results of the test methods. In their opinion, this now also applies to the test-method standards drawn up outside of the PPE bodies. A general comment was that the new method described in draft standard prEN ISO 20344 for determining the insole's water absorption and desorption involved much more effort than the old method though the meaningfulness of the results has yet to be examined.

prEN ISO 20344:2000 still contains the trough test for determining water-tightness, which had already been criticized in the past. An alternative mechanical method is described along with the trough test. Measurements show that there is a good correlation between the two methods. However, the subjectivity of the evaluation remains a point of criticism. The question of whether new methods, e.g. using walking simulators, could be introduced is currently being discussed.

As a matter of principle, the respondents consider it beneficial, for reasons of cost if nothing else, to harmonize safety and ergonomic requirements and test methods which cover the same risks. One example of existing harmonization is the test method for determining the shoe upper's resistance to cuts. prEN ISO 20344:2000 refers to EN 388:1994 "Protective gloves against mechanical risks" on this subject.

In the testers' eyes, the requirement for the measuring uncertainty to be indicated causes problems. The dispersion of the test results is based not only on the measuring devices' tolerances, but also on subjective errors, e.g. misreading by the tester. Consequently, there may be differences within the various test institutes in the measuring inaccuracies recorded. In order to avoid this problem and to be better able to judge whether a test result is within the tolerance range or is a freak value, the standards should precisely describe test methods and specify the related statistical error. This can then be indicated along with the test parameters, e.g. in the form of a range within which the test result must lie.

Although the test costs for footwear are already relatively high, the majority of the respondents feel that the cost/benefit ratio is appropriate despite the fact that some of the material tests are considered very expensive. The revisions to the standards can be expected to bring more costs because new test methods, e.g. the test to determine the ankle's impact resistance, could be added. However, since the standards for foot protection are already well-developed and detailed, the cost increases will be of an appropriate nature.

In the respondents' opinion, there is a good flow of information between the European Coordination of Notified Bodies and the standards bodies in the field of footwear. Vertical group VG 10 for "Foot Protection" within the European Coordination of Notified Bodies for PPE and CEN/TC 161 work closely together, which means that the results of the European Coordination can be well incorporated into the standardization work and acted upon. The respondents criticize the lengthy period needed to eliminate existing deficiencies in the standards by making revisions.

According to the notified bodies, the test methods need improvement. For example, the test for determining resistance to impact is considered unnecessary since the material requirements in the test for resistance to pressure are higher than in the dynamic test. This is due to the material's behaviour depending on the speed. When a load is applied, the test results improve the quicker the load is applied because the material stiffens.

Overall, the respondents' opinion is that the OH&S requirements are taken into account to a good degree. They point out that European standardization has made a larger variety of products possible and provided more design freedom when upgrading products' technical features. This is due to the fact that the national standards often contained design details whereas the European standards specify performance requirements.

In general, the respondents feel that German OH&S requirements have been implemented to a good extent in the standardization projects. ENV 13287: 2000 was quoted as an exception since concessions had to be made because Germany was the only country which used the ramp test, whereas several countries had been using procedures similar to each other, based on the test method specified in the standard, for some years.

From the point of view of ergonomics, it would be beneficial to add to the foot-protection standards, which are currently concerned with the shoe size (which refers to the length of the inside, not the outside of the shoe), a measurement system which at least takes the foot width into account as well as the foot length. This could improve production and selection of foot-friendly shoes.

Thanks to the close cooperation between the CEN and ISO bodies responsible for foot protection, it has proven possible to work towards ensuring that the CEN and ISO draft standards in the area of foot protection are identical.

In the respondents' view, the ISO standardization has a positive influence because there is a broad range of product requirements in many areas (e.g. firefighters' footwear). Consequently, rather than diminishing, the level of occupational health and safety provided by the ISO standards will be at least comparable with that specified in the present European standards.

The users draw attention to the problem that more and more parties are withdrawing from standardization activities due to financial difficulties. Consideration should thus be given to how this trend could be halted and reversed. One possibility would be to involve higher-ranking bodies – both from the point of view of human and financial resources.

4.7 Protective Clothing

Safety requirements and test methods for protective clothing are specified in the following European standards and draft standards, which were prepared in CEN/TC 162 "Protective clothing including hand and arm protection and life jack-

ets". For a better overview, existing European standards and draft standards are listed according to the relevant working groups.

WG 1
General requirements for protective clothing

The following European standards and draft standards specify general requirements for protective clothing:

- ☐ prEN 340:2000 "Protective clothing – General requirements"
- ☐ EN 510:1993 "Specification for protective clothing for use where there is a risk of entanglement with moving parts"
- ☐ EN 1149-1:1995 "Protective clothing – Electrostatic properties – Part 1: Surface resistivity (Test methods and requirements)"
- ☐ EN 1149-2:1997 "Protective clothing – Electrostatic properties – Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)"

The draft standard listed above is a draft revision of an existing European standard intended to adapt it to current developments in standardization and the state of the art. The valid European standard is:

- ☐ EN 340:1993: "Protective clothing – General requirements"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standard; the valid standard was used to show the developments.

WG 2
Resistance to heat and fire of protective clothing

Test standards:

- ☐ EN 348:1992 "Protective clothing – Test method: Determination of behaviour of materials on impact of small splashes of molten metal"
- ☐ EN 367:1992 "Protective clothing – Protection against heat and fire – Method of determining heat transmission on exposure to flame"
- ☐ EN 373:1993 "Protective clothing – Assessment of resistance of materials to molten metal splash"
- ☐ EN 532:1994 "Protective clothing – Protection against heat and flame – Test method for limited flame spread"
- ☐ EN 702:1994 "Protective clothing – Protection against heat and flame – Test method: Determination of the contact heat transmission through protective clothing or its materials"

- ☐ prEN ISO 6942:1998 "Protective clothing – Protection against heat and fire – Method of test – Evaluation of materials and material assemblies when exposed to a source of radiant heat"
- ☐ prEN ISO 13506:1998 "Protective clothing against heat and flame – Test method for complete garments – Prediction of burn injury using an instrumented manikin"

Product standards:

- ☐ prEN 469:2000 "Protective clothing for firefighters – Laboratory test methods and performance requirements for protective clothing for firefighting"
- ☐ EN 531:1995 "Protective clothing for industrial workers exposed to heat" in conjunction with EN 531/A1:1998
- ☐ EN 533:1996 "Clothing for protection against heat and flame; performance specification for limited flame spread of materials"
- ☐ EN 470-1:1995 "Protective clothing for use in welding and allied processes – Part 1: General requirements" in conjunction with EN 470-1/A1:1998
- ☐ EN 1486:1996 "Protective clothing for firefighters – Test methods and requirements for reflective clothing for specialized fire fighting"
- ☐ prEN 13911:2000 "Protective clothing for firefighters – Requirements and test methods for fire hoods for firefighters"
- ☐ prEN ISO 15384:2000 "Protective clothing for firefighters – Laboratory test methods and performance requirements for wildland firefighting clothing"

prEN 469:2000 is a draft revision of an existing European standard intended to adapt it to current developments in standardization and the state of the art. The valid European standard is:

- ☐ EN 469:1995 "Protective clothing for firefighters – Requirements and test methods for protective clothing for firefighting"

prEN ISO 6942:1998 is a draft revision of the valid European standard, EN 366:1993, the number of which has changed due to its being revised under the Vienna Agreement:

- ☐ EN 366:1993 "Protective clothing – Protection against heat and fire – Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

WG 3
Resistance to chemicals of protective clothing

Product standards:

- ☐ EN 465:1995 "Protective clothing – Protection against liquid chemicals – Performance requirements for chemical protective clothing with spray-tight connections between different parts of the clothing (Type 4 Equipment)" in conjunction with EN 465/A1:1998
- ☐ EN 466:1995 "Protective clothing – Protection against liquid chemicals – Performance requirements for chemical protective clothing with liquid-tight connections between different parts of the clothing (Type 3 Equipment)" in conjunction with EN 466/A1:1998
- ☐ EN 467:1995 "Protective clothing – Protection against liquid chemicals – Performance requirements for garments providing protection to parts of the body" in conjunction with EN 467/A1:1998
- ☐ prEN 943-1:1995 "Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles – Part 1: Performance requirements for ventilated and non-ventilated "gas-tight" (Type 1) and "non-gas-tight" (Type 2) chemical protective suits"
- ☐ prEN 943-2:1996 "Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles – Part 2: Performance requirements for "gas-tight" (Type 1) chemical protective suits for emergency teams (ET)"
- ☐ prEN 13034:1997 "Protective clothing against liquid chemicals – Performance requirements for chemical protective suits offering limited protective performance against liquid chemicals (type 6 equipment)"
- ☐ prEN ISO 13982-1:2000 "Protective clothing for use against solid particulate chemicals – Part 1: Performance requirements for chemical protective clothing providing protection to the full body against solid particulate chemicals (type 5 clothing)"
- ☐ prEN ISO 13982-2:1999 "Protective clothing for use against solid particulate chemicals – Part 2: Test method for determination of inward leakage of aerosols of fine particles into suits"

Test standards:

- ☐ DIN EN 368:1993 "Protective clothing for use against liquid chemicals – Test method: Resistance of materials to penetration by liquids"
- ☐ DIN EN 463:1994 "Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by a jet of liquid (Jet Test)"

☐ DIN EN 464:1994 "Protective clothing – Protection against liquid and gaseous chemicals, including aerosols and solid particles – Test method: Determination of leak-tightness of gas-tight suits (Internal pressure test)"

☐ DIN EN 468:1994 "Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by spray (Spray Test)"

☐ prEN ISO 6529:1998 "Protective clothing – Protection against chemicals – Determination of resistance of protective clothing materials to permeation by liquids and gases"

prEN ISO 6529:1998 is a draft revision of the valid European standard, EN 369:1993, the number of which has changed due to its being revised under the Vienna Agreement:

☐ EN 369:1993 "Protective clothing – Protection against liquid chemicals – Test method: Resistance of materials to permeation by liquids"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

WG 4
Protective clothing against foul weather, wind and cold

☐ prEN 342:2000 "Protective clothing – Ensembles and garments for protection against cold"

☐ prEN 343:2000 "Protective clothing – Garments for protection against rain"

☐ prEN 14058:2000 "Protective clothing – Garments for protection against cool environments"

Two of the above draft standards are draft revisions of existing European prestandards (see below) intended to result in the prestandard being adopted as a European standard:

☐ ENV 342:1998 "Protective clothing – Ensembles for protection against cold"

☐ ENV 343:1998 "Protective clothing – Protection against foul weather"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid prestandards were used to show the developments.

WG 5
Resistance to mechanical impact of protective clothing

☐ EN 381-1:1993 "Protective clothing for users of hand-held chainsaws –

Part 1: Test rig for testing resistance to cutting by a chainsaw"

- ☐ EN 381-2:1995 "Protective clothing for users of hand-held chain saws – Part 2: Test methods for leg protectors"
- ☐ EN 381-4:1999 "Protective clothing for users of hand-held chainsaws – Part 4: Test methods for chainsaw protective gloves"
- ☐ EN 381-5:1995 "Protective clothing for users of hand-held chain saws – Part 5: Requirements for leg protectors"
- ☐ EN 381-7:1999 "Protective clothing for users of hand-held chainsaws – Part 7: Requirements for chainsaw protective gloves"
- ☐ EN 381-8:1997 "Protective clothing for users of hand-held chain saws – Part 8: Test methods for chain saw protective gaiters"
- ☐ EN 381-9:1997 "Protective clothing for users of hand-held chain saws – Part 9: Requirements for chain saw protective gaiters"
- ☐ prEN 381-10:1999 "Protective clothing for users of hand-held chainsaws – Part 10: Test method for upper body protectors"
- ☐ prEN 381-11:1999 "Protective clothing for users of hand-held chainsaws – Part 11: Requirements for upper body protectors"
- ☐ EN 530:1994+AC:1995 "Abrasion resistance of protective clothing material"
- ☐ EN 863:1995 "Protective clothing – Mechanical properties"
- ☐ EN 1082-1:1996 "Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 1: Chain mail gloves and arm guards"
- ☐ EN 1082-2:2000 "Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 2: Gloves and arm guards made of material other than chain mail"
- ☐ EN 1082-3:2000 "Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 3: Impact cut test for fabric, leather and other materials"
- ☐ EN ISO 13995:2000 "Protective clothing — Mechanical properties — Test method for the determination of the resistance to puncture and dynamic tearing of materials"
- ☐ ISO 13997:1999 "Protective clothing — Mechanical properties — Determination of resistance to cutting by sharp objects"
- ☐ prEN ISO 13998:1998 "Protective clothing – Aprons, trousers and vests protecting against cuts and stabs by hand knives"

☐ prEN ISO 14876-1:1999 "Protective clothing – Body armour – Part 1: General requirements"

☐ prEN ISO 14876-2:1999 "Protective clothing – Body armour – Part 2: Bullet resistance – Requirements and test methods"

☐ prEN ISO 14876-3:1999 "Protective clothing – Body armour – Part 3: Knife stab resistance – Requirements and test methods"

☐ prEN ISO 14877:2001 "Protective clothing for abrasive blasting operations using granular abrasives"

prEN ISO 13998:1998 is a draft revision of the valid European standard (see below), EN 412:1993, the number of which has changed due to its being revised under the Vienna Agreement:

☐ EN 412:1993: "Protective aprons for use with hand knives"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

Since the final draft of prEN ISO 14877: 2001 was not finished until after the survey was complete, it has not been taken into account here.

WG 7
Various (ionizing radiation, electrostatic properties, high-visibility clothing)

☐ EN 471:2000 "High-visibility warning clothing for professional use – Test methods and requirements"

☐ EN 1073-1:1998 "Protective clothing against radioactive contamination – Part 1: Requirements and test methods for ventilated protective clothing against particulate radioactive contamination"

☐ prEN 1073-2:1999 "Protective clothing against radioactive contamination – Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination"

WG 9
Motorcycle rider protective clothing

☐ EN 1621-1:1996 "Motorcyclists' protective clothing against mechanical impact – Part 1: Requirements and test methods for impact protectors"

☐ prEN 1621-2:2000 "Motorcyclists' protective clothing against mechanical impact – Part 2: Motorcyclists' back protectors – Requirements and test methods"

☐ prEN 13594:1999 "Performance requirements and test methods for professional motorcyclists' protective

clothing against mechanical impact – Motorcyclists' protective gloves for road riding"

- ☐ prEN 13595-1:1999 "Protective clothing for professional motorcycle riders – Jackets, trousers and one piece or divided suits – Part 1: General requirements"
- ☐ prEN 13595-2:1999 "Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 2: Test method for determination of impact abrasion resistance"
- ☐ prEN 13595-3:1999 "Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 3: Test method for determination of burst strength"
- ☐ prEN 13595-4:1999 "Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 4: Test method for determination of impact cut resistance"
- ☐ prEN 13634:1999 "Protective footwear for professional motorcycle riders – Requirements and test methods"
- ☐ prEN 14021:2000 "Stone-shields for off-road motorcycling suited to protect riders against stones and debris – Requirements and test methods"

4.7.1 Assessment of Standard-Specific Aspects

prEN 340:2000 "Protective clothing – General requirements"

prEN 340 specifies general requirements concerning factors such as ergonomics, innocuousness, size system, ageing, effects on the skin and marking of protective clothing. It also includes general requirements for the content of the information leaflet to be provided by the manufacturer. Since this is a basic standard, it is applied in combination with a product standard which stipulates the requirements for the specific type of protective clothing in question.

Overall, the respondents' assessment of the draft standard is positive. The draft standard creates a basis which is referred to in the standards drawn up by the various working groups. This permits a uniform procedure, e.g. with regard to the pH-value requirements for the materials, and thus harmonization of safety requirements and tests.

Instead of presenting ergonomic requirements in the form of recommendations, as was the case in EN 340:1993, prEN 340:2000 lists them as basic health and ergonomic requirements in Clause 4. These basic requirements include, for example, requirements and test methods

pertaining to the material, the design and the wearer comfort of the protective clothing. Arriving at objective results causes problems because test persons are usually involved in the tests, making the results subjective.

There is dispute with regard to the cost/benefit ratio of the new material requirements and test methods in this draft standard because EC type tests entail higher costs but the additional requirements do not necessarily provide added value for the consumer.

The respondents also feel that there should be standardized intervals for the body measurements in the size system.

EN 510:1993 "Specification for protective clothing for use where there is a risk of entanglement with moving parts"

EN 510 describes protective clothing to be worn if the risk of entanglement caused by moving mechanical parts cannot be completely eliminated by safety aspects in the design. The standard replaces the national DIN 32765 standard, "Protective suit against the risk of being caught by moving parts – safety requirements, testing".

Implementing Clause 2.5 of Annex II of Directive 89/686/EEC causes problems due to the following requirement: "Where the foreseeable conditions of use include in particular the risk of the PPE being caught up by a moving object thereby creating a danger for the user, the PPE must possess an appropriate resistance threshold above which a constituent part will break and eliminate the danger." Since implementing this requirement would more or less imply "perforating" the protective clothing, it is currently not possible to implement it in line with practice.

Furthermore, the lack of a definition of outside and inside pockets in the standard leads to difficulties because of potential misunderstandings, e.g. when attaching a pocket for a folding ruler. Until this problem is taken into account in a revision of the standard, a document clarifying this issue in line with practice, to be produced by WG 1 or vertical group VG 5 of the European Coordination of Notified Bodies for PPE, will be used.

The respondents describe the cost/benefit ratio as balanced. There is currently no reason to expect the test costs to increase. In their opinion, the product requirements are, for the most part, useful for helping users select appropriate products.

EN 1149-1:1995 "Protective clothing – Electrostatic properties – Part 1: Surface resistivity (Test methods and requirements)"

EN 1149-2:1997
"Protective clothing – Electrostatic properties – Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)"

Both standards contain requirements concerning the electrostatic properties of protective clothing. EN 1149-1 covers requirements aimed at avoiding ignitable discharges and contains the relevant test methods, whilst EN 1149-2 specifies a test method for measuring materials' vertical resistance.

The respondents consider it positive that Annex A of EN 1149-1 deals with the interaction between the clothing for protection against electrostatic charges and the necessary conductible footwear.

In the respondents' opinion, the standards cover the basic health and safety requirements of Directive 89/686/EEC to a large extent.

Criticism was expressed with regard to the fact that EN 1149-1 prescribes a surface-resistivity test to assess the derivation ability of protective clothing. Although this test method is suitable for homogeneous materials, it is not suitable for woven fabrics made of conducting-core fibres. The testers therefore suggest that a suitable method specifically for such fabrics be used, e.g. a test method using an electrostatic charge.

On the subject of possible harmonization of safety and ergonomic requirements and test methods, the respondents state that the EN 1149-2 test standard could also be used as a basis for testing gloves. The standard contains a test method for measuring the specific vertical resistance, with the results being evaluated by calculating the arithmetic mean of five measurements of the vertical resistance. This offers the advantage that the thickness of the glove material does not have to be measured and the dispersion of the results can be kept to a minimum.

4.7.2 Resistance to Heat and Fire of Protective Clothing

EN 348:1992
"Protective clothing – Test method: Determination of behaviour of materials on impact of small splashes of molten metal"

EN 348 is used to test the behaviour of protective-clothing materials which can be hit by small splashes of molten metal (e.g. welding beads).

In the respondents' view, the extensive dispersion of the test results recorded by the different test institutes is problematic.

With regard to harmonization of test methods, the respondents point out that it might be possible to replace EN

348:1992 with EN 373:1993 with appropriate amendments, e.g. concerning the test fluids.

EN 348:1992 is currently being revised and it can be assumed that its content will be replaced with that of ISO 9150:1988, which largely corresponds to EN 348:1992.

EN 367:1992 "Protective clothing – Protection against heat and fire – Method of determining heat transmission on exposure to flame"

EN 367 describes a test method for determining heat transmission on exposure to flame. The standard permits a quantitative assessment of a specific risk.

In the respondents' view, the reproducibility of the test results poses a problem. Round-robin tests have shown that the results obtained by the various test institutes differ significantly. One reason given for this is that the test equipment is not described in sufficient detail. This point should therefore be improved when the standard is revised.

EN 373:1993 "Protective clothing – Assessment of resistance of materials to molten metal splash"

EN 373 specifies a test method which enables the material's resistance to molten metal splash to be assessed.

In this test method, small amounts of molten metal are poured on to the material sample. A piece of PVC film is placed directly behind the sample and the damage is assessed by noting the damage to the film after the molten metal has been poured. Any instances of the metal adhering to the sample's surface are also noted. Depending on the result, the test is repeated using a larger or smaller amount of metal until the tester identifies the smallest amount sufficient to damage the PVC film.

Problems are caused by the ageing and procurement of the PVC film. As the film is no longer commercially available, the test institutes are conducting the tests with similar films. This leads to problems with the reproducibility of the results.

Although the respondents rate the cost/benefit ratio as appropriate in principle, the division of the molten metal mass into 10g steps is, in their opinion, complex and thus cost-intensive.

One recommended solution is to use a calorimeter to improve the existing test method. As with other test methods, the test could use a calorimeter to measure the time needed for the temperature to increase by a defined amount with a constant metal weight (e.g. 200 g of aluminium).

The revision of EN 373 can be expected to bring improvements since, for in-

stance, a new material is to be defined to replace the PVC film currently in use.

prEN 469:2000 "Protective clothing for firefighters – Laboratory test methods and performance requirements for protective clothing for firefighting"

prEN 469 contains test methods and performance requirements for protective clothing for firefighting.

From the point of view of occupational health and safety, draft standard prEN 469 can be considered positive because, in addition to protection against thermal hazards, it also covers limited protection against hazardous chemical substances. This is regarded as beneficial because firefighters can also come into contact with chemically aggressive substances during firefighting operations. Furthermore, the protective clothing for firefighting provides a good level of wearer comfort since it is relatively light and has a generous cut.

A few requirements have been added to those of EN 469:1995. The following points have been improved:

- an additional class for thermal requirements (performance levels 1 and 2) has been introduced;
- performance requirements concerning watertightness and water-vapour permeability are in place; the watertightness tests have to be carried out in accordance with EN 20811:1992 and the tests for water-vapour permeability in accordance with EN 31092:1994;
- requirements for retro-reflective/fluorescent material, corresponding to those for high-visibility clothing, have been incorporated; and
- an additional clothing test (prEN 469: 2000, Clause 6.13) in accordance with prEN ISO 13506:1998 has been included.

The draft standard does consider PPE compatibility but the respondents suggest that further examples with requirements should be added. Combined use of a firefighter's suit and self-contained open-circuit compressed-air breathing apparatus was cited as an example. The shoulders of the suit should have a rib-type reinforced patch because the heat transmission is higher in the areas where the insulating air cushion is compressed.

EN 470-1:1995 including A1:1998 "Protective clothing for use in welding and allied processes – Part 1: General requirements"

EN 470-1 in conjunction with EN 470-1/A1 contains general requirements and test methods for protective clothing for use in welding and allied processes.

In the respondents' opinion, the standard largely fulfils the basic health and safety requirements of Directive 89/686/EEC.

The requirements pertaining to the tear resistance and dimensional change of leather are regarded as "too high" (Clause 5.4 "The dimensional change of the leather outer material must not exceed 5%"). The result is that leather protective clothing for welders is being ousted from the market to a certain extent.

The standard still does not include a requirement for the length of the trouser-legs, which would ensure that the trouser-legs cover the top of the footwear.

The current lack of performance-requirement grades for protective clothing for different types of welding is considered problematic by the respondents. Performance categories are already planned in the revision of EN 470-1 including Amendment A1 to rectify this problem and improve the level of occupational health and safety.

EN 531:1995 including A1:1998 "Protective clothing for industrial workers exposed to heat"

EN 531 including Amendment A1 stipulates a wide range of requirements for protective clothing for industrial workers exposed to heat. The pictograms show the user which tests have been carried out and which performance levels were achieved.

In contrast to EN 531:1995, the scope no longer explicitly excludes protective clothing for firefighting and welding. This change means that, for example, protective clothing for firefighting can be tested in accordance with EN 531. However, this is viewed as a problem because this type of protective clothing can offer a lower standard of safety than conventional protective clothing for firefighting.

The standard requires that the test criteria for limited flame spread must be complied with and at least one additional test for protection against

- ☐ convective heat,
- ☐ radiant heat or
- ☐ heat from splashes of molten metal (aluminium, iron)

is carried out with a successful result.

In this regard, the respondents criticize the fact that any one of the tests listed above can be applied irrespective of the intended use. In most cases, e.g. in the event of a large fire, however, several types of heat are present, which means that it would be useful to test several types too. It would be worth considering introducing one single test, e.g. based on ISO/DIS 17492 "Clothing for protection against heat and flame – Determi-

nation of heat transmission on exposure to both flame and radiant heat".

The large number of performance levels makes it difficult for users to select suitable clothing. The number of performance levels should be reduced to a practical amount when the standard is revised.

EN 532:1994 "Protective clothing – Protection against heat and flame – Test method for limited flame spread"

This standard describes a test method for determining materials' limited flame spread. The performance requirements for materials aimed at providing this type of protection are contained in EN 533.

The test method in EN 532:1994 is based on the method described in ISO 6941:1984 "Textile fabrics – Burning behaviour – Measurement of flame spread properties of vertically oriented specimens" but the range of samples is smaller in the European standard.

Since this test method only specifies surface flaming of materials or assemblies of materials for a flaming time of 10 s, fabrics without a flame-retardant finish also fulfil the standard's requirements. Consideration should thus be given to changing the test requirements.

The "gas pressure" and "composition of the gas" test parameters as well as the imprecise description of the test method are also regarded as problematic.

The revision of the standard can be expected to bring about an improvement because the revision is based on ISO 15025:2000 which permits edge ignition as an alternative method.

EN 533:1996 "Clothing for protection against heat and flame; performance specification for limited flame spread of materials"

In EN 533, the limited flame spread of a material is expressed by means of an index based on the results of the tests carried out in accordance with EN 532. Three performance levels are specified. This classification is certainly of assistance to the user in selecting materials for protective clothing.

EN 702:1994 "Protective clothing – Protection against heat and flame – Test method: Determination of the contact heat transmission through protective clothing or its materials"

This standard specifies a test method for determining the contact heat transmission through protective clothing or its materials.

From the point of view of occupational health and safety, the respondents consider this standard positive because it enables special risks to be assessed.

However, they feel it poses a problem due to the inadequate reproducibility of the test results. Improvements are already planned in the revision of the standard.

EN 1486:1996 "Protective clothing for firefighters – Test methods and requirements for reflective clothing for specialized fire fighting"

EN 1486 specifies test methods and requirements for reflective clothing for specialized firefighting.

In the respondents' opinion, it is difficult to realize ergonomic requirements with this type of PPE because the clothing is usually aluminized and only worn for brief spells. The introduction of a weight restriction was mentioned as a possible ergonomic requirement that could be covered in the standard.

PPE compatibility (e.g. clothing combined with head or hand protection) is dealt with in Clause 4 of the standard.

According to the manufacturers, the classification of the protective clothing into three types is unsatisfactory. Since the standard is intended to provide the entire body with protection against extreme radiant heat (e.g. in the event of a large fire), the manufacturers do not understand why the standard makes a distinction between Type 1 and 2 equipment for partial protection, especially since only Type 3 guarantees complete protection. This issue should be made clearer in the standard.

prEN ISO 6942:1998 "Protective clothing – Protection against heat and fire – Method of test – Evaluation of materials and material assemblies when exposed to a source of radiant heat"

This draft standard describes two complementary test methods for determining the behaviour of materials for clothing providing protection against heat when exposed to radiant heat. prEN ISO 6942:1998 will replace the valid European standard, EN 366:1993.

EN 366 posed the problem that the results obtained by the different test institutes were considerably dispersed. Consequently, the testing equipment has been changed in draft standard prEN ISO 6942. These changes include the following:

- ☐ the former calorimeter has been replaced by a calorimeter with a small curved copper plate;

☐ the sample holders have been redesigned and

☐ a simplified measuring system has been introduced.

The round-robin tests that have been conducted showed that the reproducibility of the test results was good.

prEN ISO 13506:1998
"Protective clothing against heat and flame – Test method for complete garments – Prediction of burn injury using an instrumented manikin"

This draft standard specifies the general principles of a test method for determining the protection provided by single-layer garments and by protective clothing ensembles when exposed to a jet flame or other flame-induced or radiation-induced heat for a short period. The test is carried out on a life-size manikin under defined laboratory conditions.

The respondents criticize the reproducibility of the results delivered by this test method because the test parameters, e.g. size of the test chamber, number and position of the burners or the size of the test dummy (manikin), are not specified precisely enough. If this deficiency is remedied, an appropriate cost/benefit ratio can be expected.

prEN 13911:2000
"Protective clothing for firefighters – Requirements and test methods for fire hoods for firefighters"

This draft standard specifies the minimum safety requirements and test methods for fire hoods for firefighters, which are worn together with the protective clothing, the respiratory protective device and the helmet.

Germany does not have a comparable national standard document. The respondents are currently not aware of any significant deficiencies in this relatively new draft standard.

prEN ISO 15384:2000
"Protective clothing for firefighters – Laboratory test methods and performance requirements for wildland firefighting clothing"

This draft standard specifies test methods and minimum performance requirements for protective clothing used in wildland firefighting and the associated activities.

The German experts have no significant interest in the standard for this protective clothing, e.g. for forest fires, because there is not much need for such clothing.

4.7.3 Resistance to Chemicals of Protective Clothing

EN 368:1992
"Protective clothing – Protection against

liquid chemicals – Test method: Resistance of materials to penetration by liquids"

EN 368 specifies test methods for determining materials' resistance to penetration by liquids. The tests mentioned examines the extent to which the material resists penetration by and repels chemical substances.

EN 368 prescribes the use of the "gutter test method", which ensures realistic exposure to chemicals. A quantitative measurement of materials' penetration behaviour and repellency can be obtained by calculating the penetration index. The disadvantage of this standard, however, is that the gutter test method is not suitable for volatile chemicals.

EN 463:1994 "Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by a jet of liquid (Jet Test)"

This standard can be applied to protective clothing consisting of one or several parts. To determine the resistance of clothing for protection against chemicals to penetration by a jet of liquid, the "jet test" method is used.

In this test method, a jet of water, containing a fluorescent or visible colour indicator, is aimed at the joins (e.g. seams) in the protective clothing. A test person or test dummy wears the suit over absorbent overalls. Stains on the absorbent overalls indicate that the fluid has penetrated the suit.

Since this test method is intended to be used for a variety of suit designs, test parameters such as the number of test points and the angle of the jet are not or not exactly defined. This means that differences in the results cannot be ruled out.

EN 464:1994 "Protective clothing – Protection against liquid and gaseous chemicals, including aerosols and solid particles – Test method: Determination of leak-tightness of gas-tight suits (Internal pressure test)"

EN 464 describes a test method for determining the resistance of a gas-tight suit to penetration by gases, e.g. due to imperfections in the materials or seams.

The chemical protective suit, including the gloves, boots and the full face mask (if intended to be used) are inflated to a defined pressure using compressed air. The fall in pressure after a specified amount of time is the criterion for assessing the leak-tightness. Overall, the respondents give the standard a good rating.

EN 465:1998, EN 466:1998, EN 467:1998, prEN 943-1:1995 and prEN 943-2:1996

"Performance requirements for chemical protective clothing for various uses"

Performance requirements for chemical protective suits are specified in the standards and draft standards listed below.

EN 465 contains minimum requirements for spraytight chemical protective suits with spraytight connections between the various parts of the clothing and with the gloves and boots (Type 4).

EN 466 contains minimum requirements for liquid-tight chemical protective suits with liquid-tight connections between the various parts of the clothing and with the gloves and boots (Type 3).

EN 467 contains minimum requirements for garments which provide parts of the body with protection against liquid chemicals, e.g. aprons, arm protectors and hoods; however, EN 467 does not specify any requirements regarding complete protective suits because each individual garment can be worn in combination with other garments.

prEN 943-1 defines performance requirements for ventilated and non-ventilated "gas-tight" (Type 1) and "non-gas-tight" (Type 2) chemical protective suits.

The performance requirements for "gas-tight" (Type 1) chemical protective suits for emergency teams are covered in prEN 943-2:1996.

A positive aspect of standards EN 465 to 467 is that mechanical and chemical requirements are specified for seams (in EN 465) and also for joins between the suit and protective gloves or shoes (in EN 466). Furthermore, the standards call for the complete suit to be tested. In addition, permeation tests and a series of mechanical tests on the protective-clothing material are always required.

The respondents consider it disadvantageous that compatibility problems, e.g. between anti-chemical protection, protective boots, protective gloves and protective clothing, could occur when the user selects products.

The respondents point out that there is a problem with the variety of classes (e.g. six mechanical parameters with up to six performance classes) in EN 465 to 467 and prEN 943-1, which makes it difficult to select a suitable type of protective clothing for a specific hazardous situation.

They also consider the breakthrough times for the permeation a problem. These times are based on laboratory conditions and are not always realistic.

The testers also point out that draft standard prEN 943-1 does not call for

the air-supply unit's resistance to chemicals to be tested.

Standards EN 465 to 467 and draft standard prEN 943-1 already contain a few ergonomic requirements. The respondents are in favour of additional ergonomic requirements being included, e.g. details concerning the dependency between product requirements and ambient temperature or how physical the work is.

On the subject of harmonization of safety and ergonomic requirements and test methods, the respondents comment that, for example, a uniform flammability test method would be useful. Clause 4.12 "Flame Retardance" of prEN 943-1 refers to prEN 1103:1993, whilst Clause 4.9 "Flame Retardance" of prEN 13034:1997 refers to prEN 1146: 2000.

EN 468:1994 "Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by spray (Spray Test)"

This standard specifies a test method for determining chemical protective clothing's resistance to penetration by sprays consisting of liquid chemicals. The test method is similar to that of EN 463, in which absorbent overalls worn under the protective suit are exposed to a test fluid. EN 468 differs from EN 463 in that the test person or test dummy is situated on a turntable and the aerosol mist is generated via fixed nozzles.

The respondents criticize the extensive dispersion of the test results and the fact that the protective function in the hood/neck area might not be adequately examined.

prEN ISO 6529:1998 "Protective clothing – Protection against chemicals – Determination of resistance of protective clothing materials to permeation by liquids and gases"

This draft standard is a draft revision of EN 369:1993, the number of which has changed due to its being revised under the Vienna Agreement.

prEN ISO 6529 specifies a test method for determining the resistance of materials which can be used in clothing providing protection against permeation by liquid or gaseous chemicals. The respondents' overall assessment of this standard, which is referred to in many product standards, is positive.

Since the scope of application in EN 369 has been extended in this draft standard, it is possible to test for permeation by gaseous chemicals. Furthermore, the standard contains a test method using a

permeation cell in accordance with the American standard ASTM/F 739, which is already used by a number of test bodies and is also used to test protective gloves in accordance with EN 374-3:1994.

prEN 13034:1997
"Protective clothing against liquid chemicals – Performance requirements for chemical protective suits offering limited protective performance against liquid chemicals (type 6 equipment)"

This draft standard specifies requirements for liquid-tight reusable chemical protective suits (type 6), which are intended to provide limited protection against the effects of liquid aerosoles, sprays and small splashes.

prEN 13034 largely covers the basic health and safety requirements of Directive 89/686/EEC and would thus permit certification on the basis of the standard. The testers point out that it does not include partial body protection and that light solvents should not be used in the test specified by EN 368:1992 because they vaporize quickly.

In the respondents' opinion, prEN 13034 does not give sufficient consideration to PPE compatibility because it only supplies general references to other European standards for gloves, protective shoes and respiratory protective equipment.

prEN ISO 13982-1:2000
"Protective clothing for use against solid particulate chemicals – Part 1: Performance requirements for chemical protective clothing providing protection to the full body against solid particulate chemicals (type 5 clothing)"

prEN ISO 13982-2:1999
"Protective clothing for use against solid particulate chemicals – Part 2: Test method for determination of inward leakage of aerosols of fine particles into suits"

prEN ISO 13982-1 specifies requirements for chemical protective clothing which provides resistance to penetration by solid particles (type 5). prEN ISO 13982-2 prescribes a test method for determining how effectively the chemical protective clothing's resistive layer protects against aerosoles of fine particles.

In the experts' opinion, PPE compatibility is only given partial consideration in prEN ISO 13982-1 since it only refers generally to the requirements for gloves, boots and respiratory protective equipment in other European standards.

In addition, the testers criticize the large number of performance levels for classifying the inward leakage. In view of the measurement method specified in the draft standard, such a detailed classification appears neither necessary nor useful. The number of performance levels

should therefore be reduced in the revision process.

4.7.4 Protective Clothing against Foul Weather, Wind and Cold

prEN 342:2000 "Protective clothing – Ensembles and garments for protection against cold"

This draft standard is intended as a common basis for requirements and test methods for ensembles (i.e. two-piece and one-piece suits) and single garments providing protection against cold. The intention is to convert ENV 342:1998 into a European standard. Similar, national standards are DIN 61536:1988 "Mens' coated winterproof outfits; safety requirements and testing" and DIN 61537:1988 "Thermal waistcoat; safety requirements and testing", which will have to be withdrawn when the prestandard is replaced by a European standard.

The respondents give a positive assessment of the draft standard's ability to aid the user in selecting suitable protective clothing. Table B.1 (Annex B) is a positive example since the test results given put the user in a better position to select clothing for his or her specific needs. The table lists the clothing's basic thermal insulation in conjunction with the ambient temperatures for the heat compensation, the different levels of exposure and the length of use.

prEN 342 includes ergonomic requirements. For instance, Clause 4.1, "General Information" specifies that the ergonomic requirements in EN 340 must be fulfilled and points out that the cut of the protective clothing influences wearer comfort. The respondents also regard the test of the thermal behaviour of the overall clothing system as a further ergonomic aspect.

In the respondents' view, the high cost of the "manikin test" poses a problem. In this test, a life-size thermal dummy is used to measure the heat loss of the protective clothing under defined conditions, e.g. temperature or humidity. There is currently no alternative method with which the thermal properties of the entire clothing system could be tested.

Problems can arise when choosing suitable combinations of clothes and footwear for protection against the cold because no similar test is carried out for footwear for protection against the cold.

prEN 343:2000 "Protective clothing – Garments for protection against rain"

Draft standard prEN 343 contains requirements for clothing providing protection against rain. In accordance with the test methods, the material's watertightness and resistance to water-vapour per-

meation, as well as other properties, are tested. The tested materials are then classified in accordance with the results. This draft standard is intended to replace ENV 343:1998. The similar, national standard DIN 61539:1988 "Weatherproof outfits; weatherproof jackets and trousers; safety requirements and testing" will be withdrawn when the prestandard is replaced by a European standard.

In the respondents' opinion, this draft standard, in conjunction with EN 340:1993, meets the basic health and safety requirements of Directive 89/686/EEC to a large extent.

The draft standard covers ergonomic requirements by stipulating that the resistance to water-vapour permeation must be measured, the dimensional stability tested and the sizes given in accordance with EN 340. This is rated positively by the respondents.

The testers do not see any problems with regard to PPE compatibility. The draft standard allows a variety of materials and designs. This results in a large number of possible adjustments to the combined PPE. The manufacturers are critical of the fact that the draft standard does not contain any information concerning clothing for protection against a combination of hazards (multifunctional protective clothing), e.g. protection against rain and resistance to flames.

The protection requirements for performance level 1 for water-vapour permeability are generally regarded as too low. It is still possible to produce clothes using materials with low water-vapour permeability, which thus cause the wearer to sweat more.

In the respondents' view, the product requirements in the draft standard are beneficial to the user. A point of criticism was that there is no test for the entire garment, e.g. a rain test. At present, only the materials themselves and materials with seams are tested. However, this does not go far enough, in the opinion of the respondents, because factors such as cut, number of pockets or presence of flaps to cover fastenings also influence the protection provided against rain. The draft standard does not contain any design requirements, thus maintaining the design freedom for category 1 products. There are plans to include a rainproofing test in the standard. This could also help identify design faults in protective clothing.

prEN 14058:2000 "Protective clothing – Garments for protection against cool environments"

This draft standard specifies requirements and test methods for the functional properties of garments designed to protect the body against cool environments. Overall, this standard is rated positively.

4.7.5 Resistance to Mechanical Impact of Protective Clothing

EN 381-1:1993, EN 381-2:1995, EN 381-4:1999, EN 381-5:1995, EN 381-7:1999, EN 381-8:1997, EN 381-9:1997, prEN 381-10:1999, prEN 381-11:1999
"Protective clothing for users of hand-held chainsaws – requirements; test methods"

EN 381-1 describes a test rig for testing resistance to cutting by a chainsaw. Further test methods have been added in EN 381-2 for leg protectors, EN 381-4 for protective gloves, EN 381-8 for protective gaiters and prEN 381-11 for upper body protectors. Requirements concerning leg protectors are contained in EN 381-5, protective gloves in EN 381-7, protective gaiters in EN 381-9 and upper body protectors in prEN 381-10.

EN 381-5 and draft standard prEN 381-10 cover the basic health and safety requirements of Directive 89/686/EEC. EN 381-7 and EN 381-9 do not fulfil them completely. EN 381-7 is criticized because the scope of protection described therein does not cover the main hazards. EN 381-9 is criticized because combined use of gaiters with customary S-2 shoes does not provide the required safety which *is* provided by comparable PPE that has to comply with the requirements of EN 344 in conjunction with EN 344/A1 or EN 345 including EN 345/A1 and EN 381-3.

According to the respondents, these standards and draft standards do not include any details relating to compatibility with other PPE. However, since there do not appear to be any problems as yet, they do not consider there to be any need for action.

In the respondents' opinion, these standards and draft standards only cover ergonomic aspects to a very insufficient level. Incorporation of ergonomic requirements would thus be desirable.

EN 530:1994 including AC:1995
"Abrasion resistance of protective clothing material"

EN 863:1995
"Protective clothing – Mechanical properties"

These standards describe special test methods for determining the mechanical strength of materials used in protective clothing.

EN 530 including AC contains two methods for determining resistance to abrasion. The first method is used to determine the resistance to abrasion and the second method is used for conditioning the materials.

EN 863 contains a test method for determining materials' resistance to puncturing. The puncture resistance is calculated as the mean maximum force needed to puncture four test samples at a certain speed with a needle. This test method is unsuitable for knitted goods and the reproducibility of the results is poor because, depending on the test point, no puncture force is measured when the sample is a loosely knit item.

Apart from the deficiencies mentioned above, the respondents give both standards a good rating.

EN 1082-1:1996
"Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 1: Chain mail gloves and arm guards"

EN 1082-2:2000
"Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 2: Gloves and arm guards made of material other than chain mail"

EN 1082-3:2000
"Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 3: Impact cut test for fabric, leather and other materials"

EN 1082-1 contains requirements for chain-mail gloves and metal and plastic arm guards for use with hand knives. These requirements cover aspects such as design, puncture resistance, ergonomics, straps, weight, material, marking, instructions and appropriate test methods.

EN 1082-2 specifies requirements for cut-resistant protective gloves, arm guards and protective sleeves made of materials other than chain mail, rigid metal or plastic. This protective clothing offers less protection than clothing that complies with EN 1082-1 and it should be used for tasks whereby, for example, the direction of the cut leads away from the hand and arm. EN 1082-3 specifies the method for conducting impact-fall tests on fabric, leather and other materials.

On the subject of consideration given to ergonomic aspects, the respondents criticize EN 1082-1 because its requirements for the dimensions of the forearm protectors, i.e. the ratio between the length and the diameter, do not take sufficient account of the user's anatomy.

ISO 13995:2000
"Protective clothing — Mechanical properties — Test method for the determination of the resistance to puncture and dynamic tearing of materials"

ISO 13997:1999
"Protective clothing — Mechanical prop-

erties — Determination of resistance to cutting by sharp objects"

ISO 13995 specifies a "test method for the determination of the resistance to puncture and dynamic tearing of materials" and ISO 13997 a test method and the associated calculations. One of the aims of these test methods is to determine resistance to cuts from sharp edges, such as those of knives, metal sheet, swarf, glass, tools fitted with blades or castings.

The respondents are not aware of any significant deficiencies in these standards.

prEN ISO 13998:1998 "Protective clothing – Aprons, trousers and vests protecting against cuts and stabs by hand knives"

This draft standard applies to protective aprons, trousers and vests which are intended to provide a certain level of protection against stabs and cuts. It specifies requirements pertaining to, for example, resistance to cuts, size, design, ergonomics and the information to be provided by the manufacturer. The draft standard also specifies the protection classes and suitable test methods.

This draft standard serves to replace EN 412:1993 and draft standard prEN 412:1996. The following changes have been made compared to EN 412:

- the general requirements concerning functional design (3.2.1), the requirements on flexibility (3.2.4), the flexibility-test apparatus (4.3), the flexibility test (4.5.4) and the specification (in A.6) that size 2 protective aprons are for persons taller than 1650 mm have been removed;
- a classification into two performance classes has been added, with protective aprons manufactured in accordance with EN 412 assigned to class 2. The German experts question the introduction of two performance classes for aprons. There is currently no known application for class 1 aprons. Furthermore, the respondents believe that there is a risk that class 1 aprons could be used by mistake in areas where a higher level of protection is required;
- specifications for trousers, vests and other garments have been added and recommendations have been made for risk assessment and selection and fit of various sizes of aprons and other garments.

In the respondents' opinion, the cost/benefit ratio of the tests specified in prEN ISO 13998 is unbalanced. Ergonomic tests will significantly increase test costs without any additional findings being obtained. The reproducibility of the results of the ergonomic tests was not comment-

ed on since there is not yet any experience in this area.

prEN ISO 14876-1:1999
"Protective clothing – Body armour – Part 1: General requirements"

prEN ISO 14876-2:1999
"Protective clothing – Body armour – Part 2: Bullet resistance – Requirements and test methods"

prEN ISO 14876-3:1999
"Protective clothing – Body armour – Part 3: Knife stab resistance – Requirements and test methods"

Body armour is intended to prevent, as far as possible, serious and fatal injuries to the body from bullets, stabs or a combination of the two. Part 1 of draft standard prEN ISO 14876 specifies general and ergonomic requirements and Part 2 specifies requirements and test methods for determining the body armour's resistance to bullet impact. Requirements and test methods for determining the body armour's resistance to knife stabs are contained in Part 3.

Ergonomic aspects are dealt with in prEN 14876-1. Ergonomic requirements to be fulfilled by the body armour are listed in Clause 4.6, and ergonomic tests, such as tests on a group of test wearers, are in Clause 5.3. In the respondents' view, the draft standard comprises too many ergonomic aspects.

The respondents are positive in their assessment of the test methods used to judge a protective vest's resistance to bullets (Part 2) and knife stabs (Part 3).

The users are also of the opinion that the content of the draft standards should be reduced. The present high test costs have a particularly negative effect in small-scale production. Consequently, the cost/benefit ratio cannot be considered good.

4.7.6 Various (Ionizing, Electrostatic Properties, High-Visibility Clothing)

prEN 471:2000
"High-visibility warning clothing for professional use"

This draft standard contains requirements and test methods for high-visibility warning clothing intended to make the wearer clearly visible in hazardous situations in daylight and in the dark. The requirements pertain to the colour, reflection, minimum area and the colour scheme. The test methods are used to determine whether the minimum protection is maintained when the warning clothing is subject to certain care methods.

prEN 471 gives a choice of three colours (fluorescent yellow, fluorescent orange-red and fluorescent red) for the

background material. Opinion in Germany is divided on these three permissible colours. On the one hand, designers, for example, consider these specifications positive because of the freedom they give them. On the other, some respondents criticize the fact that having several permissible colours confuses road users and thus reduces safety because German road users are only familiar with orange-red as the colour used for high-visibility warning clothing. The explanation given was that a follow-up regulation to the German road traffic regulations stipulates that protective clothing to be worn by road users must be orange-red. There are exceptions, e.g. for ADAC (German Automobile Club), which has special permission to provide its employees with yellow protective clothing. The working group responsible was unable to agree on a standard colour for high-visibility warning clothing, especially since Europe-wide standardization of the colour would have caused substantial costs in those countries where the colour of protective clothing is presently not in line with the draft European standard.

Studies on the reduction of the luminance factor of background materials for warning clothing due to use and cleaning show that the requirements need to be expanded, particularly due to the background material's ageing behaviour. In some experiments, certain materials fell short of the minimum luminance factor.

The experts also point out that the performance of the reflective material in wet conditions varies, with some materials reacting differently over time. As the test method does not cover this aspect, the draft standard should state the exact point of time at which the specific reflection coefficient of the reflective material should be determined.

The respondents also criticize an error whereby the German and the English version of the draft standard have different product requirements. For example, the German draft standard incorrectly states that reflective bands may only be applied horizontally whereas the English version permits an incline of $\pm$ 20°.

In some cases, a trimming material is used as well as the background material. The testers point out that the draft standard should specify that the trimming material's colour fastness should meet the same requirements as the background material.

Other points of criticism are that the minimum area of the background material for the front and back of the warning clothing is not specified and that fleece fabrics have difficulties achieving the required limit values in the burst strength test.

EN 1073-1:1998
"Protective clothing against radioactive contamination – Part 1: Requirements and test methods for ventilated protective clothing against particulate radioactive contamination"

prEN 1073-2:1999
"Protective clothing against radioactive contamination – Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination"

EN 1073-1 specifies requirements and test methods for ventilated protective clothing intended to protect the wearer against particulate radioactive contamination. Requirements and test methods for non-ventilated protective clothing intended to protect the wearer against particulate radioactive contamination are specified in prEN 1073-2.

The respondents' overall assessment of the standard and draft standard is positive.

4.7.7 Motorcycle Rider Protective Clothing

EN 1621-1:1996
"Motorcyclists' protective clothing against mechanical impact – Part 1: Requirements and test methods for impact protectors"

prEN 1621-2:2000
"Motorcyclists' protective clothing against mechanical impact – Part 2: Motorcyclists' back protectors – Requirements and test methods"

EN 1621-1 specifies requirements and test methods for impact protectors for use in motorcyclists' clothing. prEN 1621-2 applies to back protectors and contains requirements concerning the protectors' performance in the event of an impact as well as specifications on how the relevant tests are to be conducted.

The respondents state that EN 1621-1 contains many safety requirements. They are positive in their assessment of the product requirements' ability to enable the user to select a suitable product. Unlike EN 1621-1, draft standard prEN 1621-2 has two protection classes. However, this classification is the subject of dispute. The objectors protest that motorcyclists cannot know which accident scenario they could be involved in and thus can also not predict which back protector they need. In addition, prEN 1621-2 does not explain which protector should be used for which purpose. It seems, therefore, that it would be useful to have just one protection class in future, as in EN 1621-1.

The requirements in EN 1621-1 concerning the layout of the information leaflet are rated as good. The requirements in

prEN 1621-2 regarding the information leaflet are very extensive, which causes a certain lack of clarity and could result in the user not reading the leaflet.

According to the respondents, EN 1621-1 contains ergonomic requirements at least in Clause 4.2 "Protectors' Impact Areas", which refers to protectors for specific parts of the body. These body parts are defined as impact areas and it is pointed out that the size of the impact areas can vary (Clause 5.2.2 "Shape and Dimensions of Templates"). prEN 1621-2 describes ergonomic tests to be conducted by suitable test persons.

In the respondents' view, the impact-absorption test method provides a good level of representativeness but the reproducibility needs to be improved. In their opinion, this would mean identifying the causes of the dispersion of the test results by means of appropriate studies. With regard to prEN 1621-2, they point out that the dimensions of the dummy are not specified clearly.

The cost/benefit ratio of the standard and the draft standard are judged to be balanced.

prEN 13594:1999 "Performance requirements and test methods for professional motorcyclists' protective clothing against mechanical impact – Motorcyclists' protective gloves for road riding"

This draft standard applies to protective gloves worn by professional motorcyclists for road riding. It specifies performance requirements and suitable test methods.

The draft standard takes ergonomic aspects into account in that it specifies that a test person with appropriate body dimensions and motorcycling experience must perform certain tasks. This test is also used to determine compatibility with other types of protective clothing.

The respondents are not aware of any fundamental problems concerning this standard.

prEN 13595-1:1999, prEN 13595-2:1999, prEN 13595-3:1999 und prEN 13595-4:1999 "Protective clothing for professional motorcycle riders – general requirements; test methods for determination of impact abrasion resistance, burst strength and impact cut resistance"

These draft standards specify requirements and test methods for protective clothing (jackets, trousers and one-piece or divided suits) for professional motorcyclists. This protective clothing is intended to offer a defined level of protection

against injuries in the event of an accident. prEN 13595-1 specifies the general requirements for protective clothing, prEN 13595-2 specifies a test method for determining impact-abrasion resistance, prEN 13595-3 a test method for determining burst strength and prEN 13595-4 a test method for determining impact-cut resistance.

Clause 4 of draft standard prEN 13595-1 specifies two performance levels for protective clothing. The German experts are at odds as to the necessity of this classification into two protection classes. The reasons given by the objectors are similar to those given in connection with prEN 1621-2:2000 and relate to the following points:

- ☐ the hazardous situation cannot be foreseen and
- ☐ the standard does not specify the area of use.

Ergonomics and compatibility with various types of PPE are dealt with in Annex A "Determination of Fit and Ergonomics" of prEN 13595-1 and are rated positively by the respondents. In accordance with this annex, the ergonomic requirements for the protective clothing are examined on a test wearer. To pass this test, the clothing must, for example, also be equipped with appropriate protectors.

The respondents take a partly positive, partly critical view of the test methods specified in the draft standards because, for example, only a few European test bodies have the test apparatus required to determine impact-abrasion resistance (prEN 13595-2).

Since the standards comply with Directive 89/686/EEC, the respondents rate the cost/benefit ratio of the test methods as appropriate. However, from the point of view of the free market, they consider the overall scope of the tests to be very costly.

prEN 13634:1999 "Protective footwear for professional motorcycle riders – Requirements and test methods"

prEN 13634 covers protective footwear for professional motorcyclists for road or off-road riding. The draft standard contains requirements concerning the protective function, ergonomics, inocuousness marking, etc. and specifies the relevant test methods.

Compatibility with other types of PPE is dealt with in Annex A. The draft standard prescribes wearer tests, which are conducted either with the PPE specified in the information for the wearer and instructions for use or at least with one typical garment of average weight and with long trouser-legs.

As with draft standards prEN 13595-1 to -4, the respondents believe that round-robin tests are necessary in order to better judge the reproducibility of the test methods used.

prEN 14021:2000 "Stone shields for off-road motorcycling suited to protect riders against stones and debris – Requirements and test methods"

This draft standard specifies requirements and test methods for stone shields to be worn when riding a motorbike in off-road conditions. Ergonomic requirements and test methods are specified in Clauses 4.6 and 5.4.

In this area too, round-robin tests are needed before the reproducibility of the test methods can be commented on.

4.7.8 Assessment of Generic Aspects

In the respondents' opinion, the standards prepared outside of the PPE committees and quoted in the European standards and draft standards on protective clothing essentially fulfil their purpose from the point of view of occupational health and safety.

In order to ensure that ergonomics is given better consideration in the standards concerning protective clothing, members of CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets" are working in JWG 9 of CEN/TC 122 "Ergonomics". JWG 9's work is viewed critically and not always considered of concrete help. The documents it produces are either very general or contain very specific and thus complex requirements, resulting in significant costs. JWG 9 does not offer enough practice-oriented solutions that can be incorporated directly into the product standardization. No assistance is given with regard to the development of test specifications and performance limits; the reproducibility of the test methods presented is often not guaranteed.

The process of revising the standards and draft standards aims to act on the findings of the European Coordination of Notified Bodies for PPE in the field of protective clothing. The testers point out that, although they are familiar with the European Coordination's recommendations in the form of technical sheets, the vertical groups do not always receive feedback. The notified bodies see a need for action in the following areas:

- ☐ with regard to ergonomics, the requirements in the standards should be as specific as possible and the standards should specify objective and reproducible test methods;

- ☐ sufficient time and financial resources should be made available for round-robin tests during the standard-preparation process. This would enable the dispersion of the test results to be defined, thus improving the standards;
- ☐ all notified bodies should be bound to the vertical groups' recommendations; and
- ☐ standards should be worded more precisely so as to minimize the scope for interpretation that often exists.

The respondents are positive in their overall assessment of how occupational health and safety are considered in the various documents in the field of protective clothing. It proved possible to assert OH&S interests in a variety of standards. In those cases where German OH&S interests could not be asserted in the standards, the reason was either the lack of a majority in the European standardization groups or the fact that compromises had to be made. For example, water-vapour-tight materials were approved for clothing providing protection against rain because plastic-coated materials are in widespread use in Europe, are inexpensive and are considered adequate for the work places in question.

The German experts fear that German OH&S interests might be considered to a lesser degree in standards prepared in the future since representatives of Berufsgenossenschaften, government inspection bodies or even employer and employee representatives are participating directly in European working-group meetings less and less often. The reasons given for this include cost and the number of different working groups at CEN and ISO.

The influence of ISO standardization on the definition of OH&S requirements differs considerably depending on the type of protective clothing. ISO/TC 94/SC 13 is already working on numerous standards similar to those in the standardization area covered by WG 2, 3 and 5. Many of these standards will influence the revision of the corresponding European standards. This applies, for example, to EN 532:1994, which is to be replaced by ISO 15025:2000. WG 1, 4, 7 and 9 are only influenced slightly by ISO, if at all, because ISO/TC 94/SC 13 does not yet carry out similar product standardization. In general, the respondents fear that the German influence on the definition of OH&S requirements at the ISO level will continue to decrease because there are more persons entitled to vote. In addition, the number of German experts at ISO meetings is falling and, in some cases, there is no German participation at ISO meetings. The reasons cited for this development were the cost and time required for meetings lasting several days, especially outside Europe. The respondents

also consider there to be a risk that the ISO standardization might cause some very specific test methods to be introduced into European standardization, which would mean that Germany would have to procure any necessary new test equipment which it did not have.

In the respondents' view, the position of occupational health and safety in the area of protective clothing could be promoted by the following measures:

- ☐ creation of financial incentives for experts to encourage them to attend meetings of European working groups;
- ☐ activities to motivate experts to take part in the standardization work carried out by ISO/TC 94/SC 13 since this work will gain in significance in the medium term;
- ☐ securing the funding of the secretariat activities for TCs and WGs because financial shortages can be expected in the near future; and
- ☐ comprehensive market surveillance with regard to the distribution and use of PPE.

4.8 Equipment for Hand and Arm Protection

Safety requirements and test methods for protective gloves are specified in the following European standards and draft standards, drawn up by CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets":

- ☐ prEN 374-1:1998 "Protective gloves against chemicals and micro-organisms – Part 1: Terminology and performance requirements"
- ☐ prEN 374-2:1998 "Protective gloves against chemicals and micro-organisms – Part 2: Determination of resistance to penetration"
- ☐ prEN 374-3:1998 "Protective gloves against chemicals and micro-organisms – Part 3: Determination of resistance to permeation by chemicals"
- ☐ prEN 388:1999 "Protective gloves against mechanical risks"
- ☐ EN 407:1994: "Protective gloves against thermal risks (Heat and/or fire)"
- ☐ prEN 420:1998 "General requirements for gloves"
- ☐ EN 421:1994 "Protective gloves against ionizing radiation and radioactive contamination"
- ☐ EN 511:1994 "Protective gloves against cold"
- ☐ prEN 659:2000 "Protective gloves for firefighters"

- ☐ prEN 12477:1996 "Protective gloves for welders"
- ☐ EN ISO 10819:1996 "Mechanical vibration and shock — Hand-arm vibration — Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand"

Several of the draft standards listed above are draft revisions of existing European standards intended to adapt them to current developments in standardization and the state of the art. This applies to the following valid European standards:

- ☐ EN 374-1:1994 "Protective gloves against chemicals and micro-organisms – Part 1: Terminology and performance requirements"
- ☐ EN 374-2:1994 "Protective gloves against chemicals and micro-organisms – Part 2: Determination of resistance to penetration"
- ☐ EN 374-3:1994 "Protective gloves against chemicals and micro-organisms – Part 3: Determination of resistance to permeation by chemicals"
- ☐ EN 388:1994 "Protective gloves against mechanical risks"
- ☐ EN 420:1994 "General requirements for gloves"
- ☐ EN 659:1996 "Protective gloves for firefighters"

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

4.8.1 Assessment of Standard-Specific Aspects

prEN 374-1 to 3: 1998 "Protective gloves against chemicals and micro-organisms"

prEN 374-1 specifies terminology and performance requirements for protective gloves against chemicals and micro-organisms. This draft standard was intended for use in conjunction with EN 420 "General requirements for gloves". It does not specify any requirements regarding hazards posed by mechanical stress.

prEN 374-2 describes the test method for determining resistance to penetration. This test examines the impermeability of the entire glove. The test used is either the "air leakage test" or, if that proves unsuitable, the "water leakage test". In the former, the glove is submerged in a water bath and filled with air, and in the latter, the glove is filled with water.

prEN 374-3 specifies a test method for determining resistance to permeation by

potentially hazardous, non-gaseous chemicals. This method uses a simple dual-chamber flow permeation cell. The breakthrough time is measured and used as an indication of the protection (permeation class).

The respondents criticize prEN 374-1:1998 because it does not completely cover the basic health and safety requirements of Directive 89/686/EEC. Clause 3.10.2 of Annex II stipulates that there must be no holes at all in the gloves. Clause 5.2.2 of prEN 374-1 specifies acceptable quality and inspection levels in accordance with ISO 2859 "Sampling procedures for inspection by attributes". However, with the performance levels specified it is not possible to completely rule out defects in a glove batch.

The standard also fails to include requirements concerning the breathability of gloves, which means that the skin can be damaged due to moisture accumulating.

The respondents think it positive that prEN 374-1:1998 stipulates that the chemical protective glove must be tested using three test chemicals, not only one as was the case in EN 374-1:1994. However, the fact that the draft standard allows manufacturers to specify the three test chemicals themselves is considered a problem because the chemical protective glove might then only provide protection against non-hazardous chemicals.

The deficiency due to the water surface tension not being defined in the water leakage test, a shortcoming which has been evident for some time, is also present in prEN 374-2.

The respondents question the representativeness of the method specified in prEN 374-3 for testing permeation, stating, for instance, that the barrier function of a protective-glove material depends on the chemical, mechanical and thermal stress. This means that the permeation data itself can only be applied to practical conditions to a certain extent. It is thus almost impossible for the user to judge the performance capability of a used glove because the permeation and diffusion process is influenced by different factors, e.g. sequences of movements and resulting stretching or kinking, temperature or the depth of submersion in the chemical and the resulting liquid pressure. The respondents also raise the objection that a great deal of effort is involved in simulating the real-life conditions of use and that it would be better to use a method which would enable the various glove materials to be compared with one another.

The respondents comment that calculating degradation data might be of help in

the material-selection process. However, since there are no suitable and reproducible test methods for determining degradation as yet, this point had to be omitted in the revision of EN 374-3:1994.

As far as harmonizing this draft standard with others is concerned, the respondents point out that the same permeation test could be used for glove material and clothing material.

prEN 388:1999 "Protective gloves against mechanical risks"

prEN 388 specifies requirements and test methods for all types of protective gloves that are subject to stress caused by abrasion, cuts, stabs or tearing. This draft standard must be used in conjunction with EN 420, which contains general requirements and test methods for protective gloves, such as water-vapour permeability or glove design.

In a change to EN 388:1994, the tests for impact-cut resistance and specific resistivity are no longer directly specified but are contained in separate standards which are better geared to these hazards. For example, the electrostatic properties of protective clothing are dealt with in standards EN 1149-1 to -3. For the most part, the requirements and test methods are the same as those in EN 388.

In the respondents' opinion, this draft standard basically covers the basic health and safety requirements of Directive 89/686/EEC. The testers criticize the fact that, where the palm of the glove and the back of the glove are made of different materials, only the palm is tested.

The method specified in EN 388:1994 for testing resistance to cuts causes considerable dispersion of results. This is due to the material used. In the case of leather, the knife becomes sharper during the testing, whereas it becomes blunter when used on knitted goods because fibres become attached to it.

The revised version of draft standard prEN 388:1999 incorporates a few changes to the method for testing resistance to cuts. However, it is not yet possible to comment on the effects of these changes because there have not yet been sufficient round-robin tests.

With regard to the method for testing resistance to abrasion, the experts still believe it would be useful to add a performance level between the third level (2,000 cycles) and the fourth level (8,000 cycles). This would permit an even more exact indication of protective-glove materials' resistance to abrasion.

Furthermore, the test method is not suitable for all glove materials (e.g. rubber) because, in the case of rubber gloves for example, the abrasive paper becomes clogged up with rubber dust and damages the test apparatus.

EN 407:1994 "Protective gloves against thermal risks (Heat and/or fire)"

This standard specifies test methods, general requirements and thermal requirements for gloves intended to provide protection against heat and/or fire. It applies to all gloves which protect the hands against fire, contact heat, convective heat, radiant heat, small splashes of molten metal and large quantities of liquid metal.

Past studies pointed to the problems of determining heat transfer level 3 according to EN 366: 1993 "Protection against heat and fire – Test method: Evaluation of materials and material assemblies when exposed to a source of radiant heat". The opinion was that the t_3 value calculated using method B in this standard was too imprecise and it was recommended that the heat transfer level 2 (t_2 value) be calculated. The test institutes have now agreed to calculate the t_2 value; this should be taken into account when the standard is revised.

In the manufacturers' opinion, standard EN 407 basically covers the basic health and safety requirements of Directive 89/686/EEC. The testers would like to see, as with prEN 388, a requirement that both the glove back and the glove palm must be tested if they are made of different materials.

Both the testers and the manufacturers criticize the product requirements' inability to enable the user to select a suitable product. In the testers' view, it is difficult to understand why a distinction is made between radiant heat and convective heat (see also EN 531:1998).

The manufacturers also suggest that another performance level (700°C) be added for the measurement of the contact heat. The reason for this is that there are many work places where the temperature is often higher than 500°C. Furthermore, users often have difficulty understanding the difference between the maximum temperature for use specified by the manufacturer (e.g. aramide = 450°C) and the result of the material-structure test described in EN 702:1994. In order to solve this problem, the manufacturers suggest that an appropriate measurement of the heat transmission be taken.

As EN 407:1994 refers to other standards' test methods which have been found to contain deficiencies, those defi-

ciencies also apply here. The test methods concerned are as follows:

- ☐ contact-heat test in EN 702:1994,
- ☐ convective-heat test based on EN 367: 1992,
- ☐ radiant-heat test based on EN 366: 1993, method B,
- ☐ test for small splashes of molten metal in EN 348:1992 and
- ☐ test for large quantities of liquid metal based on EN 373:1993.

Consequently, the test methods cannot presently be said to have a good level of reproducibility or representativeness.

prEN 420:1998 "General requirements for gloves"

prEN 420 specifies general requirements for ergonomics, glove fabrication, innocuousness, cleaning, comfort, efficiency, marking and information. These requirements apply to all protective gloves.

The following deficiencies have been identified:

- ☐ prEN 420 does not include a reference list for known allergens. However, such a list would require the CEN states to agree on a uniform classification system for allergens first, and
- ☐ the dexterity test must be considered a subjective test method and its cost/benefit ratio cannot be said to be balanced. However, there is currently no suitable alternative test method.

In principle, the product requirements contained in the draft standard are sufficient to allow the user to select suitable products in the respondents' view. However, the manufacturers suggest that the following points should be added to the draft standard:

- ☐ pictograms should be affixed to gloves and
- ☐ the rules for dimensioning sizes should be defined more precisely.

Clause 4.4.4, "Determination of the Protein Content", of prEN 420 specifies that protective gloves made of natural latex must comply with the requirements of prEN 455-3:1996. The respondents complain that prEN 455-3 permits powdered gloves made of natural rubber latex to be produced and distributed. This poses a risk that the powder can cause latex allergens to be transported and distributed through the air. Furthermore, no limit is specified for the protein content. In addition, natural latex gloves with a protein content of less than 50 μg/g are not allowed to be marked as such. However, according to some experts, allergies can be triggered even if the glove's protein content is lower than 50 μg/g.

EN 421:1994
"Protective gloves against ionizing radiation and radioactive contamination"

This standard specifies requirements and test methods for gloves intended to provide protection against ionizing radiation and radioactive contamination. Generally speaking, it can be positively assessed from the point of view of occupational health and safety.

The respondents suggest that the climatic conditions in the test for water-vapour permeability should be harmonized with those of the test specified in EN 420. They do not see any need at the moment for the standard to be revised in detail.

EN 511:1994
"Protective gloves against cold"

EN 511 specifies requirements and test methods for gloves intended to provide protection against convective cold or contact cold down to – 50°C.

In the respondents' view, the protective gloves' insulation behaviour is tested in a variety of realistic conditions.

prEN 659:2000
"Protective gloves for firefighters"

This draft standard describes minimum requirements and test methods for protective gloves for firefighters. These gloves are intended to protect the hands against injuries in normal firefighting activities including rescue operations. Compared to DIN EN 659:1994, a new requirement has been added to stipulate that the gloves must also offer protection against inadvertent contact with liquid chemicals.

In order to rule out confusion with other protective gloves, which was certainly possible with EN 659:1994, Clause 6, "Markings", specifies the following requirement: "The markings must comply with Clause 7.2 of EN 420:1994. In addition, each firefighters' protective glove must be marked with the number of this standard, i.e. EN 659, and the special firefighters' pictogram."

Since this draft standard refers to test methods in other standards, the deficiencies in those test methods also apply to this draft standard (EN 420:1994, EN 388:1994, EN 366:1993 and EN 367:1992). The comparability and reproducibility of the results of these test methods are considered questionable.

prEN 12477:1996
"Protective gloves for welders"

This draft standard specifies requirements and test methods for protective gloves used for manual welding, cutting and allied processes. The gloves are intended

to protect the wrists and hands during welding and related tasks. The standard makes a distinction between designs A and B because the requirements specified for the protective gloves (protective effect and dexterity) can vary depending on the intended use.

Design B is recommended if a high level of dexterity is needed for the welding. For other cases, design A gloves can be used.

In the respondents' view, this draft standard covers the basic health and safety requirements of Directive 89/686/EEC. As with prEN 388:1999 and EN 407:1994, the testers feel that this draft standard should stipulate that both the palm and the back of the glove must be tested if they are made of different materials.

Since the draft standard refers to test methods in other standards, the deficiencies in those test methods also apply to this draft standard (EN 420:1994, EN 388:1994, EN 366:1993 and EN 367:1992). The comparability and reproducibility of the results of these test methods are considered questionable.

EN ISO 10819:1996
"Mechanical vibration and shock — Hand-arm vibration — Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand"

This standard describes a laboratory procedure for measuring, evaluating and indicating the vibration transmissibility of gloves in the form of vibration transmission from the handle to the palm in the frequency range 31.5 Hz to 1250 Hz.

This process is intended to assess the risk to wearers from vibration exposure.

The respondents are not aware of any significant problems concerning this draft standard.

4.8.2 Assessment of Generic Aspects

These standards and draft standards cover requirements concerning the content of the manufacturer's information leaflet by referring to EN 420 "General requirements for gloves". Clause 7.3, "Information and Instructions for Use", of EN 420:1994 specifies the minimum information which must be supplied with protective gloves when they are distributed. This information includes:

- ☐ manufacturer's name and full address,
- ☐ glove marking,
- ☐ information on available glove sizes,
- ☐ reference to the relevant European standards,

- ☐ instructions for use,
- ☐ care instructions and
- ☐ information concerning accessories and spare parts.

In addition, the individual standards specify extra information to be supplied. prEN 374-1:1998, for example, requires that a list of the tested chemicals and the protection index must also accompany the information provided by the manufacturer.

In the respondents' opinion, sufficient consideration is given to protective gloves' compatibility with other PPE. They do not see a necessity for a more specific standard since it cannot cover all possible combinations.

The standards take ergonomics into account by referring to EN 420:1994. In Clause 4, "General Requirements", and Clause 5, "Comfort and Performance Requirements", of that standard, ergonomic aspects such as the innocuousness of protective gloves (determination of the pH value) or water-vapour permeability and water-vapour absorption are specified. The manufacturers point out that the protective function must remain the primary concern and not be overshadowed by ergonomic requirements.

In general, the respondents feel that the cost/benefit ratio of the test methods is balanced. The costs can be expected to increase as a result of revisions to the standards because additional ergonomic and environmental aspects will be included. For the most part, these cost increases will be at an appropriate level.

The European Coordination of Notified Bodies for PPE delivers concrete results which should be taken into account as swiftly as possible in the process of evolving standards. However, the results are acted on rather sluggishly with the most serious problems currently being caused by the mismatched timing of the standardization work and the incorporation of round-robin findings from the European Coordination. These processes should be improved to ensure that further development of standards is not delayed.

Whilst considering it a worthy aim, in principle, to carry out standardization for arm and leg protectors at the ISO level in view of market globalization, the respondents fear that the influence of extra-European states on the practical implementation will increase. In their opinion, this trend is already foreseeable now because even at the European meetings participation is constantly on the decrease. They thus see a risk at the ISO level that the European OH&S requirements and European problems and possible solutions will play an ever smaller role.

The assessment of the level of occupational health and safety provided by the different standards varies considerably. The manufacturers rate, for example, EN 407:1994 as very good from the point of view of occupational health and safety. It offers excellent possibilities for differentiation and allows extremely high protection levels based on the performance levels. In contrast, EN 374:1994 and its new draft are considered insufficient when it comes to occupational health and safety. In the respondents' opinion, the current requirements can only be viewed as minimum requirements and must therefore be raised. In general, specific OH&S interests promoted by Germany can only be asserted by investing a large amount of time and, where appropriate, testing effort and/or forming interest groups.

In response to the question concerning standardization projects on which it proved impossible to assert Germany's OH&S interests, the respondents listed the revision projects for EN 420:1994, EN 374:1994 and EN 388:1994. The reason is the lack of a majority in votes and the voting system. Moreover, voting behaviour often appears irrational. For example, although the German argument that pictograms should be compulsory on protective gloves was accepted at the TC level, it has proven impossible to incorporate this point so far and draft standard prEN 420:1998 omits it.

The respondents also comment that the bodies responsible for market surveillance of the PPE area in Germany should be more active. Ultimately, all manufacturers are in the same boat legally speaking and have to ensure that their products comply with the basic health and safety requirements of Directive 89/686/EEC. The standards provide a clearly comprehensible framework for ensuring that the products can be presumed to conform. Market surveillance bodies should make increased use of the requirements specified in the harmonized European standards as the basis for assessing conformity.

4.9 PPE for Protection against Drowning

Safety requirements and test methods for PPE for protection against drowning are specified in the following European standards and draft standards, which were developed in CEN/TC 162/WG 6 "Life jackets".

Personal flotation devices

- ☐ prEN ISO 12402-1:2000 "Personal flotation devices – Part 1: Class A (SOLAS lifejackets), safety requirements"
- ☐ prEN ISO 12402-2:2000 "Personal flotation devices – Part 2: Class B (offshore lifejackets, extreme conditions – 275 N), safety requirements"

- ☐ prEN ISO 12402-3:2000 "Personal flotation devices – Part 3: Class C (offshore lifejackets – 150 N), safety requirements"
- ☐ prEN ISO 12402-4:2000 "Personal flotation devices – Part 4: Class D (inland/close to shore lifejackets – 100 N), safety requirements"
- ☐ prEN ISO 12402-5:2000 "Personal flotation devices – Part 5: Class E (buoyancy aids – 50 N), safety requirements"
- ☐ prEN ISO 12402-8:2000 "Personal flotation devices – Part 8: Additional items, safety requirements and test methods"
- ☐ prEN ISO 12402-9:2000 "Personal flotation devices – Part 9: Test methods for classes A to F"

The prEN ISO 12402 series of standards now consists of ten parts. It was not possible to examine parts 6, 7 and 10 at the time of the study because they did not yet exist as valid draft standards.

The prEN ISO 12402 series of standards is a series of draft revisions of existing European standards intended to restructure them and adapt them to the state of the art. This applies to the following valid European standards:

- ☐ EN 393:1993 "Lifejackets and personal buoyancy aids – Buoyancy aids – 50 N" in conjunction with EN 393/A1:1998
- ☐ EN 394:1993 "Lifejackets and personal buoyancy aids – Additional items"
- ☐ EN 395:1993 "Lifejackets and personal buoyancy aids – Lifejackets – 100 N" in conjunction with EN 395/A1:1998
- ☐ EN 396:1993 "Lifejackets and personal buoyancy aids – Lifejackets – 150 N" in conjunction with EN 396/A1:1998
- ☐ EN 399:1993 "Lifejackets and personal buoyancy aids – Lifejackets – 275 N" in conjunction with EN 399/A1:1998

In order to give as up-to-date as possible a picture of the current level of standardization, the study examined the current draft standards; the valid standards were used to show the developments.

Immersion suits

- ☐ prEN ISO 15027-1:2000 "Immersion suits – Part 1: Constant wear suits, requirements including safety"
- ☐ prEN ISO 15027-2:2000 "Immersion suits – Part 2: Abandonment suits, requirements including safety"
- ☐ prEN ISO 15027-3:2000 "Immersion suits – Part 3: Test methods"

Assessment of Standard-Specific and Generic Aspects

Since the structure and requirements of the standards/draft standards for the var-

ious categories of flotation devices build upon one another, the standards were not analysed in two groups, i.e. standard-specific and generic aspects, but in one generic assessment. The deficiencies in the standards and draft standards mentioned by the respondents are supplied as examples.

In contrast to the European standards, the draft standards were divided into product requirements and test methods. This created a clear distinction between standards for test methods and standards for requirements.

The product requirements are contained in standards prEN ISO 12042-1 to -8. More detailed requirements concerning components and materials have been added to the standards and draft standards.

The test methods to which the standards refer are to be found in prEN ISO 12402-9:2000.

Generally speaking, the respondents gave a positive assessment of the reproducibility and representativeness of the test methods in the standards.

The only test method to attract criticism was the method for determining the CO_2 concentration under the spray hood. The respondents criticize the flow rate of the surrounding air and the arrangement of the measuring devices in the laboratory test method. At present, there is no alternative to this test method. A method that could reflect the conditions in practice to a better extent is considered too expensive. Furthermore, the risk of drowning in the splash water is much higher than the risk posed to the user by increased CO_2 concentration under the spray hood. Airholes or air valves and wave-induced pump effects in the design also facilitate sufficient ventilation.

There have long been problems with thermal tests using test persons or dummies for constant-wear immersion suits. These tests are used to calculate a clo value, which indicates the insulation provided by the clothing. Both tests are considered very complex and their suitability is questioned. The relevant committees are discussing this subject and the results will probably be included in the next revision of the standard.

In the respondents' view, the cost/benefit ratio of the test methods is appropriate. It is not possible to say with certainty whether the test costs will increase. On the one hand, they may decrease because, due to the new structuring of the standards, the "additional items" and materials are tested and certified separately and only once and the test costs are partly shifted to the manufacturers'

suppliers. On the other hand, cost increases can be expected if JWG 9 "Ergonomics of PPE" of CEN/TC 122 "Ergonomics" manages to push through its plans for tests to be carried out with a much higher number of test persons. This could rapidly cause high costs. Further costs could arise due to urgently needed quality assurance measures.

In the respondents' opinion, the issue of compatible PPE is given sufficient consideration in both sets of standards, where possible. For example, Clause 3.10.2, "Test in Combination with Other Accessories", of prEN ISO 15027-3:2000 specifies, "If a harness or another accessory tested in accordance with a European standard or an international standard is an integrated part of a constant-wear suit, the performance tests must be carried out in combination with these parts and in accordance with the relevant standards". In addition, the information to be provided by the manufacturer indicates compatibility with safety harnesses, garments and other pieces of equipment, where necessary.

Special combinations are developed on the basis of agreements between the manufacturer, customer and test body and the influences of the various PPE types on each other are tested. Combined use of a life jacket with a constant-wear immersion suit was cited as an example. With this combination, a test should be carried out to ensure, for example, that the life jacket's functions, e.g. its ability to turn the wearer in to a safe position on his/her back, are still guaranteed when the additional buoyancy of the constant-wear suit comes into play. Another example given for a special combination was combined use of a firefighter's life jacket and a respiratory protective device. With this combination, the test must rule out the risk of the activated life jacket pressing against the mask, due to its volume, and possibly causing the mask to let in water.

In general, the respondents praise all of the standards for taking ergonomics into account. For example, Clause 4.5, "Performance of Personal Flotation Devices", of prEN ISO 12402-3 specifies ergonomic tests. The fact that numerous ergonomic tests have a subjective character, a well-known shortcoming, also applies to life jackets. Currently, the respondents see no way of eliminating this deficiency since the requirements must be tested using test persons.

CEN/TC 162 WG 6 "Life jackets" has harmonized as far as possible safety and ergonomic requirements and test methods intended to provide protection against the same hazard. In the respondents' view, it is difficult to harmonize these factors for all of the various

types of PPE. Where additional requirements have to be met, e.g. resistance to chemicals or suitability for use in environments where welding is carried out, additional measures have to be taken into account (e.g. use of suitable protective covers) when selecting the life jacket. These requirements are either specified in prEN ISO 12402-8 or comparable PPE standards are used. The respondents do not see any further need for action.

In the experts' opinion, the standards take considerable account of occupational health and safety. So far, it has proven possible to assert Germany's position on occupational health and safety in all standardization projects.

On the subject of the influence exerted by ISO standardization, the respondents explain that ISO/TC 188/WG 14 and CEN/TC 162/WG 6 have been collaborating for approximately six years and all documents are drawn up in accordance with the Vienna Agreement. In their opinion, it is also only possible to continue this work in cooperation with ISO. Consequently, resources urgently need to be provided, e.g. by the German Federation of Institutions for Statutory Accident Insurance and Prevention (HVBG), especially since venues are occasionally outside the EU.

With regard to how the results of the European Coordination of Notified Bodies are acted on, the respondents consider it positive that the direct contact between ISO/TC 188/WG 14, CEN/TC 162/WG 6 and vertical group VG 8 of the European Coordination of Notified Bodies for PPE means that experiences and solutions can be exchanged quickly. A negative point is that only around a quarter of the test bodies actively participate in this coordination at the present time.

5 Summary Assessment of PPE Standardization Based on the Questionnaire

This summary assessment covers the questions (see list in Section 3), for all PPE types, on which the analysis of the standards was based. Characteristic examples are briefly outlined once again. Questions 6 and 7 and 11 and 12 are dealt with together. Exact descriptions of the problems discussed can be found in Sections 4.1 to 4.9. This assessment of PPE standardization according to the questionnaire is primarily based on the majority opinion of those consulted. Any varying or opposing views voiced by a particular group (e.g. authorities or experts for a specific PPE type) are, however, also presented.

5.1 Coverage of the Basic Health and Safety Requirements

The question of whether the different standards cover the basic health and safety requirements of Directive 89/686/EEC is relevant with regard to PPE design by the manufacturer, conformity assessment carried out in the certification process and market surveillance.

With a few exceptions, the respondents generally rate the situation positively. Those criticisms made mainly concern specific suggestions for requirements and test criteria which can supplement or improve individual standards. In the area of protective clothing, the respondents would like to see, for example, an additional test method for woven fabrics made of conducting-core fibres (EN 1149-1:1995) and, in the area of gloves, testing of the material in both the back and the palm of the glove if the materials are different (EN 407:1994).

Some proposed amendments are concerned with adapting requirements in standards to the conditions of use in practice. One example is the area of "PPE against falls from a height", where edge stress on fall-arrest systems or non-vertical positioning of rigid anchorage lines for fall arresters should be taken into account in the further development of the standards. One example from the area of protective clothing is EN 381-9:1999 "Protective clothing for users of hand-held chain saws – Part 9: Requirements for chain saw protective gaiters", for which the respondents suggest that the requirements should be adapted to the leg areas which really have to be protected by gaiters during work using motorized chain saws. In the area of protective footwear, the respondents recommend that requirements be added to the standards and the test methods be adapted since technical developments have led to non-metallic inserts which are penetration-resistant (EN 12568:1998). And in the area of hearing protection, the respondents suggest that a test method be introduced to cover potential hazards caused by impulse

noise, e.g. when shooting (EN 352-4:2001 and prEN 352-5:2000).

In the respondents' opinion, there is still a need for action with regard to ensuring that certain standards cover the directive requirements on ergonomic PPE design. The subject of ergonomics is dealt with in detail in Section 5.5

For some points referred to in the standards drawn up in accordance with 89/686/EEC, the respondents criticize the precise requirements specified in the PPE Directive. This is true, for example, of the stipulation, aimed at ensuring ergonomic hearing-protector designs, that a comfort index must be specified. A standard cannot provide beneficial and reproducible requirements for such an index. Another example is EN 510:1993 "Specification for protective clothing for use where there is a risk of entanglement with moving parts". Since the possibility of protective clothing getting caught up in machinery can generally not be ruled out during machine work, protective garments which cannot become entangled would have to be perforated in order to comply with Clause 2.5 of Annex II of Directive 89/686/EEC, which would be in keeping neither with practice nor with the intended protection. As a rule, consideration should be given in such cases to the extent of implementation or fulfilment to which the basic health and safety requirements should be laid down in keeping with practice in the standards.

By and large, PPE products usually *can* be certified on the basis of the standards. However, there *are* PPE products on the market which do not comply with the basic requirements of the directive. In particular, this poses a considerable problem for manufacturers competing on the market, but product users can also suffer uncertainty. On the basis of various studies and talks at the European and national levels on the subject of the efficiency of market surveillance, improvements to market surveillance have been suggested. In Germany, the Laender High Joint Committee of Labour Inspection Services (LASI) has assigned the "Market surveillance" committee the task of coordinating these measures. A special EU-wide information and communication system (ICSMS) is intended to improve the flow of information between authorities and adapt it to today's business practice. ICSMS is currently being set up and is also intended as an information source for the public.

5.2 Product Requirements and Users' Selection of PPE

Personal protective equipment is intended to protect users against potential hazards at their place of work. Consequently, the study examined whether the prod-

uct features defined in the standards and draft standards enable users to select PPE products suitable for countering the identified hazards and thus to protect themselves to an adequate extent.

For the most part, the respondents feel that the product requirements contained in the standards and draft standards are suitable as selection criteria for the user. A positive example is prEN 342:2000 "Protective clothing – Ensembles and garments for protection against cold". With the aid of the test results obtained in accordance with this draft standard, users can select clothing for their specific purpose.

However, problems can occur if the requirements and test methods in the standards and draft standards do not adequately reflect conditions in practice. An example given in this context was prEN 374-3:1998 "Protective gloves against chemicals and micro-organisms – Part 3: Determination of resistance to permeation by chemicals". Since the barrier function of a protective-glove material also depends on, for example, mechanical and thermal stress, the permeation data supplied by the standard can only be applied to practical conditions to a certain extent.

The suggestion was made that another performance level for the measurement of the contact heat should be added to EN 407:1994 because work places can be subject to higher temperatures than the temperatures specified in the standard.

On the other hand, a very large number of performance levels can also cause problems. In the area of eye protection, for example, prEN 169:2000 "Personal eye-protection – Filters for welding and related techniques – Transmittance requirements and recommended utilisation" lists a number of filter categories which are scarcely relevant in practice. In the area of protective clothing too, e.g. chemical protective clothing (e.g. EN 465 to 467:1998), users are often faced with a very large number of different performance classes which can make it difficult for them to choose suitable PPE in line with conditions in practice.

The conditions in practice should always serve as the basis when defining performance levels.

5.3 Requirements Concerning Manufacturers' Information Leaflets

Directive 89/686/EEC requires manufacturers to enclose an information leaflet with their PPE. In particular, this leaflet is intended to give the user important information concerning the possibilities of-

fered by the PPE and how to use it as intended. Thus, a good structure and clear, comprehensible presentation are two of the basic requirements for ensuring that the information leaflet enables the user to select PPE suitable for the purpose in hand. The aim of this question was to establish to what extent the standards and draft standards contain requirements concerning the structure of manufacturers' information leaflets.

In general, the answers show that all of the product standards and draft product standards dealt with in this study contain requirements concerning the information leaflet. However, the different standards bodies take different approaches with regard to its structure. For example, protective-footwear manufacturers mainly have to inform the user by means of markings on the footwear, and certain footwear which has to meet additional requirements, e.g. for conductivity, has to come with an appropriate leaflet. In the area of protective clothing, on the other hand, the requirements for the information leaflet are specified in the individual standards concerned, based on the structure in the directive.

With some product groups, e.g. chemical protective clothing or motorcyclists' protective clothing (prEN 1621-2:2000), it can be difficult for users to select suitable protective clothing for a specific use because they are faced with a very large volume of information and the variety of possible combinations makes it difficult to interpret that information correctly with regard to use in practice. Consideration should be given to whether special information in the leaflet, e.g. notes on the protective function of the different classes or indications of limit values, could make it easier for the user to select the right PPE and understand which PPE is for which use.

In order to improve the structure of information leaflets, the PPE Sector Forum, the coordination group on PPE standardization within CEN, assigned a working group the task of listing the key content of the information leaflets as required by the directive and producing sample information leaflets. The Sector Forum also suggested that the individual TCs should use this basis to examine whether additional specifications are needed for certain standards. In the field of eye protection, for example, the experts are discussing whether the standard concerned should directly specify a "template" for the information leaflet. In order to create a better foundation for further standardization, the respondents suggest that more importance be attached to the document which explains the requirements of the directive. This would mean that the product standards could be used to ensure that the information leaflets

contain details which the user can translate into practice, thereby boosting occupational health and safety.

5.4 PPE Compatibility

The assessments of the hazards concerned show that it is often necessary in everyday work to combine different types of PPE. The study therefore also examined the extent to which standards and draft standards take possible PPE combinations into account and which aspects should be given more consideration in future.

This question has also already been dealt with by a special working group in the PPE Sector Forum. The group identified various types of possible combinations and drew up recommendations concerning the standardization thereof, with particular importance attributed to coordination and cooperation between working groups and committees concerned.

Numerous examples illustrate that various possible combinations of PPE have already been considered in the standards/draft standards in many cases. However, the respondents repeatedly point out that the standards cannot cover all possible combinations and thus that the standards should only specify requirements for PPE combinations in widespread use. In areas such as foot protection or life jackets, therefore, the respondents are of the opinion that the standards take sufficient account of PPE compatibility and that further standardization is not necessary.

However, in other areas, the respondents feel that it would be beneficial if more effort were made to ensure consideration is given to PPE compatibility. Firstly, they would like to see individual TCs incorporating PPE compatibility into the standards directly, e.g. in the field of PPE against falls from a height, where the example was given of combined use of a rescue lifting device as described in EN 1496 and a retractable-type fall arrester as described in EN 360. Secondly, they point out that some PPE combinations are treated differently in different standards and draft standards. Some standards and draft standards contain concrete requirements concerning combinations, e.g. prEN 352-3:2000, which deals with combined use of ear-muffs and an industrial safety helmet. Other standards and draft standards, e.g. on chemical protective clothing (prEN ISO 13982-1:2000), only contain general information regarding compatibility but no specifications.

Overall, the respondents consider it necessary to strive for more intense cooperation and coordination between the various

areas of PPE standardization in order to identify common PPE combinations and carry out standardization, with the involvement of the committees concerned, e.g. for combined use of respiratory and eye protection. A positive start has already been made here since joint working groups are increasingly being used to conduct such standardization projects.

5.5 Ergonomic PPE Design and Links between CEN/TCs for PPE and JWG 9 of CEN/TC 122

In accordance with the basic health and safety requirements of Directive 89/686/EEC, manufacturers must take ergonomic aspects into account when designing and producing PPE. This means that ergonomic aspects must also be considered in European product standards. One of the questions investigated by this study was to what extent European standards take ergonomic aspects into account and whether the cooperation between the PPE CEN/TCs and JWG 9 of CEN/TC 122 "Ergonomics" cater for the needs of occupational health and safety. JWG 9 is a joint coordinating working group, which consists of representatives from the field of ergonomics and the PPE CEN/TCs and has the task of developing principles regarding ergonomic design. By making this a joint working group, the aim is to ensure that the interests of the various parties concerned can be directly incorporated into standardization.

The respondents think it positive and beneficial that ergonomic aspects are being given increasing consideration in standards and draft standards. Having said that, they often comment that "exaggerated" ergonomic requirements in the standards do not bring any real benefit because they often cause safety-related criteria to be pushed into the background. In the same regard, the respondents point to the influence of the market, saying that it is an important regulatory instrument, especially in the area of ergonomics. In the long run, customers will not buy PPE products which do not comply or do not sufficiently comply with ergonomic design criteria. Since, in most cases, existing products were used as the basis for standardization, it can also be assumed that ergonomic aspects have been incorporated into standards even if there is no explicit reference to ergonomics as such. One example in this context is the area of foot protection, where the water-vapour permeability of a shoe upper is calculated, which is certainly an ergonomic characteristic.

However, the current methods specified in the standards and draft standards for testing ergonomic requirements are often criticized because they are usually sub-

jectively influenced by the use of test persons. The standards and draft standards could include even more, suitable dummy tests both in order to make the tests objective and to counter the difficulty of finding suitable test persons. However, the respondents believe that this would cause problems due to the high costs that would be incurred. A point in favour of tests using test persons is that subjective tests provide the first data on the wearer comfort of a PPE product.

In principle, the respondents consider JWG 9's work positive because the working group has created a possibility for offering the PPE TCs assistance in ensuring that even better consideration is given to ergonomic aspects in standards. However, the results of JWG 9's work are presently not always a concrete aid in the development of PPE standards. On the one hand, the documents it produces are too general, i.e. they do not include test specifications or performance limits, which means that they are virtually impossible to translate into practice. On the other hand, some of the requirements are so specific or so complex that they might lead to significant costs, e.g. in the field of protective clothing, if they were incorporated into the standards.

Since there is also often no experience as yet of ergonomic requirements in use, the respondents are of the opinion that the documents produced by JWG 9 should be issued in the form of technical reports and not European standards. These technical reports would then form the basis of a sort of "checklist" which the individual standards bodies could use in their standardization of the products in question.

5.6 Suitability of Test Methods

The PPE test methods specified in the standards are intended to ascertain whether and to what extent the product in question complies with the requirements in the standard.

The question examined here was whether the cost/benefit ratios of these test methods are considered balanced and appropriate and whether new standards or draft standards can be expected to bring additional test requirements and to increase test costs. An inappropriate cost/benefit ratio could cause problems in competition because particularly those manufacturers who produce PPE on a small scale would have difficulties passing on the cost increases to the consumer. Furthermore, disproportionately high test costs could swiftly reduce manufacturers' willingness to invest in developing new PPE products or upgrading existing ones.

Apart from a few exceptions, the experts questioned consider the cost/benefit ra-

tio appropriate and balanced. The exceptions relate, for example, to some standards in the field of eye protection which specify extensive and thus cost-intensive series of tests.

Criticism is often voiced with regard to the cost/benefit ratio of test methods which depend on subjective assessments and where it is questionable that the reproducibility and representativeness justify the effort involved. For example, the result of the method for testing the efficiency of the fastening system of high-performance industrial safety helmets depends on the way in which each test person moves. This test is used to establish whether the protective helmet falls off the head or not. Other examples where the experts doubt the practical benefit are the tests used to establish dexterity when wearing protective gloves or the test for determining the watertightness of protective footwear (prEN ISO 20344:2000) when walking through a trough of water. The results of these test methods are extremely subjective because they depend on the test subjects' skill and the sequences of their individual movements. The large amount of time needed to conduct the test leads to further cost increases.

Some experts also doubt the benefit of certain objective test methods. They criticize, for example, the locking test for PPE against falls from a height (EN 360: 1992) and, in the field of hearing protection, the test to measure the pressure exerted by the headband and the cushion of ear-muffs as well as the drop test for acrylic ear-plugs (prEN 13819-1:2000), and suggest that these tests should be abandoned due to the costs involved.

Another aspect in the assessment of the benefit to be drawn from the test methods is the reproducibility of test results. In some cases, there are significant differences in the values measured by different test institutes using the same test method. This is sometimes because the test parameters or the test equipment are not defined precisely enough in the standards or draft standards, as is the case, for example, in prEN ISO 13506 "Test method for complete garments – Prediction of burn injury using an instrumented manikin" or in EN 13087-7:2000 and prEN 13087-9:1998 "Protective helmets – Test methods". The respondents agree that the causes of such dispersion of results must be identified and suitable measures must be taken to avoid it recurring. To do this it would make sense to carry out round-robin tests though this approach has already often failed in the past due to a lack of financial and human resources. The respondents consider well-functioning cooperation of the test and certifying bodies in the vertical

groups of the Coordination of Notified Bodies a useful and key form of support in this aspect of standardization.

In addition, the respondents in some PPE fields, such as head protection, are striving for a uniform course of action with regard to the normative annex on "Test Results – Measurement Uncertainty" which CEN/BT has called for. The procedure would entail estimating the measurement uncertainty but could include subjective errors, e.g. imprecise reading, as well as objective factors, e.g. the measuring equipment's tolerances. In this process, the measurement uncertainties listed by the various test institutes may differ. The standards should therefore describe the test methods in exact detail and indicate the associated statistical error.

In order to ensure an appropriate and balanced cost/benefit ratio in new standards, the standard must describe the test method precisely and, as far as possible, make reference to existing equivalent test methods. Costs can be reduced in the medium term by changing existing standards in order to increasingly harmonize the test methods for various PPE types, as far as possible, or by making test equipment more efficient, as would be possible, for instance, with the method for testing protective helmets' UV ageing if cheaper, high-intensity lamps were used.

In some cases, where new test methods have to be added to standards, test costs will rise. However, in the respondents' opinion, these cost increases will generally be of an appropriate and acceptable nature.

5.7 Occupational Health and Safety in Standards Prepared outside PPE Committees

In addition to the standards prepared in the PPE committees, there are a number of standards concerning test methods which were prepared outside the PPE committees and are quoted in the European standards. The experts were asked to what extent such testing standards fulfil their purpose.

Overall, the answers given indicate that most of the quoted CEN or ISO standards fulfil their purpose from the point of view of occupational health and safety as well as providing a good basis on which to test PPE products' safety-related parameters.

The few criticisms voiced relate to, for example, the ISO/TR 4869-4:1998 method for testing level-dependent earplugs as quoted in prEN 352-7:2000 because this test method does not permit a sufficient assessment of the protective effect.

5.8 Harmonization of Requirements for Protection against the Same Hazards

Since there are a number of activities in which various types of PPE are used and are subject to the same or similar conditions, it is important to examine, not least due to the costs involved, whether it is useful and possible to harmonize safety and ergonomic requirements and test methods which refer to the same hazard. The survey also set out to establish to what extent harmonization of this kind has already been realized in European standards and draft standards.

The answers given reveal that there is a growing trend in standardization towards exploring possible ways of harmonizing requirements and test methods and, where possible, realizing those possibilities by drawing up appropriate requirements. For example, in the field of foot and leg protectors (CEN/TC 161) reference is made to a cut-resistance test method in EN 388:1994 "Protective gloves against mechanical risks" prepared by CEN/TC 162. All of the respondents considered this a positive trend.

In general, the respondents believe that there are many areas where it would make sense to harmonize safety and ergonomic requirements as well as test methods, particularly since some testing parameters were established some time ago and could be harmonized from a technical point of view. In the field of respiratory protection, for example, it is expected that the CO test for CO filters will be harmonized. It can be assumed that the requirements for the mining industry will be copied in the standards for respiratory protection, thus harmonizing the requirements at a high level.

In the respondents' view, however, a universal call for requirements and test methods to be harmonized would probably not only cause difficulties but could also bring disadvantages because of the different design objectives for the different PPE types.

Better coordination of standardization at the various levels should, in the opinion of the respondents, be supported and, as far as possible, realized so that the effort involved in testing can be reduced and costs can be cut.

5.9 Results of the European Coordination of Notified Bodies for PPE

The aims of the European Coordination of Notified Bodies for PPE are to discuss problems and procedures in PPE testing and certification and to specify joint European courses of action as well as to

discuss concrete testing problems posed by the standards and to derive from that discussion practical suggestions as to how standards should be applied and evolved.

In addition to the "Horizontal Committee" of the European Coordination of Notified Bodies for PPE, which deals mainly with matters of general concern, there are also "Vertical Groups", which each discuss concrete aspects relating to the testing of a single PPE type. This concerns, for example, practical application of standards and the associated problems.

To ensure that European standards are developed further in keeping with practice, it is essential that the coordination between all parties concerned is as efficient as possible. This means that the cooperation between the standards bodies and the vertical groups is extremely important. Generally speaking, the vertical groups issue recommendations, in the form of technical sheets, concerning standards which, for example, contain deficiencies or imprecise specifications, and forward those recommendations to the relevant CEN/TC. The CEN/WGs responsible for the product standards in question examine whether and to what extent the recommendations should be taken into account when the standards are revised. Some of the vertical groups criticize the fact that the flow of information in this process needs to be improved. For example, in the areas of chemical protective clothing and PPE against falls from a height, they complain that there is no or only sluggish feedback as to the extent to which proposals have been taken into account. This situation needs to be improved though it should be pointed out that the CEN Management Center has adopted rules which stipulate that, after the standard has been revised, the CEN/TC must inform the vertical group as to which recommendations have been acted on. Where recommendations are not taken into account, the reasons must be explained.

In many areas, particularly due to direct contacts between those involved in standardization and those involved in the vertical groups, it has already proven possible to make improvements to the standards thanks to the suggestions and ideas presented by the vertical groups. For example, the exchange of experiences in the field of head protection led to the idea that an objective method for testing the efficiency of the fastening system should be added to draft standard prEN 14052:2001 "Specifications for high performance industrial safety helmets".

The round-robin tests organized in order to improve the reproducibility and com-

parability of the various testing bodies' testing often produce results which are of direct benefit for standardization. For example, a round-robin test on the test equipment specified in EN 366:1993 was conducted in the area of clothing for protection against heat because of the significant dispersion of the results for the effects of radiant heat. On the basis of the round-robin results, the test method was validated and improved when the standard was revised, thus achieving a good level of reproducibility for the test results.

5.10 The Level of Occupational Health and Safety from Germany's Point of View

In general, European PPE standards are reviewed after an effective period of five years in order to ascertain whether revision is necessary, in order to correct errors, adapt the requirements to technological advances or to bring standards into line with international standardization. In many cases, the respondents see a need for the PPE standards to be revised; in some of these cases, new draft standards or new standards already exist. The aim of this question was to investigate the extent to which Germany's OH&S interests have been taken into consideration in the standards and what the reasons were where those interests were not asserted.

The overall opinion of the respondents is that the standards and draft standards cover the OH&S interests to a good extent. The degree to which they are implemented is said to range from "very good" (equipment for protection against drowning) to "level maintained" (eye protection) to "not implemented" in a few cases (hand and arm protection).

Even within single CEN/TCs, the level fluctuates considerably. For example, the level of occupational health and safety provided by EN 374:1994/1998 "Protective gloves against chemicals and micro-organisms" is not sufficient in the respondents' opinion. On the other hand, in the same CEN/TC, EN 407:1994 "Protective gloves against thermal risks" is rated as very good because it permits very high protection levels.

Many of the criticisms made with regard to the standards in the field of PPE against falls from a height refer to actual practice at the place of work, which is an important issue in occupational health and safety. Actual practice is not always completely reflected in the requirements in the standards.

For example, the standards only refer to PPE against falls from a height being used in a vertical position. However, in everyday work there are situations where,

for example, guided-type fall arresters are subject not only to vertical stress, but also diagonal or horizontal stress, which impairs the protective effect. Thus, in the experts' opinion, it is absolutely essential that the content of the standards is constantly compared with the conditions in practice and that changes are made where appropriate.

Cases of Germany not being able to assert its OH&S interests or not being able to do so fully were mainly due to the lack of a majority in the European working group or to compromises which had to be made because of other factors having priority. For example, watertight materials were approved for clothing providing protection against rain because plastic-coated materials are in widespread use in Europe and are considered "sufficently safe" for the work places in question.

The respondents are generally anxious that CEN standardization will probably not give OH&S needs the present level of consideration in future. The main reason given for this was the decline in the willingness of the institutions currently working in European standardization to continue providing sufficient human and financial resources in the future, particularly in view of the fact that standardization is shifting into the international arena (ISO).

5.11 The Influence of ISO Standardization

This question was intended to establish the extent to which European standardization is influenced by ISO standardization and how the OH&S requirements in the standards can be expected to develop.

The influence of ISO standardization currently differs considerably depending on the PPE field in question. For example, only a few influences on European standardization are apparent in the field of PPE against falls from a height. There is no cooperation on the basis of the Vienna Agreement in this field as yet. This is particularly due to major differences in the European and the American safety philosophies, making *gradual* harmonization necessary. For example, the ISO requirements pertaining to harnesses are higher. Although this offers the advantage that the harnesses are safer, it is also disadvantageous because they become heavier. An increase in weight is not in keeping with the requirements of Directive 89/686/EEC since they stipulate that equipment must be light and efficient.

In the PPE fields "Head protection", "Eye protection" and "Respiratory protection", the influence of ISO standardization on CEN standardization and thus

the influence on OH&S interests is relatively weak. In the area of hearing protection, the influence of ISO standardization is not always deemed helpful. For example, ISO has standardized an acoustic test method (ISO TR 4869-4:1989) which is not able to fulfil the requirements of Directive 89/686/EEC because the protective effect is considerably overestimated due to the interpretation of the results. In other PPE areas, particularly protective clothing and foot protection, there is extensive, positive experience in cooperation with the ISO committees. The corresponding ISO and CEN committees in the area of PPE for protection against drowning, for example, have been collaborating for approximately six years and all documents are drawn up in accordance with the Vienna Agreement.

The respondents are generally in favour of the trend towards ISO standardization. However, depending on the PPE type, it is not always possible to harmonize the ISO requirements with the principles of European standardization, i.e. the requirements of PPE Directive 89/686/EEC.

Irrespective of the current influence of ISO standardization in the various PPE areas, there is general consensus that ISO standardization will continue to gain in significance, especially since trade is globally oriented and does not stop at the boundaries of the European Community. This means that ISO standardization will increasingly have a harmonizing effect on trade and European standardization.

The respondents fear that ISO standardization will cause the German influence on OH&S requirements to decrease in the medium term. The reasons for this fear are the costs involved and the proportionally low number of German representatives with voting rights. This means that there is a risk, which should not be underestimated, that the ISO standardization might cause some very specific test methods to be introduced into European standardization, which would mean that Germany would have to procure any necessary new test equipment which it did not have.

The respondents therefore consider it particularly important that the German representatives, e.g. of the Berufsgenossenschaften, do not withdraw from standardization but continue to be actively involved in order to ensure that the existing expertise benefits the member companies and is not lost. In the long run, sufficient consideration of occupational health and safety can only be guaranteed by means of involvement in standardization work.

5.12 Possibilities for the Commission for Occupational Health and Safety and Standardization (KAN) to Exert Influence

This question was intended to examine the respondents' opinion as to the possible ways in which KAN can exert influence in order to promote the position of occupational health and safety.

Firstly, the respondents' general opinion is that the members of the standards bodies will address any deficiencies or problems of detail in the European standards and draft standards themselves and that there is thus no need for direct support in this area. However, back-up measures would be welcomed.

In the respondents' view, KAN could promote the position of occupational health and safety in Germany and Europe with respect to the following points:

- ☐ development of financial support models for representatives of and experts from statutory accident insurance institutions, authorities, the Laender and users so that they can represent Germany's interests at the European and international levels;
- ☐ supporting measures aimed at continuing the secretariat activities for TCs and WGs, even though financial shortages are expected soon in some PPE fields because, for example, of the abolition of mandate funds;
- ☐ development of models for generating financial support to enable Berufsgenossenschaft employees and experts to participate in CEN or ISO meetings;
- ☐ promotion of practice-oriented research;
- ☐ stepping-up of PR work, e.g. with regard to the significance of CEN and ISO standardization;
- ☐ assistance in the presentation of subjects related to standardization and setting-up of discussion forums with the aid of new media;
- ☐ promotion of exchange of information between experts and
- ☐ motivation of the market-surveillance authorities.

Annex A
List of PPE standards, draft standards and standardization projects

A 1: Respiratory Protective Equipment
A 2: Equipment for Eye Protection and Full or Partial Face Protection
A 3: Equipment for Head Protection
A 4: Equipment for Hearing Protection
A 5: Equipment for Protection against Falls from a Height
A 6: Equipment for Foot and Leg Protection
A 7: Protective Clothing
A 8: Equipment for Hand and Arm Protection
A 9: PPE for Prevention of Drowning
A 10: Acoustics
A 11: Sports, Playground and Other Recreational Equipment

Annex B
Deficiencies in standards relating to the different types of PPE

B 1: Respiratory Protective Equipment
B 2: Equipment for Eye Protection and Full or Partial Face Protection
B 3: Equipment for Head Protection
B 4: Equipment for Hearing Protection
B 5: Equipment for Protection against Falls from a Height
B 6: Equipment for Foot and Leg Protection
B 7: Protective Clothing
B 8: Equipment for Hand and Arm Protection
B 9: PPE for Prevention of Drowning

Annex C
Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

C 1: Respiratory Protective Equipment
C 2: Equipment for Eye Protection and Full or Partial Face Protection
C 3: Equipment for Head Protection
C 4: Equipment for Hearing Protection
C 5: Equipment for Protection against Falls from a Height
C 6: Equipment for Foot and Leg Protection
C 7: Protective Clothing
C 8: Equipment for Hand and Arm Protection
C 9: PPE for Prevention of Drowning

A 1: Respiratory Protective Equipment (CEN/TC 79)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 132:1998	Respiratory protective devices - Definitions of terms and pictograms	DIN EN 132:1991	04.06.1999
EN 133:1990	Respiratory protective devices - Classification	DIN 3179-2:1988	19.02.1992
EN 134:1998	Respiratory protective devices - Nomenclature of components	DIN 3180-1:1988	13.06.1998
EN 135:1998	Respiratory protective devices - List of equivalent terms	DIN EN 135:1991	04.06.1999
EN 136:1997 + AC1:1998	Respiratory protective devices - Full face masks - Requirements, testing, marking	DIN 58646-1:1990 DIN EN 136-10:1992	13.06.1998
EN 137:1993	Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus - Requirements, testing, marking	DIN 58645-1:1988	23.12.1993
EN 138:1994	Respiratory protective devices - Fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly - Requirements, testing, marking	DIN 58649-1:1989	16.12.1994
EN 139:1993 + A1:1999	Respiratory protective devices - Compressed air line breathing apparatus for use with a full face mask, half mask or a mouthpiece assembly - Requirements, testing, marking	DIN 58648-1:1989	30.08.1995 05.11.1999
EN 140:1998 + AC1:1999	Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking	DIN EN 140:1992	06.11.1998
EN 141:2000	Respiratory protective devices - Gas filters and combined filters - Requirements, testing, marking	DIN EN 141:1991	19.02.1992
EN 142:1989	Respiratory protective devices - Mouthpiece assemblies - Requirements, testing, marking	(veröffentlicht als DIN 58646-3:1990)	19.02.1992
EN 143:2000	Respiratory protective devices - Particle filters - Requirements, testing, marking	DIN EN 143:1991	19.09.1992
EN 144-1:1991	Respiratory protective devices - Gas cylinder valves - Part 1: Thread connections for insert connector	DIN 477-6:1983 (z.T.)	19.09.1992
EN 144-2:1998	Part 2: Outlet connections	DIN 3189-2:1990	04.06.1999

Standard	Title	Replaces	Publication in Official Journal
EN 145:1997 + A1:2000	Respiratory protective devices - Self-contained closed-circuit breathing apparatus compressed oxygen or compressed oxygen-nitrogen type - Requirements, testing, marking	DIN EN 145:1997	19.02.1998
EN 148-1:1999	Respiratory protective devices - Threads for facepieces - Part 1: Standard thread connection	DIN 3183-2:1988	04.06.1999
EN 148-2:1999	- Part 2: Centre thread connection	DIN 3183-1:1988	04.06.1999
EN 148-3:1999	- Part 3: Thread connection M 45 x 3	DIN EN 148-3:1992	04.06.1999
EN 149:1991	Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking	DIN 58645-3:1982	19.09.1992
EN 250:2000	Respiratory equipment - Open-circuit self-contained compressed air diving apparatus - Requirements, testing, marking	DIN EN 250:1993	08.06.2000
EN 269:1994	Respiratory protective devices - Powered fresh air hose breathing apparatus incorporating a hood - Requirements, testing, marking	DIN 58649-2:1989	16.12.1994
EN 270:1994 + A1:2000	Respiratory protective devices - Compressed air line breathing apparatus incorporating a hood - Requirement, testing, marking	DIN EN 270:1994	08.06.2000
EN 271:1995 + A1:2000	Respiratory protective devices - Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations - Requirements, testing, marking	DIN EN 271:1995	08.06.2000
EN 371:1992	Respiratory protective devices - AX gas filters and combined filters against low boiling organic compounds - Requirements, testing, marking	DIN 3181-4:1988	23.12.1993
EN 372:1992	Respiratory protective devices - SX gas filters and combined filters against specific named compounds - Requirements, testing, marking	DIN 3181-5:1990	23.12.1993
EN 400:1993	Respiratory protective devices for self-rescue - Self-contained closed-circuit breathing apparatus - Compressed oxygen escape apparatus - Requirements, testing, marking	DIN 58647-5:1990	23.12.1993

A 1: Respiratory Protective Equipment (CEN/TC 79)

Standard	Title	Replaces	Publication in Official Journal
EN 401:1993	Respiratory protective devices for self-rescue - Self-contained closed-circuit breathing apparatus - Chemical oxygen (KO2) escape apparatus - Requirements, testing, marking	DIN 58647-4:1990	23.12.1993
EN 402:1993	Respiratory protective devices for escape - Self-contained open-circuit compressed air breathing apparatus with full face mask or mouthpiece assembly - Requirements, testing, marking	DIN 58647-3:1990	16.12.1994
EN 403:1993	Respiratory protective devices for self-rescue - Filtering devices with hood for self-rescue from fire - Requirements, testing, marking	DIN 58647-1:1987	23.12.1993
EN 404:1993	Respiratory protective devices for self-rescue - Filter self-rescuer - Requirements, testing, marking	DIN 58647-6:1990	16.12.1994
EN 405:1992	Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking	DIN 58645-4:1982	23.12.1993
EN 1061:1996	Respiratory protective devices for self-rescue - Self-contained closed-circuit breathing apparatus - Chemical oxygen (NaClO3) escape apparatus - Requirements, testing, marking		14.06.1997
EN 1146:1997 + A1:1998 + A2:1999	Respiratory protective devices for self-rescue - Self-contained open-circuit compressed air breathing apparatus incorporating a hood (compressed air escape apparatus with hood) - Requirements, testing, marking	DIN EN 1146:1997	16.03.2000
EN 1827:1999	Respiratory protective devices - Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only - Requirements, testing, marking		24.02.2001
EN 1835:1999	Respiratory protective devices - Light duty construction compressed air line breathing apparatus incorporating a helmet or a hood - Requirements, testing, marking		08.06.2000

Standard	Title	Replaces	Publication in Official Journal
EN 12083:1998	Respiratory protective devices - Filters with breathing hoses, (Non-mask mounted filters) - Particle filters, gas filters, and combined filters - Requirements, testing, marking		04.07.2000
EN 12419:1999	Respiratory protective devices - Light duty construction compressed air line breathing apparatus incorporating a full face mask, half mask or quarter mask - Requirements, testing, marking	DIN 58648-4:1991 (z.T.)	05.11.1999
EN 12941:1998	Respiratory protective devices - Powered filtering devices incorporating a helmet or a hood - Requirements, testing, marking	DIN EN 146:1991	04.06.1999
EN 12942:1998	Respiratory protective devices - Power assisted filtering devices incorporating full face masks, half masks or quarter masks - Requirements, testing, marking	DIN EN 147:1991	04.06.1999

b) Other European standards

Standard	Title	Replaces
EN 12021:1998	Respiratory protective devices - Compressed air for breathing apparatus	DIN EN 132:1991 DIN 3188:1984 (partly)
EN 13274-1:2001	Respiratory protective devices - Methods of test - Part 1: Determination of inward leakage and total inward leakage	
EN 13274-2:2001	- Part 2: Practical performance tests	
EN 13274-5:2001	- Part 5: Climatic conditions	

c) Draft European standards

Standard	Title	Intended to Replace
prEN 133:1999	Respiratory protective devices - Classification	DIN EN 133:1991
prEN 142:2001	Respiratory protective devices - Mouthpiece assemblies - Requirements, testing, marking	DIN 58646-3:1990
prEN 144-1:1998	Respiratory protective devices - Gas cylinder valves - Part 1: Thread connections for insert connector	DIN EN 144-1:1991

A 1: Respiratory Protective Equipment (CEN/TC 79)

Standard	Title	Intended to Replace
prEN 144-3:2000	Respiratory protective devices - Gas cylinder valves - Part 3: Outlet Nitrox connections	
prEN 149:1998	Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking	DIN EN 149:1991
prEN 402:2000	Respiratory protective devices - Lung governed demand self-contained open-circuit compressed air breathing apparatus with full face mask or mouthpiece assembly for escape - Requirements, testing, marking	DIN EN 402:1993
prEN 405:1998	Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking	DIN EN 405:1993
EN 1146:1997/ prA3:2000R	Respiratory protective devices for self-rescue - Self-contained open-circuit compressed air breathing apparatus incorporating a hood (compressed air escape apparatus with hood) - Requirements, testing, marking	
prEN 12942/ prA1:2000	Respiratory protective devices - Power assisted filtering devices incorporating full face masks, half masks or quarter masks - Requirements, testing, marking	
prEN 13105:1997	Respiratory protective devices - Full face masks con-nected with fire fighters head protection for use as a part of a respiratory protective device - Requirements, testing, marking	
prEN 13274-3: 1998	Respiratory protective devices - Methods of test - Part 3: Determination of breathing resistance	
prEN 13274-4: 1998	Respiratory protective devices - Methods of test - Part 4: Flame tests	
prEN 13274-6: 2000	Respiratory protective devices - Methods of test - Part 6: Determination of carbon dioxide content of the inhalation air	
prEN 13274-7: 2000	Respiratory protective devices - Methods of test - Part 7: Determination of particle filter penetration	
prEN 13274-8: 2000	Respiratory protective devices - Methods of test - Part 8: Determination of dolomite dust clogging	
prEN 13794:1999	Self-contained closed-circuit breathing apparatus for self-rescue - Requirements, testing marking	
prEN 13949:2000	Respiratory equipment - Open-circuit self-contained compres-sed Nitrox diving apparatus - Requirements, testing, marking	
prEN 14143:2001	Respiratory protective devices - Self-contained re-breathing diving apparatus - Requirements, testing, marking	

d) Standardization projects

Standard	Title	Intended to Replace
WI 00079104	Respiratory protective devices for self-rescue - Filtering devices with hood for self-rescue from fire - Requirements, testing, marking	DIN EN 403:1993
WI 00079105	Self-contained open-circuit compressed air breathing apparatus - Requirements, testing, marking	DIN EN 137:1993
WI 00079108	Respiratory protective devices - Heavy duty construction compressed air line breathing apparatus - Part 1: Apparatus with a demand valve for use with a full face mask - Requirements, testing, marking	
WI 00079109	Respiratory protective devices - Heavy duty construction compressed air line breathing apparatus - Part 2: Apparatus with continuous flow for use with a full face mask, half mask or incorporating a hood - Requirements, testing, marking	
WI 00079112	Respiratory protective devices for self-rescue - Filter self-rescuer - Requirements, testing, marking	DIN EN 404:1993
WI 00079113	Respiratory protective devices - Mouthpiece assemblies - Requirements, testing, marking	DIN 58646-3:1990
WI 00079114	Gas and combined filters for special applications - Requirements, testing, marking	
WI 00079115	Compressed air line breathing apparatus with demand valve - Part 2: Apparatus with a half mask at positive pressure - Requirements, testing, marking	
WI 00079116	Self-contained open-circuit compressed air breathing apparatus with half mask, with lung governed demand valve and positive pressure for escape - Requirements, testing, marking	
WI 00079117	Self-contained open-circuit compressed air breathing apparatus with half mask designed to be used with positive pressure only - Requirements, testing, marking	DIN EN 271:2000
WI 00079119	Respiratory protective devices - Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations - Requirements, testing, marking	DIN EN 1142:1999
WI 00079120	Respiratory protective devices for self-rescue - Self-contained open-circuit compressed air breathing appara-tus incorporating a hood (compressed air escape apparatus with hood) - Requirements, testing, marking	

e) National standards

Standard	Title
DIN 3179-4:1982	Classification of respiratory equipment; respiratory protective devices for self-rescue with main application at environmental pressure of 1 (+0.2 or -0.3) bar
DIN 3182-1:1996	Respiratory protective devices and diving apparatus - Standard thread - Part 1: Theoretic profile
DIN 3182-2:1996	Respiratory protective devices and diving apparatus - Standard thread - Part 2: GO ring gauges and NOT GO ring gauges
DIN 3182-3:1996	Respiratory protective devices and diving apparatus - Standard thread - Part 3: Screw plug gauges
DIN 14092-4:1985	Fire stations - Part 4: Workshop for respirators; Elements for design
DIN 14093-1:1988	Equipment for practicing respiratory protective devices; elements of design

A 2: Equipment for Eye Protection and Full or Partial Face Protection (CEN/TC 85)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 165:1995	Personal eye-protection - Vocabulary		15.05.1996
EN 166:1995	Personal eye-protection - Specifica-tions		03.12.1996
EN 167:1995	Personal eye-protection - Optical test methods	DIN 4646-2:1975	10.10.1996
EN 168:1995	Personal eye-protection - Non-optical test methods	DIN 4646-3:1976 DIN 4646-3:1976 DIN 4646-3:1976 DIN 4646-5:1976 DIN 4646-6:1976 DIN 4646-7:1976 DIN 4646-8:1986 DIN 58212-1:1998 DIN 58212-2:1988 DIN 58212-4:1988 DIN 58212-5:1988 DIN 58212-6:1988 DIN 58212-7:1988 DIN 58212-8:1988 DIN 58212-9:1988 DIN 58212-10:1988	10.10.1996
EN 169:1992	Personal eye-protection - Filters for welding and related techniques - Transmittance requirements and recom-mended utilisation	DIN 4647-1:1977	23.12.1993
EN 170:1992	Personal eye-protection - Ultraviolet filters - Transmittance requirements and recom-mended use	DIN 4647-2:1977	23.12.1993
EN 171:1992	Personal eye-protection - Infrared filters - Transmittance requirements and recom-mended use	DIN 4647-3:1977	23.12.1993
EN 172:1994+ A1:2000	Personal eye protection - Sunglare filters for industrial use	DIN 4647-4:1980	15.05.1996 04.07.2000
EN 174:2001	Personal eye-protection - Ski goggles for downhill skiing	DIN EN 174:1997	13.06.1998
EN 175:1997	Equipment for eye and face protec-tion during welding and allied processes	DIN 58211:1988 (partly)	19.02.1998

A 2: Equipment for Eye Protection and Full or Partial Face Protection (CEN/TC 85)

Standard	Title	Replaces	Publication in Official Journal
EN 207:1998	Personal eye-protection - Filters and eye-protectors against laser radiation (laser eye-protectors)	DIN EN 207:1993	21.11.1998
EN 208:1998	Personal eye-protection - Eye-protectors for adjustment work on lasers and laser systems (laser ad-justment eye-protectors)	DIN EN 208:1993	21.11.1998
EN 379:1994 + A1:1998	Specification for welding filters with switchable luminous transmittance and welding filters with dual luminous transmittance	DIN EN 379:1994	06.11.1998
EN 1731:1997 + A1:1997	Mesh type eye and face protectors for industrial and non-industrial use against mechanical hazards and/or heat	DIN EN 1731:1997	13.06.1998
EN 1836:1997	Personal eye protection - Sunglasses and sunglare filters for general use	DIN 58217:1980	14.06.1997
EN 1938:1998	Personal eye protection - Goggles for motorcycle and moped users		04.06.1999

b) Other European standards

Standard	Title	Replaces
EN 12254:1998	Screens for laser working places - Safety requirements and testing	DIN 5335:1993
EN 13178:2000	Personal eye-protection - Eye protectors for snowmobile users	

c) Draft European standards

Standard	Title	Intended to Replace
prEN 166:1998	Personal eye-protection - Specifications	DIN EN 166:1996
prEN 167:1998	Personal eye-protection - Optical test methods	DIN EN 167:1995
prEN 168:1998	Personal eye-protection - Non-optical test methods	DIN EN 168:1995
prEN 169:2000	Personal eye-protection - Filters for welding and related techniques - Transmittance requirements and recommended utilisation	DIN EN 169:1992
prEN 170:1999	Personal eye-protection - Ultraviolet filters - Transmittance requirements and recommended use	DIN EN 170:1992
prEN 171:1999	Personal eye-protection - Infrared filters - Transmittance requirements and recommended use	DIN EN 171:1992
prEN 172/A2:2001	Personal eye protection - Sunglare filters for industrial use	Amendment to DIN EN 172:1995
prEN 208:2000	Personal eye-protection - Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors); Amendment 1	DIN EN 208:1998
prEN 12254/A1: 2000	Screens for laser working places - Safety requirements and testing	Amendment to DIN EN 12254:1999

d) Standardization projects

Standard	Title	Intended to Replace
WI 00085035	Test methods for resistance to misting for complete eye-protectors	
WI 00085045	Personal eye-protection - Infrared filters - Transmittance requirements and recommended use	DIN EN 171:1992
WI 00085047	Personal eye protection - Sunglare filters for industrial use	DIN EN 172:1995
WI 00085048	Screens for laser working places - Safety requirements and testing	DIN EN 12254:1999
WI 00085053	Personal eye protection - Sunglare filters for industrial use	DIN EN 172:1995
WI 00085054	Faceshields and visors for use with firefighters, ambulance and emergency service helmets	

A 2: Equipment for Eye Protection and Full or Partial Face Protection (CEN/TC 85)

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO 4007:1977	Personal eye-protectors - Vocabulary	EN 165:1994
ISO 4849:1981	Personal eye-protectors - Specifications	EN 166:1995
ISO 4850:1979	Personal eye-protectors for welding and related techniques - Filters - Utilisation and transmittance requirements	EN 169:1992
ISO 4851:1979	Personal eye-protectors - Ultra-violet filters - Utilisation and transmittance requirements	EN 170:1992
ISO 4852:1978	Personal eye-protectors - Infra-red filters - Utilisation and transmittance requirements	EN 171:1992
ISO 4854:1981	Personal eye-protectors - Optical test methods	EN 167:1995
ISO 4855:1981	Personal eye-protectors - Non-optical test methods	EN 168:1995
ISO 4856:1982	Personal eye-protectors - Synoptic tables of requirements for oculars and eye-protectors	
ISO 6161:1981	Personal eye-protectors - Filters and eye-protectors against laser radiation	EN 207:1993

f) National standards

Standard	Title
DIN 58214:1997	Eye-protectors - Helmets - Terms, forms and safety requirements
DIN 58218:1981	Visors (eye screens) of helmets for vehicle users; safety requirements and testing

g) Technical reports

Report	Title	Replaces
CR 13464	Guide to selection, use and maintenance of occupational eye and face protectors	(published by DIN as DIN technical report 77:1999)

A 3: Equipment for Head Protection (CEN/TC 158)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 397:1995 + A1:2000	Industrial safety helmets	DIN EN 397:1995	12.01.1996
EN 443:1997	Helmets for firefighters	DIN 14960:1990	19.02.1998
EN 812:1997	Industrial bump caps		19.02.1998
EN 960:1994 + A1:1998	Headforms for use in the testing of protective helmets	DIN EN 960:1995	06.11.1998
EN 966:1996 + A1:2000	Helmets for airborne sports		10.10.1996
EN 967:1996	Head protectors for ice hockey play-ers		14.06.1997
EN 1077:1996	Helmets for alpine skiers	DIN 33952:1988	10.10.1996
EN 1078:1997	Helmets for pedal cyclists and for users of skateboards and roller skates	DIN 33954:1990	14.06.1997
EN 1080:1997	Impact protection helmets for young children		14.06.1997
EN 1384:1996	Helmets for equestrian activities	DIN 33951:1988	14.06.1997
EN 1385:1997	Helmets for canoeing and white water sports		13.06.1998

b) Other European standards

Standard	Title	Replaces
EN 12492:2000	Mountaineering equipment - Helmets for mountaineers - Safety requirements and for test methods	
EN 13087-1:2000	Protective helmets - Test methods - Part 1: Conditions and conditioning	
EN 13087-2:2000	Protective helmets - Test methods - Part 2: Shock absorption	
EN 13087-3:2000	Protective helmets - Test methods - Part 3: Resistance to penetration	
EN 13087-4:2000	Protective helmets - Test methods - Part 4: Retention system effectiveness	
EN 13087-5:2000	Protective helmets - Test methods - Part 5: Retention system strength	
EN 13087-6:2000	Protective helmets - Test methods - Part 6: Field of vision	

Standard	Title	Replaces
EN 13087-7:2000	Protective helmets - Test methods - Part 7: Flame resistance	
EN 13087-8:2000	Protective helmets - Test methods - Part 8: Electrical properties	
EN 13087-10:2000	Protective helmets - Test methods - Part 10: Resistance to radiant heat	
EN 13781:1999	Protective helmets for drivers and passengers of snow-mobiles and bobsleighs	

c) Draft European standards

Standard	Title	Intended to Replace
prEN 812/prA1:2001	Industrial bump caps	
prEN 1384/prA1:1999	Helmets for equestrian activities - Amendment	
prEN ISO 10256:2001	Head and face protection for ice hockey players	
prEN 13087-9:1998	Protective helmets - Test methods - Part 9: Mechanical rigidity.	
prEN 13484:1999	Helmets for users of luges	
prEN 14052:2001	Specifications for high performance industrial safety hel-mets	

d) Standardization Projects

Standard	Title	Intended to Replace
WI 00158044	Headforms for use in the testing of protective helmets	DIN EN 960:1998
WI 00158046	Helmets for firefighters	DIN EN 443:1997
WI 00158047	High performance helmets for equestrian activities	DIN EN 1384:1996

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO 3873:1977	Industrial safety helmets	EN 397:1995 EN 397/A1:2000
ISO/DIS 6220:1983	Headforms for use in the testing of protective helmets	EN 960:1994 EN 960/A1:1994
ISO 10256:1996	Protective helmets for ice hockey players	EN 967:1996
ISO/DIS 10256:2001	Head and face protection for ice hockey players	prEN ISO 10256:2001
ISO 10257:1996	Face protectors and visors for ice hockey players	

A 4: Equipment for Hearing Protection (CEN/TC 159)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 352-1:1993	Hearing protectors - Safety requirements and testing - Part 1: Ear muffs	DIN 32760:1985 (with DIN EN 352-2:1993)	23.12.1993
EN 352-2:1993	Hearing protectors - Safety requirements and testing - Part 2: Ear plugs	DIN 32760:1985 (with DIN EN 352-1:1993)	23.12.1993
EN 352-3:1996	Hearing protectors - Safety requirements and testing - Part 3: Ear-muffs attached to an industrial safety helmet		14.06.1997
EN 458:1993	Hearing protectors - Recommendations for selection, use, care and maintenance - Guidance document		16.12.1994

b) Other European standards

Standard	Title	Replaces
EN 352-4:2001	Hearing protectors - Safety requirements and testing - Part 4: Level-dependent ear-muffs	

c) Draft European standards

Standard	Title	Intended to replace
prEN 352-1:2000	Hearing protectors - General requirements - Part 1: Ear muffs	DIN EN 352-1:1993 (partly)
prEN 352-2:2000	Hearing protectors - General requirements - Part 2: Ear-plugs	DIN EN 352-2:1993 (partly)
prEN 352-3:2000	Hearing protectors - Safety requirements and testing - Part 3: Ear-muffs attached to an industrial safety helmet	DIN EN 352-3:1997 (partly)
prEN 352-5:2000	Hearing protectors - Safety requirements and testing - Part 5: Active noise reduction ear-muffs.	
prEN 352-6:2000	Hearing protectors - Safety requirements and testing - Part 6: Ear-muffs with electrical audio input	

Standard	Title	Intended to replace
prEN 352-7:2000	Hearing protectors - Safety requirements and testing - Part 7: Level-dependent ear-plugs	
prEN 458:2001	Hearing protectors - Recommendations for selection, use, care and maintenance - Guidance document	prEN 458:1993
prEN 13819-1:2000	Hearing protectors - Testing - Part 1: Physical test methods	DIN EN 352-1:1993 (partly) DIN EN 352-2:1993 (partly) DIN EN 352-3:1997 (partly)
prEN 13819-2:2000	Hearing protectors - Testing - Part 2: Acoustic test methods	DIN EN 352-1:1993 (partly) DIN EN 352-2:1993 (partly) DIN EN 352-3:1997 (partly)

d) Standardization Projects

Standard	Title	Replaces
WI 00159017	Hearing protectors - Recommendations for selection, use, care and maintenance - Guidance document	

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO/DIS 10449:1996	Hearing protectors - Safety requirements and testing - Ear-muffs	EN 352-1:1993
ISO/DIS 10452:1996	Hearing protectors - Recommendations for selection, use, care and maintenance - Guidance document	EN 458:1993
ISO/DIS 10453:1996	Hearing protectors - Safety requirements and testing - Ear-plugs	EN 352-2:1993
ISO/CD 10923:1995	Ear-muffs incorporated into helmets	EN 352-3:1996

A 5: Equipment for Protection against Falls from a Height (CEN/TC 160)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 341:1992 + AC:1993 *) + A1:1996 *)	Personal protective equipment against falls from a height - De-scender devices	*) Amendments published as corrections to DIN EN 341:1993-02)	23.12.1993 06.11.1998
EN 353-1:1992	Personal protective equipment against falls from a height - Guided type fall arresters on a rigid anchor-age line	DIN 32770:1986	23.12.1993
EN 353-2:1992	Personal protective equipment against falls from a height - Guided type fall arresters on a flexible an-chorage line	DIN 32769:1986	23.12.1993
EN 354:1992	Personal protective equipment against falls from a height - Lanyards	DIN 7471:1985	23.12.1993
EN 355:1992	Personal protective equipment against falls from a height - Energy absorbers	DIN 32766:1981	23.12.1993
EN 358:1999	Personal protective equipment for work positioning and prevention of falls from a height - Belts for work positioning and restraint and work positioning lanyards	DIN EN 358:1993 DIN 7470:1982	23.12.1993
EN 360:1992	Personal protective equipment against falls from a height - Retractable type fall arresters	DIN 23326:1982	23.12.1993
EN 361:1992	Personal protective equipment against falls from a height - Full body harnesses	DIN 7874:1990 (with DIN 7478:1993)	23.12.1993
EN 362:1992	Personal protective equipment against falls from a height - Connectors		23.12.1993
EN 363:1992	Personal protective equipment against falls from a height - Fall arrest systems		23.12.1993
EN 364:1992 + AC:1993	Personal protective equipment against falls from a height - Test methods	(Amendment published as correction to DIN EN 364:1993-02)	23.12.1993
EN 365:1992	Personal protective equipment against falls from a height - General requirements for instructions for use and for marking		23.12.1993
EN 795:1996+A1:	Protection against falls from a height - Anchor devices - Requirements and testing		12.02.2000 (classes A, C, D only partly)
EN 813:1997	Personal protective equipment for preven-tion of falls from a height - Sit harnesses		14.06.1997

A 5: Equipment for Protection against Falls from a Height (CEN/TC 160)

Standard	Title	Replaces	Publication in Official Journal
EN 1095:1998	Deck safety harness and safety line for use on recreational craft	DIN 7925:1988 DIN 7927:1988	06.11.1998
EN 1868:1997	Personal protective equipment against falls from a height - List of equivalent terms		18.10.1997
EN 1891:1998	Personal protective equipment for the prevention of falls from a height - Low stretch kernmantel ropes		06.11.1998

b) Other European standards

Standard	Title	Replaces
EN 1496:1996	Rescue equipment - Rescue lifting devices	
EN 1497:1996	Rescue equipment - Rescue harnesses	
EN 1498:1996	Rescue equipment - Rescue loops	

c) Draft European standards

Standard	Title	Intended to replace
prEN 353-1:1992/ prA1:1997	Personal protective equipment against falls from a height - Guided type fall arresters on a rigid anchorage line - Amendment	Amendment to DIN EN 353-1:1993
prEN 353-2:1992/ prA1:1997	Personal protective equipment against falls from a height - Guided type fall arresters on a flexible anchorage line - Amendment	Amendment to DIN EN 353-2:1993
prEN 354:1992/ prA1:1997	Personal protective equipment against falls from a height - Lanyards - Amendment	Amendment to DIN EN 354:1993
prEN 355:1992/ prA1:1997	Personal protective equipment against falls from a height - Energy absorbers - Amendment	Amendment to DIN EN 355:1993
prEN 360:1992/ prA1:1997	Personal protective equipment against falls from a height - Retractable type fall arresters - Amendment	Amendment to DIN EN 360:1993
prEN 361:1992/ prA1:1997	Personal protective equipment against falls from a height - Full body harnesses - Amendment	Amendment to DIN EN 361:1993
prEN 363:1992/ prA1:1997	Personal protective equipment against falls from a height - Fall arrest systems - Amendment	Amendment to DIN EN 363:1993

Standard	Title	Replaces
prEN 365:2001	Personal protective equipment and other equipment for protection against falls from a height - General requirements for instructions for use, maintenance, periodical examination, repair, marking and packaging	DIN EN 365:1993
prEN 12841:1997	Personal protective equipment for prevention of falls from a height - Work positioning systems - Rope adjustment devices	

d) Standardization Projects

Standard	Title	Replaces
WI 00160042	Personal protective equipment against falls from a height - Connectors	DIN EN 362:1993
WI 00160045	Protection against falls from a height - Anchor devices - Requirements and testing	DIN EN 795:1996
WI 00160046	Personal protective equipment against falls from a height - Test methods	DIN EN 364:1993
WI 00160047	Personal protective equipment against falls from a height - Descender devices	DIN EN 341:1993

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO 10333-1:2000	Personal fall-arrest systems - Part 1:Full-body harnesses	EN 361:1992
ISO 10333-1:2000/ DAM1	Amendment 1	
ISO 10333-2:2000	Personal fall-arrest systems - Part 2:Lanyards and energy absorbers	EN 354:1992 EN 355:1992 EN 363:1992
ISO 10333-3:2000	Personal fall-arrest systems - Part 3:Self-retracting life-lines	EN 360:1992 EN 363:1992
ISO/DIS 10333-4: 1998	Personal fall-arrest systems -- Part 4: Fall arresters and vertical systems	EN 353-2:1992 EN 363:1992
ISO/FDIS 10333-5: 2001	Personal fall-arrest systems -- Part 5: Connectors with self-closing and self-locking gates	EN 362:1992 EN 363:1992
ISO/CD 10333-6: 2000	Personal fall-arrest systems -- Part 6: System performance tests	

A 5: Equipment for Protection against Falls from a Height (CEN/TC 160)

Standard	Title	Linked to
ISO/CD 14566:2000	Personal equipment for protection agains falls – Work positioning systems	EN 358:1999
ISO 14567:1999	Personal protective equipment for protection against falls from a height -- Single-point anchor devices	EN 795:1996
ISO/CD 16024	Personal equipment for protection agains falls – Horizontal lifelines	EN 795:1996

f) National standards

Standard	Title
DIN 7478:1993	Safety harnesses; upper body harness for mining
DIN 34300:2001	Rescue equipment - Rescue hooks with safety eyelet holes

A 6: Equipment for Foot and Leg Protection (CEN/TC 161)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 344:1992 + A1:1997	Requirements and test methods for safety, protective and occupational footwear for professional use		23.12.1993 19.02.1998
EN 344-2:1996	Safety, protective and occupational footwear for professional use - Part 2: Additional requirements and test methods	DIN 4843-100:1993 (partly); DIN 23329:1990 (partly)	03.12.1996
EN 345:1992 + A1:1997	Specification for safety footwear for professional use		23.12.1993 19.02.1998
EN 345-2:1996	Safety footwear for professional use - Part 2: Additional specifications	DIN 4843-100:1993 (partly)	03.12.1996
EN 346:1992 + A1:1997	Specification for protective footwear for professional use		23.12.1993 19.02.1998
EN 346-2:1996	Protective footwear for professional use - Part 2: Additional specifications	DIN 23329:1990 (partly)	03.12.1996
EN 347:1992 + A1:1997	Specification for occupational foot-wear for professional use		23.12.1993 19.02.1998
EN 347-2:1996	Occupational footwear for professional use - Part 2: Additional specifi-cations		14.06.1997
EN 12568:1998	Foot and leg protectors - Require-ments and test methods for toecaps and metal penetration resistant in-serts		06.11.1998

b) Other European standards

Standard	Title	Replaces
ENV 13287:2000	Safety, protective and occupational footwear for profes-sional use. Test method and specifications for the deter-mination of slip resistance	

c) Draft European standards

Standard	Title	Intended to replace
prEN 13832:2000 micro-organisms	Footwear protecting against chemicals and	
prEN ISO 17249:2000	Safety footwear with resistance to chain saw cutting	DIN EN 344-2:1996 (partly) DIN EN 345-2:1996 (partly)
prEN ISO 17250:2000	Safety footwear with resistance to fire-fighting hazards	DIN EN 344-2:1996 (partly) DIN EN 345-2:1996 (partly)
prEN ISO 20344:2000	Test methods for safety, protective, occupational and DIN EN 344-1:1997 (partly) specific job related footwear for professional use	DIN EN 344-2:1996 (partly)
prEN ISO 20345:2000	Safety footwear for professional use - Specifications	DIN EN 344-1:1997 (partly) DIN EN 345-1:1997 DIN EN 345-2:1996 (partly)
prEN ISO 20346:2000	Protective footwear for professional use - Specifications	DIN EN 344-1:1997 (partly) DIN EN 346-1:1997 DIN EN 346-2:1996
prEN ISO 20347:2000	Occupational footwear for professional use - Specifications	DIN EN 344-1:1997 (partly) DIN EN 347-1:1997 DIN EN 347-2:1996

d) Standardization Projects

Standard	Title	Replaces
WI 00161039	Foot and leg protectors - Requirements and test methods for protective footwear for metal fabricating	
WI 00161047	Shoe laces	
WI 00161048	Guidance for use, selection and maintenance of safety, protective and occupational footwear	

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO 8782-1:1998	Safety, protective and occupational footwear for professional use - Part 1: Requirements and test methods	EN 344-1:1992 + A1:1997
ISO 8782-2:1998	- Part 2: Specification for safety footwear	EN 345-1:1992 + A1:1997
ISO 8782-3:1998	- Part 3: Specification for protective footwear	EN 346-1:1992 + A1:1997
ISO 8782-4:1998	- Part 4: Specification for occupational foot-wear	EN 347-1:1992 + A1:1997
ISO 8782-5:2000	- Part 5: Additional requirements and test methods	EN 344-2:1996
ISO 8782-6:2000	- Part 6: Additional specifications for safety footwear	EN 345-2:1996
ISO 8782-7:2000	- Part 7: Additional specifications for protective footwear	EN 346-2:1996
ISO 8782-8:2000	- Part 8: Additional specifications for occupational footwear	EN 347-2:1996
ISO/DIS 17249:2000	Safety footwear with resistance to chain saw cutting	prEN ISO 17249:2000
ISO/DIS 17250:2000	Safety footwear with resistance to fire-fighting hazards	prEN ISO 17250:2000
ISO/DIS 20344:2000	Test methods for safety, protective, occupational and specific job related footwear for professional use	prEN ISO 20344:2000
ISO/DIS 20345:2000	Safety footwear for professional use - Specifications	prEN ISO 20345:2000
ISO/DIS 20346:2000	Protective footwear for professional use - Specifications	prEN ISO 20346:2000
ISO/DIS 20347:2000	Occupational footwear for professional use - Specifications	prEN ISO 20347:2000

f) Nationale Normen

Standard	Title
DIN 4843-100: 1993	Safety, protective and occupational footwear; slip resistance, metatarsal protection, protective insert and thermal behaviour; safety requirements, testing. Draft
DIN 4843-101: 1996	Safety, protective and occupational footwear - Part 101: Safety footwear for underground mining. Draft
DIN 4843-102: 1998	Safety, protective and occupational footwear - Part 102: Shoelaces

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
General requirements for protective clothing			
EN 340:1993	Protective clothing - General requirements		16.12.1994
EN 510:1993	Specification for protective clothing for use where there is a risk of entanglement with moving parts	DIN 32765:1983	16.12.1994
EN 1149-1:1995	Protective clothing - Electrostatic properties - Part 1: Surface resistivity (Test methods and requirements)		10.10.1996
EN 1149-2:1997	Protective clothing - Electrostatic properties - Part 2: Test method for measurement of the electrical resis-tance through a material (vertical resistance)		19.02.1998
Clothing for protection against heat and fire			
EN 348:1992	Protective clothing - Test method: Determination of behaviour of materials on impact of small splashes of molten metal		23.12.1993
EN 366:1993	Protective clothing - Protection against heat and fire - Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat	DIN 4842:1977	16.12.1994
EN 367:1992	Protective clothing - Protection against heat and fire - Method of de-termining heat transmission on exposure to flame		16.12.1994
EN 373:1993	Protective clothing - Assessment of resistance of materials to molten metal splash		16.12.1994
EN 469:1995 + A1:1998	Protective clothing for firefighters - Requirements and test methods for protective clothing for firefighting	DIN EN 469:1995	15.05.1996
EN 470-1:1995	Protective clothing for use in welding and allied processes - Part 1: General requirements	DIN EN 470-1:1995	13.06.1998
EN 531:1995 + A1:1998	Protective clothing for industrial workers exposed to heat	DIN EN 531:1995	06.11.1998

Standard	Title	Replaces	Publication in Official Journal
EN 532:1994	Protective clothing - Protection against heat and flame - Test method for limited flame spread		12.01.1996
EN 533:1996	Clothing for protection against heat and flame; performance specification for limited flame spread of materials		14.06.1997
EN 702:1994	Protective clothing - Protection against heat and flame - Test method: Determination of the contact heat transmission through protective clothing or its materials		12.01.1996
EN 1486:1996	Protective clothing for firefighters - Test methods and requirements for reflective clothing for specialized fire fighting		03.12.1996
EN ISO 14460: 1999+ AC:1999	Protective clothing for automobile racing drivers -- Protection against heat and flame - Performance requirements and test methods (ISO 14460:1999) (includes AC:1999)		16.03.2000
Clothing for protection against chemicals			
EN 368:1992	Protective clothing - Protection against liquid chemicals - Test method: Resistance of materials to penetration by liquids	DIN 32763:1986 (partly)	23.12.1993
EN 369:1993	Protective clothing - Protection against liquid chemicals - Test method: Resistance of materials to permeation by liquids		23.12.1993
EN 463:1994	Protective clothing - Protection against liquid chemicals - Test method: Determination of resistance to penetration by a jet of liquid (Jet Test)		16.12.1994
EN 464:1994	Protective clothing - Protection against liquid and gaseous chemicals, including aerosols and solid particles - Test method: Determination of leak-tightness of gas-tight suits (Internal pressure test)		16.12.1994

A 7: Protective Clothing (CEN/TC 162)

Standard	Title	Replaces	Publication in Official Journal
EN 465:1995 + A1:1998	Protective clothing - Protection against liquid chemicals - Performance requirements for chemical protective clothing with spray-tight connections between different parts of the clothing (Type 4 Equipment)	DIN EN 465:1995	04.06.1999
EN 466:1995 + A1:1998	Protective clothing - Protection against liquid chemicals - Perform-ance requirements for chemical pro-tective clothing with liquid-tight con-nections between different parts of the clothing (Type 3 Equipment)	DIN EN 466:1995	04.06.1999
EN 467:1995 + A1:1998	Protective clothing - Protection against liquid chemicals - Perform-ance requirements for garments pro-viding protection to parts of the body	DIN EN 467:1995	04.06.1999
EN 468:1994	Protective clothing - Protection against liquid chemicals - Test method: Determination of resistance to penetration by spray (Spray Test)		16.12.1994
Clothing for protection against mechanical impact			
EN 381-1:1993	Protective clothing for users of hand-held chainsaws - Part 1: Test rig for testing resistance to cutting by a chainsaw		23.12.1993
EN 381-2:1995	- Part 2: Test methods for leg protec-tors		12.01.1996
EN 381-3:1996	- Part 3: Test methods for footwear		10.10.1996
EN 381-4:1999	- Part 4: Test methods for chainsaw protective gloves		16.03.2000
EN 381-5:1995	- Part 5: Requirements for leg pro-tectors		12.01.1996
EN 381-7:1999	- Part 7: Requirements for chainsaw protective gloves		16.03.2000
EN 381-8:1997	- Part 8: Test methods for chain saw protective gaiters		18.10.1997
EN 381-9:1997	- Part 9: Requirements for chain saw protective gaiters		18.10.1997
EN 412:1993	Protective aprons for use with hand knives		23.12.1993

Standard	Title	Replaces	Publication in Official Journal
EN 530:1994 + AC:1995	Abrasion resistance of protective clothing material	(Amendment published as correction to DIN EN 530:1995-01)	30.08.1995
EN 863:1995	Protective clothing - Mechanical properties		15.05.1996
EN 1082-1:1996	Protective clothing - Gloves and arm guards protecting against cuts and stabs by hand knives - Part 1: Chain mail gloves and arm guards		14.06.1997
EN ISO 13997:	Protective clothing - Mechanical properties - Determination of resistance to cutting by sharp objects		04.07.2000
Special protective clothing			
EN 471:1994	High-visibility warning clothing	DIN 30711-1:1987 DIN 30711-2:1987 DIN 30711-3:1987	16.12.1994
EN 1073-1:1998	Protective clothing against radioactive contamination - Part 1: Requirements and test methods for ventilated pro-tective clothing against particulate radioactive contamination		06.11.1998
EN 1150:1999	Protective clothing - Visibility clothing for non-professional use - Test methods and requirements	99	
Protective clothing for motorcyclists			
EN 1621-1:1996	Motorcyclists' protective clothing against mechanical impact - Part 1: Requirements and test methods for impact protectors		13.06.1998
Body protection for sports and recreational use			
EN 13277-1:2000	Protective equipment for martial arts - Part 1: General requirements and test methods		24.02.2001
EN 13277-2:2000	- Part 2: Additional requirements and test methods for instep protectors, shin protectors and forearm protectors		24.02.2001
EN 13277-3:2000	- Part 3: Additional requirements and test methods for trunk protectors		24.02.2001

b) Other European standards

Standard	Title	Replaces
Protective clothing for cold and wet conditions		
ENV 342:1998	Protective clothing - Ensembles for protection against cold	DIN 61536:1988 DIN 61537:1988
ENV 343:1998	Protective clothing - Protection against foul weather	DIN 61539:1988
Clothing for protection against mechanical impact		
EN 1082-2:2000	Protective clothing - Gloves and arm guards protecting against cuts and stabs by hand knives - Part 2: Gloves and arm guards made of material other than chain mail	
EN 1082-3:2000	Protective clothing - Gloves and arm guards protecting against cuts and stabs by hand knives - Part 3: Impact cut test for fabric, leather and other materials	
EN ISO 13995:2001	Protective clothing -- Mechanical properties -- Test method for the determination of the resistance to puncture and dynamic tearing of materials (ISO 13995:2000)	
Body protection for sports and recreational use		
EN 13158:2000	Protective clothing - Protective jackets, body and shoulder protectors for horse riders - Requirements and test methods	

c) Draft European standards

Standard	Title	Intended to replace
General requirements for protective clothing		
prEN 340:2000	Protective clothing - General requirements	DIN EN 340:1993
prEN 1149-3:2001	Protective clothing - Electrostatic properties – Part 3:Test methods for measurement of charge decay	
prEN ISO 11610:1997	Protective clothing - Glossary of terms and definitions	
Clothing for protection against heat and fire		
prEN 469:2000	Protective clothing for firefighters - Laboratory test methods and performance requirements for protective clothing for firefighting	DIN EN 469:1996
prEN ISO 6942:1998	Protective clothing – Protection against heat and fire – Method of test - Evaluation of materials and material assemblies when exposed to a source of radiant heat	DIN EN 366:1993
prEN ISO 11611:2000	Protective clothing for use in welding and allied processes	
prEN ISO 11612:2001	Protective clothing - Clothing to protect against heat and flame	
prEN ISO 13506:1998	Protective clothing against heat and flame - Test method for complete garments - Prediction of burn injury using an instrumented manikin	
prEN 13911:2000	Protective clothing for firefighters - Requirements and test methods for fire hoods for firefighters	
prEN ISO 14460: 1999/ prA1:2000	Protective clothing for automobile racing drivers - Protection against heat and flame - Performance requirements and test methods (includes AC:1999)	
prEN ISO 15025:2000	Protective clothing - Protection against heat and flame - Method of test for limited flame spread	DIN EN 532:1995
prEN ISO 15384:2000	Protective clothing for firefighters - Laboratory test methods and performance requirements for wildland firefighting clothing	

A 7: Protective Clothing (CEN/TC 162)

Standard	Title	Intended to replace
Clothing for protection against chemicals		
prEN 943-1:1995	Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles - Part 1: Per-formance requirements for ventilated and non-ventilated "gas-tight" (Type 1) and "non-gas-tight" (Type 2) chemical protective suits	
prEN 943-2:1996	Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles - Part 2: Performance requirements for "gas-tight" (Type 1) chemical protective suits for emergency teams (ET)	
prEN 13034:1997	Protective clothing against liquid chemicals - Performance requirements for chemical protective suits offering limited protective performance against liquid chemicals (type 6 equipment)	
prEN ISO 6529:1998	Protective clothing - Protection against chemicals - Determination of resistance of protective clothing materials to permeation by liquids and gases	
prEN ISO 13982-1: 2000	Protective clothing for use against solid particulate chemicals - Part 1: Performance requirements for chemical protective clothing providing protection to the full body against solid particulate chemicals (type 5 clothing) (ISO/DIS 13982-1:2001)	
prEN ISO 13982-2: 1999	Protective clothing for use against solid particulate chemicals - Part 2: Test method for determination of inward leakage of aerosols of fine particles into suits (ISO/DIS 13982-2:1999)	
prEN 14126:2001	Protective clothing - Performance requirements and test methods for protective clothing against infective agents	
Protective clothing for cold and wet conditions		
prEN 342:2000	Protective clothing - Ensembles and garments for protection against cold	DIN V ENV 342:1998
prEN 343:2000	Protective clothing - Garments for protection against rain	DIN V ENV 343:1998
prEN 14058:2000	Protective clothing - Garments for protection against cool environments	

Standard	Title	Intended to replace
Clothing for protection against mechanical impact		
prEN 381-10:1999	Protective clothing for users of hand-held chainsaws – Part 10: Test method for upper body protectors	
prEN 381-11:1999	Protective clothing for users of hand-held chainsaws – Part 11: Requirements for upper body protectors	
prEN ISO 13998: 1998	Protective clothing – Aprons, trousers and vests protecting against cuts and stabs by hand knives	DIN EN 412:1993
prEN ISO 14876-1: 1999	Protective clothing – Body armour – Part 1: General requirements	
prEN ISO 14876-2: 1999	Protective clothing – Body armour – Part 2: Bullet resistance – Requirements and test methods	
prEN ISO 14876-3: 1999	Protective clothing – Body armour – Part 3: Knife stab resistance – Requirements and test methods	
prEN ISO 14876-4: 2001	Protective clothing – Body armour – Part 4: Needle and spike stab resistance – Requirements and test methods	
prEN ISO 14877: 2001	Protective clothing for abrasive blasting operations using granular abrasives (ISO/FDIS 14877:2001)	
Special protective clothing		
prEN 471:2000	High-visibility warning clothing for professional use – Test methods and requirements	DIN EN 471:1994
prEN 1073-2:1999	Protective clothing against radioactive contamination – Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination	
prEN 13356:1998	High-visibility accessories for non-professional use – Test methods and requirements	
Protective clothing for motorcyclists		
prEN 1621-2:2000	Motorcyclists' protective clothing against mechanical impact – Part 2: Motorcyclists' back protectors – Requirements and test methods	
prEN 13594:1999	Performance requirements and test methods for professional motorcyclists' protective clothing against mechanical impact – Motorcyclists' protective gloves for road riding	

A 7: Protective Clothing (CEN/TC 162)

Standard	Title	Intended to replace
prEN 13595-1:1999	Protective clothing for professional motorcycle riders – Jackets, trousers and one piece or divided suits – Part 1: General requirements	
prEN 13595-2:1999	Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 2: Test method for determination of impact abrasion resistance	
prEN 13595-3:1999	Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 3: Test method for determination of burst strength	
prEN 13595-4:1999	Protective clothing for professional motorcycle riders – Jackets, trousers and one-piece or divided suits – Part 4: Test method for determination of impact cut resistance	
prEN 13634:1999	Protective footwear for professional motorcycle riders – Requirements and test methods	
prEN 14021:2000	Stone shields for off-road motorcycling suited to protect riders against stones and debris – Requirements and test methods	
Body protections for sports and recreational use		
prEN 13061:1997	Protective clothing – Shin guards for association football players – Requirements and test methods	
prEN 13277-4:1999	Protective equipment for martial arts - Part 4: Additional requirements and test methods for head protectors	
prEN 13277-5:1999	Protective equipment for martial arts - Part 5: Additional requirements and test methods for genital protectors and abdominal protectors	
prEN 13277-6:2000	Protective equipment for martial arts - Part 6: Additional requirements and test methods for breast protectors for females	
prEN 13546:1999	Protective clothing - Hand, arm, chest, abdomen, leg, foot and genital protectors for field hockey goal keepers, and shin protectors for field players - Requirements and test methods	
prEN 13567:1999	Protective clothing - Hand, arm, chest, abdomen, leg, genital and face protectors for fencers - Requirements and test methods	

Standard	Title	Intended to replace
prEN ISO 18814-1:1999	Protective clothing - Hand, arm, chest, abdomen, leg, genital and neck protection for use in ice hockey - Part 1: Protectors for players other than goalkeepers - Requirements and test methods	

d) Standardization Projects

Standard	Title	Replaces
General requirements for protective clothing		
WI 00162222	Protective clothing - Electrostatic properties – Part 1: Surface resistivity (Test methods and requirements)	DIN EN 1149-1:1996
Clothing for protection against heat and fire		
WI 00162198	Protective clothing - Protection against heat and flame – Limited flame spread materials and material assemblies	DIN EN 533:1997
WI 00162224	Guidelines for selection, use, care and maintenance of protective clothing against heat and flame	
Clothing for protection against chemicals		
WI 00162180	Protective clothing for use against liquid chemicals – Test method – Resistance of materials to penetration by liquids	DIN EN 368:1993
WI 00162201	Protection against liquid chemicals – Performance requirements for chemical protective clothing	
WI 00162202	Protective clothing against chemicals – Test methods and performance classification of chemical protective clothing materials, seams, joins and assemblages	
WI 00162217	Protective clothing against chemicals – Determination of resistance to penetration by atomized liquid chemicals, emulsions and dispersions Atomizer test	
Protective clothing for cold and wet conditions		
WI 00162164	Measurement of thermal insulation by means of a thermal manikin (ISO/CD 15831)	
WI 00162211	Protective clothing against foul weather – Test method for the rain tightness of a ready made garment – Impact from above with high energy droplets	

Standard	Title	Replaces
Clothing for protection against mechanical impact		
WI 00162212	Protective clothing – Gloves and armguards protecting against cuts by powered knives – Requirements and test methods	
WI 00162218	Knee protectors for work in the kneeling position	
WI 00162223	Abrasion resistance of protective clothing material	DIN EN 530:1995
Body protection for sports and recreational use		
WI 00162174	Wrist, palm, knee and elbow protectors for users of roller sports equipment	

e) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
General requirements for protective clothing		
ISO/DIS 11610:1997	Protective clothing - Glossary of terms and definitions	prEN ISO 11610:1997
ISO 13688:1998	Protective clothing -- General requirements	EN 340:1993
ISO/WD 22613:2000	Protective clothing - General test methods and performance requirements for hand protection	
Clothing for protection against heat and fire		
ISO 2801:1998	Clothing for protection against heat and flame – General recommendations for selection, care and use of protective clothing	
ISO 6942:1993	Clothing for protection against heat and fire – Evaluation of thermal behaviour of materials and material assemblies when exposed to a source of radiant heat	EN 366:1993
ISO/DIS 6942:1998	Protective clothing – Protection against heat and fire – Method of test – Evaluation of materials and material assemblies when exposed to a source of radiant heat	prEN ISO 6942:1998
ISO 9150:1988	Protective clothing – Determination of behaviour of materials on impact of small splashes of molten metal	EN 348:1992
ISO/WD 9150:1988	Protective clothing – Test method – Determination of behaviour of materials on impact of small splashes of molten metal	WI 00162136

Standard	Title	Linked to
ISO 9151:1995	Protective clothing against heat and flame – Determination of heat transmission on exposure to flame	EN 367:1992
ISO 9185:1990	Protective clothing – Assessment of resistance of materials to molten metal splash	EN 373:1993
ISO/AWI 9185	Protective clothing – Assessment of resistance of materials to molten metal splash	WI 00162179
ISO/DIS 11611:2000	Protective clothing for use in welding and allied processes	prEN ISO 11611:2000
ISO 11612:1998	Clothing for protection against heat and flame – Test methods and performance requirements for heat-protective clothing	EN 531:1995
ISO/DIS 11612: 2001	Protective clothing – Clothing to protect against heat and flame	prEN ISO 11612:2001
ISO 11613:1999	Protective clothing for firefighters – Laboratory test methods and performance requirements	prEN 469rev
ISO/CD 11613:2000	Protective clothing for firefighters – Laboratory test methods and performance requirements	prEN 469rev
ISO 12127:1996	Clothing for protection against heat and flame – Determination of contact heat transmission through protective clothing or constituent materials	EN 702:1994
ISO/DIS 13506:2000	Protective clothing against heat and flame – Test method for complete garments – Prediction of burn injury using an instrumented manikin	prEN ISO 13506
ISO/AWI 14116	Clothing for protection against heat and flame – Test methods and performance requirements for limited flame spread materials	EN 533:1996
ISO 14460:1999	Protective clothing for automobile racing drivers – Protection against heat and flame – Performance requirements and test methods	EN ISO 14460:1999
ISO 14460/DAM 1: 2000	Protective clothing for automobile racing drivers – Protection against heat and flame – Performance requirements and test methods	EN ISO 14460/ prA1:2000
ISO 15025:2000	Protective clothing – Protection against heat and flame – Method of test for limited flame spread	prEN ISO 15025:2001
ISO/DIS 15384:2000	Protective clothing for firefighters – Laboratory test methods and performance requirements for wildland firefighting clothing	EN ISO 15384:2000

A 7: Protective Clothing (CEN/TC 162)

Standard	Title	Linked to
ISO/FDIS 15538: 2000	Protective clothing for firefighters – Laboratory test methods and performance requirements for protective clothing with a reflective outer surface	EN 1486:1996
ISO/DIS 17492:2000	Clothing for protection against heat and flame – Determination of heat transmission on exposure to both flame and radiant heat	
ISO 17493:2000	Clothing and equipment for protection against heat – Test method for convective heat resistance using a hot air circulating oven	
Clothing for protection against chemicals		
ISO 6529:1990	Protective clothing – Protection against liquid chemicals – Determination of resistance of air-impermeable materials to permeation by liquids	EN 369:1993
ISO/FDIS 6529:2001	Protective clothing – Protection against chemicals – Determination of resistance of protective clothing materials to permeation by liquids and gases (revision of ISO 6529:1990)	prEN ISO 6929:2001
ISO 6530:1990	Protective clothing – Protection against liquid chemicals – Determination of resistance of materials to penetration by liquids	EN 368:1992
ISO/CD 6530:1998	Protective clothing for use against liquid chemicals – Test method – Resistance of materials to penetration by liquids	WI 00162180
ISO/DIS 13982-1: 2000	Protective clothing for use against solid particulate chemicals – Part 1: Performance requirements for chemical protective clothing providing protection to the full body against solid particulate chemicals (type 5 clothing)	prEN ISO 13982-1: 2000
ISO/DIS 13982-2: 1999	Protective clothing for use against solid particulate chemicals – Part 2: Test method for determination of inward leakage of aerosols of fine particles into suits	prEN ISO 13982-2: 1999
ISO 13994:1998	Clothing for protection against liquid chemicals – Determination of the resistance of protective clothing materials to penetration by liquids under pressure	
ISO/CD 16542:2001	Clothing for protection against contact with blood and body fluids – Performance requirements for surgical gowns, surgical drapes and protective apparel in health care facilities	

Standard	Title	Linked to
ISO/DIS 16602:2001	Clothing for protection against chemicals – Classification, labelling and performance requirements	
ISO/DIS 16603:2001	Clothing for protection against contact with blood and body fluids – Determination of the resistance of protective clothing materials to penetration by blood and body fluids – Test method using synthetic blood	
ISO/DIS 16604:2001	Clothing for protection against contact with blood and body fluids – Determination of resistance of protective clothing materials to penetration by blood-borne pathogens – Test method using Phi-X-174 Bacteriophage	
ISO/DIS 17491:2001	Protective clothing – Protection against gaseous and liquid chemicals – Determination of resistance of protective clothing to penetration by liquids and gases	
ISO/CD 22609:2001	Clothing for protection against infectious agents – Medical face masks – Test methods for resistance against penetration by synthetic blood	
ISO/CD 22610:2001	Clothing for protection against infectious agents – Test methods for determination of penetration by bacteria through protective clothing materials	
ISO/CD 22611:2001	Clothing for protection against infectious agents – Test method for resistance to penetration by biologically contaminated aerosols	
ISO/CD 22612:2001	Clothing for protection against infectious agents – Test method for resistance against penetration by biologically contaminated dust	
Protective clothing for cold and wet conditions		
ISO/CD 15831:2000	Measurement of thermal insulation by means of a thermal manikin	WI 00162164
Clothing for protection against mechanical impact		
ISO 11393-1:1998	Protective clothing for users of hand-held chain-saws – Part 1: Test rig driven by a flywheel for testing resistance to cutting by a chain-saw	EN 381-1:1993
ISO 11393-2:1999	Protective clothing for users of hand-held chain-saws – Part 2: Test methods and performance requirements for leg protectors	EN 381-2:1995 EN 381-5:1995
ISO 11393-3:1999	Protective clothing for users of hand-held chain-saws – Part 3: Test methods for footwear	EN 381-3:1996

A 7: Protective Clothing (CEN/TC 162)

Standard	Title	Linked to
ISO/DIS 11393-4: 2001	Protective clothing for users of hand-held chain saws – Part 4: Test methods and performance requirements for protective gloves	prEN 381-4:1999 prEN 381-7:1999
ISO/FDIS 11393-5: 2001	Protective clothing for users of hand-held chain-saws – Part 5: Test methods and performance requirements for protective gaiters	prEN 381-8:1997 prEN 381-9:1997
ISO/NP 11393-6: 1997	Protective clothing for users of hand-held chain-saws – Part 6: Requirements and test methods for upper body protectors	prEN 381-10:1999 prEN 381-11:1999
ISO 13995:2000	Protective clothing – Mechanical properties – Test method for the determination of the resistance to puncture and dynamic tearing of materials	EN ISO 13995:2000
ISO 13996:1999	Protective clothing – Mechanical properties – Determination of resistance to puncture	EN 863:1995
ISO 13997:1999	Protective clothing – Mechanical properties – Determination of resistance to cutting by sharp objects	EN ISO 13997:1999
ISO 13998:2001	Protective clothing – Aprons, trousers and vests protecting against cuts and stabs by hand knives	EN ISO 13998:2001
ISO 13999-1:1999	Protective clothing – Gloves and arm guards protecting against cut and stabs by hand knives – Part 1: Chain-mail gloves and arm guards	EN 1082-1:1996
ISO/DIS 13999-2: 2001	Protective clothing – Gloves and arm guards protecting against cut and stabs by hand knives – Part 2: Gloves and arm guards made of materials other than chain-mail	EN 1082-2:2000
ISO/DIS 13999-3: 2001	Protective clothing – Gloves and arm guards protecting against cuts and stabs by hand knives – Part 3: Impact cut test for fabric, leather and other materials	EN 1082-3:2000
ISO/DIS 14876-1: 1999	Protective clothing – Body armour – Part 1: General requirements	prEN ISO 14876-1: 1999
ISO/DIS 14876-2: 1999	Protective clothing – Body armour – Part 2: Bullet resistance – Requirements and test methods	prEN ISO 14876-2: 1999
ISO/DIS 14876-3: 1999	Protective clothing – Body armour – Part 3: Knife stab resistance – Requirements and test methods	prEN ISO 14876-3: 1999
ISO/CD 14876-4: 2001	Protective clothing – Body armour – Part 4: Needle and spike stab resistance – Requirements and test methods	prEN ISO 14876-4: 2001
ISO/FDIS 14877:2001	Protective clothing for abrasive blasting operations using granular abrasives	prEN ISO 14877:2001

f) National standards

Standard	Title
General requirements for protective clothing	
Draft DIN 32780-100:2000	Protective clothing – Part 100: Protection against electromagnetic fields in the frequency range from 80 MHz to 1 GHz; Requirements and test methods
Clothing for protection against heat and fire	
DIN 23319:1990	Protective aprons for welding- and transport-working for the mining industry
DIN 23320-1:1998	Flameproof protective clothing for the mining industry – Part 1: Safety requirements and testing
DIN 23320-2:1988	Flameproof clothing for the mining industry; one-piece coveralls
DIN 23320-3:1988	Flameproof clothing for the mining industry; two-piece outfits
DIN 23320-4:1988	Flameproof clothing for the mining industry; underwear
DIN 23320-5:1988	Flameproof clothing for the mining industry; protective hoods
Clothing for protection against chemicals	
DIN 32763:1986	Grade 2 clothing for protection against chemicals; safety requirements, testing
Draft DIN 32780-300:2000	Protective clothing – Part 300: Determination of resistance to penetration by atomized liquid chemicals, emulsions and suspensions; atomizer test

A 8: Equipment for Hand and Arm Protection (CEN/TC 162)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
Protective gloves			
EN 374-1:1994	Protective gloves against chemicals and micro-organisms - Part 1: Terminology and performance requirements	DIN 4841-1:1990 (partly)	16.12.1994
EN 374-2:1994	Protective gloves against chemicals and micro-organisms - Part 2: Determination of resistance to penetration	DIN 4841-1:1990 (partly)	16.12.1994
EN 374-3:1994	Protective gloves against chemicals and micro-organisms - Part 3: Determination of resistance to permeation by chemicals	DIN 4841-1:1990 (partly)	16.12.1994
EN 388:1994	Protective gloves against mechanical risks	DIN 4841-1:1990 (partly)	16.12.1994
EN 407:1994	Protective gloves against thermal risks (Heat and/or fire)	DIN 4841-1:1990 (partly)	16.12.1994
EN 420:1994	General requirements for gloves	DIN 4841-1:1990 (partly)	16.12.1994
EN 421:1994	Protective gloves against ionizing radiation and radioactive contamination		16.12.1994
EN 511:1994	Protective gloves against cold	DIN 4841-1:1990 (partly)	16.03.2000
EN 659:1996	Protective gloves for firefighters		10.10.1996
EN ISO 10819: 1996	Mechanical vibration and shock – Hand-arm vibration – Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand		03.12.1996

b) Draft European standards

Standard	Title	Intended to replace
Protective gloves		
prEN 374-1:1998	Protective gloves against chemicals and micro-organisms – Part 1: Terminology and performance requirements	DIN EN 374-1:1994
prEN 374-2:1998	Protective gloves against chemicals and micro-organisms – Part 2: Determination of resistance to penetration	DIN EN 374-2:1994

Standard	Title	Intended to replace
prEN 374-3:1998	Protective gloves against chemicals and micro-organisms – Part 3: Determination of resistance to permeation by chemicals	DIN EN 374-3:1994
prEN 388:1999	Protective gloves against mechanical risks	DIN EN 388:1994
prEN 420:1998	General requirements for gloves	DIN EN 420:1994
prEN 659:2000	Protective gloves for firefighters	EN 659:1996
prEN 12477:1996	Protective gloves for welders	DIN 4841-4:1987 (partly)

c) Standardization Projects

Standard	Title	Intended to replace
Protective gloves		
WI 00162215	Protective gloves against thermal risks (Heat and/or fire)	DIN EN 407:1994
WI 00162216	Protective gloves against cold	DIN EN 511:1994

d) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
Protective gloves		
ISO 10819:1996	Mechanical vibration and shock – Hand-arm vibration – Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand	EN ISO 10819:1996
ISO/FDIS 15383:2001	Protective gloves for firefighters – Laboratory test methods and performance requirements	EN 659:1996

e) National standards

Standard	Title
Protective gloves	
DIN 4841-4:1987	Protective gloves – Leather protective gloves for welders – Safety requirements and testing

A 9: PPE for Prevention of Drowning (CEN/TC 162)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
Life jackets			
EN 393:1993 + A1:1998	Lifejackets and personal buoyancy aids – Buoyancy aids - 50 N	DIN 7874:1989 (z.T.)	16.12.1994 06.11.1998
EN 394:1993	Lifejackets and personal buoyancy aids – Additional items		16.12.1994
EN 395:1993 + A1:1998	Lifejackets and personal buoyancy aids – Lifejackets – 100 N	DIN 7928:1987 DIN 7929:1987 (with DIN EN 396:1994 and DIN EN 399:1994)	16.12.1994 06.11.1998
EN 396:1993 + A1:1998	Lifejackets and personal buoyancy aids – Lifejackets – 150 N	DIN 7928:1987 DIN 7929:1987 (with DIN EN 395:1994 and DIN EN 399:1994)	16.12.1994 06.11.1998
EN 399:1993 + A1:1998	Lifejackets and personal buoyancy aids – Lifejackets – 275 N	DIN 7928:1987 DIN 7929:1987 (with DIN EN 395:1994 and DIN EN 396:1994)	16.12.1994 06.11.1998

b) Draft European standards

Standard	Title	Replaces
Life jackets		
prEN ISO 12402-1:2000	Personal flotation devices – Part 1: Class A (SOLAS lifejackets), safety requirements	
prEN ISO 12402-2:2000	Personal flotation devices – Part 2: Class B (offshore life-jackets, extreme conditions – 275 N), safety requirements	DIN EN 399:1994
prEN ISO 12402-3:2000	Personal flotation devices – Part 3: Class C (offshore life-jackets – 150 N), safety requirements	DIN EN 396:1994
prEN ISO 12402-4:2000	Personal flotation devices – Part 4: Class D (inland/ close to shore lifejackets – 100 N), safety requirements	DIN EN 395:1994
prEN ISO 12402-5:2000	Personal flotation devices – Part 5: Class E (buoyancy aids – 50 N), safety requirements	DIN EN 393:1994
prEN ISO 12402-8:2000	Personal flotation devices – Part 8: Additional items, safety requirements and test methods	DIN EN 394:1994

Standard	Title	Replaces
prEN ISO 12402-9: 2000	Personal flotation devices – Part 9: Test methods for classes A to F	
prEN ISO 15027-1: 2000	Immersion suits – Part 1: Constant wear suits, requirements including safety	
prEN ISO 15027-2: 2000	Immersion suits – Part 2: Abandonment suits, requirements including safety	
prEN ISO 15027-3: 2000	Immersion suits – Part 3: Test methods	
Buoyant aids for swimming instruction		
prEN 13138-1:1998	Buoyant aids for swimming instruction – Part 1: Buoyant aids to be worn – Safety requirements and test methods	
prEN 13138-2:1999	Buoyant aids for swimming instruction – Part 2: Requirements and test methods for buoyant devices to be held	
Diving suits		
prEN 14225-3:2001	Diving suits – Part 3: Actively heated or cooled suit (Systems) – Requirements and test methods	
prEN 14225-4:2001	Diving suits – Part 4: One atmosphere diving suit – Human factors requirements and test methods	

A 9: PPE for Prevention of Drowning (CEN/TC 162)

c) Standardization Projects

Standard	Title	Intended to replace
Life jackets		
WI 00162185	Personal floatation devices – Part 6: Class F (special purpose devices), additional, specific safety requirements	
WI 00162187	Personal protection equipment – Lifejackets and buoyancy aids - Guide for selection and use	CR 13033:1997
WI 00162194	Personal flotation devices – Part 7: Materials and components, safety requirements and test methods	
Buoyant aids for swimming instruction		
WI 00162220	Buoyant aids for swimming instruction - Part 3: Buoyant aids to be worn, swim seats – Safety requirements and test methods	
Diving suits		
WI 00162207	Diving suits and protective devices against cold water and other liquids – Part 1: Wet suit - Requirements, test methods and guidelines for selection and use	
WI 00162208	Diving suits and protective devices against cold water and other liquids – Part 2: Dry suit - Requirements, test methods and guidelines for selection and use	

d) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
Life jackets		
ISO/DIS 12402-1: 2000	Personal flotation devices – Part 1: Class A (SOLAS lifejackets), safety requirements	prEN ISO 12402-1: 2000
ISO/DIS 12402-2: 2000	Personal flotation devices – Part 1: Class B (offshore lifejackets, extreme conditions - 275 N), safety requirements	prEN ISO 12402-2: 2000
ISO/DIS 12402-3: 2000	Personal flotation devices – Part 1: Class C (offshore lifejackets – 150 N), safety requirements	prEN ISO 12402-3: 2000
ISO/DIS 12402-4: 2000	Personal flotation devices – Part 1: Class D (inland/close to shore lifejackets – 100 N), safety requirements	prEN ISO 12402-4: 2000
ISO/DIS 12402-5: 2000	Personal flotation devices – Part 1: Class E (buoyancy aids – 50 N), safety requirements	prEN ISO 12402-5: 2000

Standard	Title	Linked to
ISO/NP 12402-6 2000	Personal floatation devices – Part 6: Class F (special purpose devices), additional, specific safety requirements	WI 00162185
ISO/NP 12402-7 2000	Personal flotation devices – Part 7: Materials and components, safety requirements and test methods	WI 00162194
ISO/DIS 12402-8: 2000	Personal flotation devices – Part 8: Additional items, safety requirements and test methods	prEN ISO 12402-8: 2000
ISO/DIS 12402-9	Personal flotation devices – Part 9: Test methods for classes A to F	prEN ISO 12402-9: 2000
ISO/FDIS 15027-1: 2000	Immersion suits – Part 1: Constant wear suits, requirements including safety	prEN ISO 15027-1: 2000
ISO/FDIS 15027-2: 2000	Immersion suits – Part 2: Abandonment suits, requirements including safety	prEN ISO 15027-2: 2000
ISO/FDIS 15027-3: 2000	Immersion suits – Part 3: Test methods	prEN ISO 15027-3: 2000

e) Technical reports

Standard	Title
Life jackets	
CR 13033:1997	Personal protective equipment – Lifejackets and buoyancy aids – Guide for selection and use

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 24869-1:1992	Acoustics - Hearing protectors - Subjective method for the measurement of sound attenuation		16.12.1994
EN 24869-3:1993	Acoustics - Hearing protectors - Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes (ISO/TR 4869-3:1989)		16.12.1994

b) Other European standards

Standard	Title	Replaces
EN ISO 4869-2: 1995	Acoustics – Hearing protectors – Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn (ISO 4869-2:1994)	

c) Standardization Projects

Standard	Title	Intended to replace
WI 00211056	Acoustics – Hearing protectors – Part 4: Measurement of effective sound pressure leves for level-dependent sound-restoration ear-muffs	
WI 00211057	Acoustics - Measurement of performance characteristics of hearing protectors in impulsive noise	

d) ISO standards/draft standards and standardization projects

Standard	Title	Linked to
ISO 4869-1:1990	Acoustics – Hearing protectors – Part 1: Subjective method for the measurement of sound attenuation	EN ISO 4869-1:1991
ISO 4869-2:1994	Acoustics – Hearing protectors – Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn	EN ISO 4869-2:1995
ISO/TR 4869-3: 1989	Acoustics – Hearing protectors – Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes	EN 24869-3:1993

A 11: Sports, Playground and Other Recreational Equipment (CEN/TC 136)

a) Harmonized European standards

Standard	Title	Replaces	Publication in Official Journal
EN 568:1997	Mountaineering equipment – Ice anchors – Safety requirements and test methods	DIN EN 568:1993	14.06.1997
EN 892:1996	Mountaineering equipment – Dynamic mountaineering ropes – Safety requirements and test methods	DIN 7946:1984	14.06.1997
EN 958:1996	Mountaineering equipment – Energy absorbing systems for use in klettersteig (via ferrata) climbing – Safety requirements and test methods	DIN 33949:1988	14.06.1997
EN 1809:1997	Diving accessories – Buoyancy compensators – Functional and safety requirements, test methods		13.06.1998
EN 12270:1998	Mountaineering equipment – Chocks – Safety requirements and test methods	DIN 32919:1988	16.03.2000
EN 12275:1998	Mountaineering equipment – Connectors – Safety requirements and test methods	DIN 7944:1989	16.03.2000
EN 12276:1998	Mountaineering equipment – Frictional anchors – Safety requirements and test methods	DIN 33948:1988	
EN 12277:1998	Mountaineering equipment – Harnesses – Safety requirements and test methods	DIN 7947:1987	06.11.1998
EN 12278:1998	Mountaineering equipment – Pulleys – Safety requirements and test methods		06.11.1998

A 11: Sports, Playground and Other Recreational Equipment (CEN/TC 136)

b) Other European standards

Standard	Title	Replaces
EN 564:1997	Mountaineering equipment – Accessory cord – Safety requirements and test methods	
EN 565:1997	Mountaineering equipment – Tape – Safety requirements and test methods	DIN EN 564:1993
EN 566:1997	Mountaineering equipment – Slings – Safety requirements and test methods	DIN EN 566:1993
EN 567:1997	Mountaineering equipment – Rope clamps – Safety requirements and test methods	DIN EN 567:1993
EN 569:1997	Mountaineering equipment – Pitons – Safety requirements and test methods	
EN 893:1999	Mountaineering equipment – Crampons – Safety requirements and test methods	
EN 959:1996	Mountaineering equipment – Rock anchors – Safety requirements and test methods	
EN 12628:1999	Diving accessories – Combined buoyancy and rescue devices – Functional and safety requirements, test methods	DIN 32925:1985 (partly)
EN 13089:1999	Mountaineering equipment – Ice-tools – Safety requirements and test methods	DIN 7945:1985 (partly)

c) Standardization Projects

Standard	Title	Intended to replace
WI 00136079	Mountaineering equipment – Descenders – Safety requirements and test methods	

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

Deficiencies in Standards Relating to the Different Types of PPE

The deficiencies listed below refer to the standards documents upon which this study is based. Since standards are constantly being developed further, it is very possible that the deficiencies mentioned have already been dealt with in the revision process.

B 1: Respiratory Protective Equipment

Standard / draft standard	Deficiency
EN 372:1992 Respiratory protec-tive devices - SX gas filters and combined filters against specific named compounds - Requirements, test-ing, marking	Test-gas concentration Concentrations of gas lower than the test-gas concentration are possible. This can make it difficult to test such gases.

B 2: Equipment for Eye Protection and Full or Partial Face Protection

Standard / draft standard	Deficiency
EN 166: 1998 Personal eye-protection - Specifications	Impact testing/shooting test It is difficult to meet the required strength in practice. Combined use of various PPE types The interference caused by combined use of various types of PPE (e.g. respiratory protection/eye protection) is not always taken into consideration. Better coordination between the various PPE committees would be desirable.
prEN 168: 1998 Personal eye-protection - Non-optical test methods	The reproducibility and representativeness of the following test methods are problematic: – test method to determine the protection against coarse dust, – test method to determine the fogging resistance of the oculars and – test method to determine surface resistance to damage caused by fine particles.

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

B 3: Equipment for Head Protection

Standard / draft standard	Deficiency
EN 397:1995/A1:2000 Industrial safety helmets	**Compliance with the basic requirements of Directive 89/686/EEC** The respondents would like a more precise description of the area to be protected.
EN 443:1997 Helmets for firefighters	**Resistance to radiant heat** Radiation of 7 KW/m^2 is not considered strict enough. The respondents recommend radiation of 14 KW/m^2. **Ergonomic requirements** Additional ergonomic requirements should be incorporated into the standard.
EN 960:1994/ A1:1998 Headforms for use in the testing of protective helmets	**Correspondence of the dimensions of child head-sizes with the human head** The head forms for children do not reflect the human anatomy very well. This can cause difficulties in testing.
EN 13087-1:2000 Protective helmets – Test methods – Part 1: Conditions and conditioning	**Cost/benefit ratio** The artificial ageing process is considered too expensive.
EN 13087-2:2000 – Part 2: Shock absorption	**Dispersion of test results** The dispersion of the test results of the different test institutes causes problems.
EN 13087-5:2000 – Part 5: Retention system strength	**Test of retention-system strength** The results can vary depending on how the helmet is put on. The deformation caused by the shock-absorbing elements is also measured.
EN 13087-7:2000 – Part 7: Flame resistance	**Test-method representativeness and reproducibility** According to the manufacturers, problems can occur due to an imprecise description of the burner or failure to specify a burner temperature.
EN 13087-9:1998 – Part 9: Mechanical rigidity	**Reproducibility of test results** There are too many unpredictabilities in this test method and the results are not reproducible. This has been confirmed by a round-robin test.
prEN 14052:2001 Specifications for high performance industrial safety helmets	**Test method to determine the efficiency of the fastening system** This test method is considered subjective. There can be problems with the reproducibility/representativeness of the results.

B 4: Equipment for Hearing Protection

Standard / draft standard	Deficiency
prEN 352-1: 2000 Hearing protectors – General requirements – Part 1: Ear muffs	Basic health and safety requirements of Directive 89/686/EEC Compliance with Section 3.5, Paragraph 2 of the directive is considered a problem. There is no objective test method for the comfort index required by the directive.
EN 352-4:2001 – Part 4: Level-dependent ear-muffs	Basic health and safety requirements of Directive 89/686/EEC There is no test for sufficient protection against impulse noise (e.g. gun-fire).
prEN 352-5:2000 – Part 5: Active noise reduction ear-muffs	Basic health and safety requirements of Directive 89/686/EEC There is no test for sufficient protection against impulse noise (e.g. gun-fire).
prEN 352-6:2000 – Part 6: Ear-muffs with electrical audio input	Selection by the user This draft standard only covers a small proportion of the products available on the market.
prEN 352-7:2000 – Part 7: Level-dependent ear-plugs	Test method The respondents criticize the test method specified by ISO/TR 4869-4: 1998 because the actual protective effect is rated too highly.

B 5: Equipment for Protection against Falls from a Height

Standard / draft standard	Deficiency
EN 341:1992/A1: 1996 Personal protective equipment against falls from a height – Descender devices	Basic health and safety requirements of Directive 89/686/EEC The following additional requirements should be incorporated into the standard: – the standard should also take into account that the direction of descent might not be vertical; – a dynamic test should be included in order to take into account the potential impact load; – the respondents recommend that requirements be specified for descender devices which can carry two people simultaneously. Functional test This test is considered very cost-intensive.

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

Standard / draft standard	Deficiency
EN 353-1: 1992 Personal protective equipment against falls from a height – Guided type fall arresters on a rigid anchorage line	Basic health and safety requirements of Directive 89/686/EEC The following additional points should be incorporated into the standard: – the standard should also specify testing for other components of the arrester, e.g. a crossing bar; – the standard should take into account that a guided-type fall arrester on a rigid anchorage line can be used in combination with an anchor device; – the standard should specify a test for an inclined rigid anchorage line. The requirements, e.g. concerning the impact force, would be the same; – with some devices, the arresting process is triggered by a spring. The standard should cover the possibility of the spring breaking; – there should be more precise rules on how to ensure that a fall arrester is attached in the proper manner; – test criteria should be defined for the upper termination and the type of such a termination should be described in more detail.
EN 353-2: 1992 Personal protective equipment against falls from a height – Guided type fall arresters on a flexible anchorage line	Basic health and safety requirements of Directive 89/686/EEC The following additional points should be incorporated into the standard: – dynamic tests and functional tests; – the standard should take "panic gripping" into account and specify requirements for safer upward and downward movements; – the standard should contain requirements to ensure that detachable fall arresters are attached in the proper manner
EN 354: 1992 Personal protective equipment against falls from a height – Lanyards	Minimum number of circular stitches The standard does not include a requirement for the minimum number of circular stitches for spliced rope terminations. Reduced rigidity The respondents recommend that requirements be added with regard to the lanyard's resistance to foul weather since some lanyards without UV stabilizers quickly lose their rigidity.
EN 358: 1999 Personal protective equipment for work positioning and prevention of falls from a height – Belts for work positioning and restraint and work positioning lanyards	Flammability test Any lanyard or belt can pass this test, without being specifically designed to do so, because the specified flame intensity is too low.

Standard / draft standard	Deficiency
EN 360: 1992 Personal protective equipment against falls from a height – Retractable type fall arresters	**Basic health and safety requirements of Directive 89/686/EEC** – Inclusion of additional drop tests which also take into account the function and strength of the fall arrester in a horizontal or inclined position as well as the edge stresses. – Inclusion of drop tests after exposure to cold. – Inclusion of criteria to test functional reliability of retractable-type fall arresters on inclined surfaces. **Locking test** The results of the locking test are not sufficiently meaningful.
EN 361: 1992 Personal protective equipment against falls from a height – Full body harnesses	**Ergonomics** Inclusion of more precise and more practicable ergonomic specifications.
EN 362: 1992 Personal protective equipment against falls from a height – Connectors	**Consideration of the possible uses of the different connectors** The standard should give consideration to the various possible uses of the different connectors because stress can develop lengthways and sideways.
EN 567:1997 Mountaineering equipment – Rope clamps – Safety requirements and test methods	**Dynamic test** The respondents criticize the fact that this standard does not require a dynamic test. Such a test could examine whether the rope clamps destroy the rope in an arrest process.
EN 795: 1996 Protection against falls from a height – Anchor devices – Requirements and testing	**Basic health and safety requirements of Directive 89/686/EEC** The standard does not take into account the possibility of several persons being secured on one anchor device.
EN 892:1996 Mountaineering equipment – Dynamic mountaineering ropes – Safety requirements and test methods	**Drop test** The respondents criticize the reproducibility of the test results. One reason is that the standard does not provide a sufficiently precise description of the test equipment. In addition, the drop mass is subject to an additional braking force due to the frictional forces in the anchorage line.

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

B 6: Equipment for Foot and Leg Protection

Standard / draft standard	Deficiency
EN 12568:1998 Foot and leg protectors - Requirements and test methods for toecaps and metal penetration resistant inserts	Penetration-resistant inserts Requirements for non-metallic penetration-resistant inserts should be added to the standard.
ENV 13287:2000 Safety, protective and occupational footwear for professional use. Test method and specifications for the determination of slip resistance	Test parameters There are still various test parameters, e.g. the lubricant, which have to be defined for the slip-resistance test. There are also problems with the test method.
prEN ISO 20344 Test methods for safety, protective, occupational and specific job related footwear for professional use	Ergonomic properties In order to improve the fit of protective footwear, it is suggested that the size specification should also include a reference to the foot width in addition to the reference to the foot length/shoe-inner length. Determination of watertightness The method specified in Clause 26.1 for determining watertightness is subjective and time-consuming.

B 7: Protective Clothing

Standard / draft standard	Deficiency
prEN 340:2000 Protective clothing – General requirements	Quantification of ergonomic parameters Due to a lack of suitable test methods for ergonomic parameters, the standard does not fully cover the basic safety requirements of Directive 89/686/EEC. Product requirements enabling the user to select a suitable product There are no standardized intervals for the body measurements in the size system.
EN 510:1993 Specification for protective clothing for use where there is a risk of entanglement with moving parts	Tear resistance of essential components Clause 2.5 of Annex II of Directive 89/686/EEC, which requires essential components of the clothing to be tear-resistant in order to reduce the risk if the PPE becomes entangled with moving parts, cannot be implemented using this standard.

Standard / draft standard	Deficiency
EN 1149-1: 1995 Protective clothing – Electrostatic properties – Part 1: Surface resistivity (Test methods and requirements)	**Conducting-core fibres** The standard does not yet contain a test method which could also be used to test woven fabrics made of conducting-core fibres.
EN 348: 1992 Protective clothing – Test method: Determination of behaviour of materials on impact of small splashes of molten metal	**Dispersion of test results** The dispersion of the test results obtained by the different test institutes causes problems.
EN 366: 1993 Protective clothing – Protection against heat and fire – Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat	**Dispersion of test results** The dispersion of the test results obtained by the different test institutes causes problems.
EN 367:1992 Protective clothing – Protection against heat and fire – Method of determining heat transmission on exposure to flame	**Dispersion of test results** The dispersion of the test results obtained by the different test institutes causes problems.
EN 373: 1993 Protective clothing – Assessment of resistance of materials to molten metal splash	**Grading of molten metal masses to be poured** The respondents criticize the cost/benefit ratio of this test method due to the molten metal masses poured being graded in steps of 10 g. **PVC film** Problems exist e. g. with regard to the procurement and the ageing characteristics of the PVC film.
EN 532: 1994 Protective clothing – Protection against heat and flame – Test method for limited flame spread	**Surface flaming** The flaming time of 10 s for the surface flaming of materials or assemblies of materials was criticized. **Inexact test parameters** Inexact test parameters, e. g. for the gas pressure, the composition of the gas and the pressure for multi-layer materials, as well as an inexact description of the test procedure give rise to criticism.

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

Standard / draft standard	Deficiency
EN 470-1: 1995 /A1:1998 Protective clothing for use in welding and allied processes – Part 1: General requirements	**Tear resistance and dimensional change of leather** The requirements regarding the tear resistance and the dimensional change of leather are considered to be too high. These requirements have caused welders' protective clothing made from leather to be ousted from the market. **Length of trouser-legs** There is no length requirement for trouser-legs to ensure that the trousers cover the top of the footwear. **Grading of performance requirements** The fact that the performance requirements for protective clothing are not graded for different welding tasks is considered problematic.
EN 531:1995 +A1:1998 Protective clothing for industrial workers exposed to heat	**Number of performance levels** The respondents criticize the high number of performance levels, as this renders selection of clothing difficult in practice. **Scope** In contrast to EN 531:1995, this standard no longer explicitly excludes protective clothing for firefighters and welders.
prEN ISO 13506:1998 Protective clothing against heat and flame – Test method for complete garments – Prediction of burn injury using an instrumented manikin	**Imprecise test parameters** The respondents criticize the reproducibility of the results obtained with this test method because the test parameters, e.g. the size of the test chamber, are not specified in sufficiently precise detail.
EN 368: 1992 Protective clothing – Protection against liquid chemicals – Test method: Resistance of materials to penetration by liquids	**Volatile chemicals** The gutter test method is not suitable for volatile chemicals.
EN 463: 1994 Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by a jet of liquid (Jet Test)	**Inexact definition of the procedure** Due to an inexact specification of parameters such as the number of test points and the angle of the jet, test results may vary as a consequence of subjective testing.
EN 468: 1994 Protective clothing – Protection against liquid chemicals – Test method: Determination of resistance to penetration by spray (Spray Test)	**Extremity of dispersion of test results** The results of this test method are extremely dispersed. The verification of the protective function in the hood/neck area may not be sufficient.

Standard / draft standard	Deficiency
EN 465, EN 466 and EN 467:1998: Protective clothing – Protection against liquid chemicals – Performance requirements	Problems of compatibility Problems of compatibility may arise due to the permeation data for protective clothing, protective boots and protective gloves not being harmonized. Variety of classes The variety of classes for mechanical parameters renders selection of the correct protective clothing difficult. Breakthrough times The breakthrough times for permeation are based on laboratory conditions and are not always in keeping with actual conditions in practice.
prEN 943-1:1995 Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles – Part 1: Performance requirements for ventilated and non-ventilated "gas-tight" (Type 1) and "non-gas-tight" (Type 2) chemical protective suits	Variety of classes The variety of classes for mechanical parameters renders selection difficult. Basic health and safety requirements of Directive 89/686/EEC The air-supply unit's resistance to chemicals should be tested. Breakthrough times The breakthrough times for permeation are based on laboratory conditions and are not always in keeping with actual conditions in practice.
prEN ISO 13982-1:2000 prEN ISO 13982-2:1999 Protective clothing for use against solid particulate chemicals – Part 1: Performance requirements Part 2: Test method	Variety of classes The respondents criticize the high number of performance levels for classifying inward leakage because, in view of the test method used, there is no need for and no benefit to be drawn from such detailed classification.
prEN 342:2000 Protective clothing – Ensembles and garments for protection against cold	High cost The manikin test makes implementation of this standard very expensive. Compatibility Problems can arise when choosing a suitable combination of clothing and footwear for protection against cold because no similar test is carried out for footwear intended to protect against the cold.
prEN 343:2000 Protective clothing – Garments for protection against rain	Lower protective requirements The protective requirements for the water-vapour permeability in performance level 1 are generally considered too low. User benefit of product requirements There is no test for the entire garment (e.g. rain test).

Annex B
Deficiencies in Standards Relating to the Different Types of PPE

Standard / draft standard	Deficiency
prEN ISO 13998:1998 Protective clothing – Aprons, trousers and vests protecting against cuts and stabs by hand knives	**Cost/benefit ratio** The ergonomic test increases the test costs but does not deliver any additional findings.
EN 381-7:1999 Protective clothing for users of hand-held chainsaws – Part 7: Requirements for chainsaw protective gloves	**Basic health and safety requirements of Directive 89/686/EEC** The defined scope of protection does not cover the main hazards.
prEN 14876-1:1999 Protective clothing – Body armour – Part 1: General requirements	**Ergonomics** In the users' opinion, too much consideration is given to ergonomic aspects.
prEN 471: 2000 High-visibility warning clothing for professional use – Test methods and requirements	**Positioning of reflective bands** The product requirements described in the German and English versions of the draft standard are different. **Reduction of luminance factor** It is recommended that the requirements with regard to the ageing behaviour of the background material be extended. **Time for the determination of the specific reflexion coefficient of the reflective material after the rain test** The test method should specify the exact point of time at which the specific reflexion coefficient of the reflective material has to be determined after rainfall conditioning. **Burst-resistance test** The limit values specified in the burst-resistance test are difficult for fleece fabrics to reach. **Trimming material** The draft standard should specify that the trimming material's colour fastness has to meet the same requirements as the background material.
prEN 1621-1:1996 Motorcyclists' protective clothing against mechanical impact – Part 1: Requirements and test methods for impact protectors	**Impact-absorption test** The reproducibility of the impact-absorption measurement should be improved.

Standard / draft standard	Deficiency
prEN 1621-2:2000 – Part 2: Motorcyclists' back protectors – Requirements and test methods	Number of protection classes The benefit of the division into two protection classes is disputed. Impact-absorption test The reproducibility of the impact-absorption measurement should be improved.
prEN 13595-1:1999 Protective clothing for professional motorcycle riders – Jackets, trousers and one piece or divided suits – Part 1: General requirements	Number of protection classes The benefit of the division into two protection classes is disputed.

B 8: Equipment for Hand and Arm Protection

Standard / draft standard	Deficiency
prEN 374-1: 1998 Protective gloves against chemicals and micro-organisms - Part 1: Terminology and performance requirements	Sampling procedures It is doubted that Annex II of Directive 89/686/EEC is fully covered when acceptable quality and examination levels according to ISO 2859 are applied. Furthermore, there are no requirements concerning glove breathability.
prEN 374-2: 1998 – Part 2: Determination of resistance to penetration	Water leakage test The surface resistance of the water should be defined.
prEN 374-3: 1998 – Part 3: Determination of resistance to permeation by chemicals	Foreseeable intended conditions of use The permeation test does not fully reflect reality since the performance of the barrier depends upon chemical, mechanical and thermal stress. Degradation At present, there are no requirements or test methods for determining degradation.
prEN 388: 1999 Protective gloves against mechanical risks	Cut resistance It is doubted that the cut-resistance test represents actual conditions. In addition, the test results are considerably dispersed. Abrasion resistance The step between performance levels 3 and 4 is too big. It is not possible to test the abrasion resistance of some glove materials (e. g. rubber). Basic health and safety requirements of Directive 89/686/EEC In the case of protective gloves whose palm and back are made of different materials, only the glove palm is tested.

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Deficiencies in Standards Relating to the Different Types of PPE

Standard / draft standard	Deficiency
EN 407: 1994 Protective gloves against thermal risks (Heat and/or fire)	Radiant heat The determination of heat transfer level 3 (t_3 value) is not sufficiently exact. It is recommended that the t_2 value of heat transfer level 2 be determined. Basic health and safety requirements of Directive 89/686/EEC In the case of protective gloves whose palm and back are made of different materials, only the glove palm is tested. Product features relevant to the user's selection The product requirements should be adapted even more to conditions in practice.
prEN 420: 1998 General requirements for gloves	Allergens The standard does not include a reference list for known allergens. Dexterity The dexterity test depends on the skill of the tester and is thus subjective. The cost/benefit ratio of the test method is considered to be inappropriate.
EN 421: 1994 Protective gloves against ionizing radiation and radioactive contamination	Climatic conditions The climatic conditions for the water-vapour permeability test should be harmonized with those of the test method according to EN 420.
prEN 12477:1996 Protective gloves for welders	Basic health and safety requirements of Directive 89/686/EEC In the case of protective gloves whose palm and back are made of different materials, only the glove palm is tested.

B 9: PPE for Prevention of Drowning

Standard / draft standard	Deficiency
prEN ISO 12402-8:2000 Personal flotation devices – Part 8: Additional items, safety requirements and test methods	CO_2 concentration under the spray hood The test method, the flow rate of the surrounding air and the arrangement of the measurement devices for the determination of the CO_2 concentration under spray hoods should be defined more precisely.
prEN 15027-3:2000 Immersion suits - Part 3: Test methods	Determination of the clo value The test methods described in Clause 3.8 "Thermal testing" are extremely time-consuming and their suitability is doubted.

Annex C
Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

C 1: Respiratory Protective Equipment

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 404 : 1993 Respiratory protective equipment for self-rescue – Filter self-rescuer – Requirements, testing, marking	**Breathing minute volume** From the German point of view, the breathing volume of 30 l/min specified for the determination of the rated duration is not considered practicable for escape conditions in German coal mining.	*This standard is currently being revised. It remains to be seen what the resulting changes will be.*
EN 271 : 1993 Respiratory protective devices – Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations – Requirements, testing, marking	**Mechanical testing** At present the standard specifies two mechanical test procedures. It is debated if, with the abrasion resistance test, additional testing of the mechanical resistance of the eye pieces by applying the "shooting test" is still necessary.	*This deficiency is currently being discussed. It can be assumed that one of the two mechanical tests will be abandoned.*

C 2: Equipment for Eye Protection and Full or Partial Face Protection

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 166 : 1995 Personal eye protection – Specifications	**Resistance to fogging** The resistance to fogging was only specified as an optional requirement and only applies to oculars. Testing should apply to the entire eye protector. **Ergonomic requirements** No requirements are specified for the weight and the adjustability of the frame of the spectacles. **Combined use of different PPE** The interference occurring when different types of PPE are used in combination have not always been taken into account to a satisfactory extent. This applies e. g. to the combined use of eye protectors with earmuffs or respiratory half-masks or the combination of a face screen and an industrial safety helmet.	*There are currently no solutions to this problem.* *The opinion on this deficiency was that the market is a better regulatory instrument. This deficiency still exists.*

Annex C
Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
	Information leaflet provided by the manufacturer The information to be supplied in the information leaflet by the manufacturer according to the list in the standard is criticized as being too technical and not sufficiently meaningful for the user. It would be better to prepare an optimized information leaflet which could serve as an example.	*Changes will be made in the future with regard to the manufacturer's information leaflet. It is not possible to comment further until the changes have been made.*
EN 169 : 1992 Personal eye protection; Filters for welding and related techniques; Transmittance requirements and recommended utilisation	**Levels of protection and recommended use for arc welding** Table 4 which defines the levels of protection and the recommended use in arc welding applications is considered to be obsolete and should therefore be revised.	*This deficiency no longer exists.*

C 3: Equipment for Head Protection

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 397 : 1995 Industrial safety helmets	**Compatibility with other PPE** Criticism was expressed about insufficient consideration of the problem of combinations of PPE. A design requirement providing for the edge of the helmet to be raised in the area of the ear in order to facilitate combination with hearing protectors would be conceivable, for example. **Weight limit for combinations including head protection** There is no weight limit for combinations of PPE, e. g. head protection combined with accessories such as hearing protectors or face protection.	*This deficiency no longer exists.* *This point of criticism still exists. It has not yet proven possible to get a weight limit accepted because the weight is not the sole factor contributing to the comfort of a helmet.*
EN 960 : 1994 Headforms for use in the testing of protective helmets	Dimensions of small headforms and the human head In the case of small headforms (e. g. for a head circumference of 500 mm) the distance between the apex and the chin does not reflect the dimensions of the human head.	*This deficiency no longer exists.*

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
prEN 443 Helmets for firefighters		*EN 443:1997 is currently being revised. The following points are examples of the issues being discussed in the revision process.*
	Combination with other PPE There is a lack of clear requirements and test methods with regard to combination with other PPE.	*It is not possible to comment on this at the present.*
	Visibility The European draft standard no longer comprises requirements regarding a retro-reflective band.	*The requirement for retro-reflective bands is to be reintroduced.*
	Impact resistance test The impact resistance test according to prEN 443 is not considered to correspond with practical conditions. Concern is expressed that with a maximum value of 15 kN for the force transferred to the headform the human spine will not be able to take these high forces.	*The maximum force transferred to the head form is to be reduced from 15 kN to 5 kN.*
	Tear resistance of the chin strap The tear resistance requirement for the chin strap was considered to be critical. The value should be limited to 150 N to 250 N as is the case for industrial safety helmets (EN 397).	*It is not possible to comment on this at the present.*
	UV conditioning The cost/benefit ratio with regard to UV ageing was questioned. The importance of the influence of UV ageing on the testing of the burning behaviour and the behaviour in radiant heat should be reconsidered.	*It is not possible to comment on this at the present.*
	Electrical insulation Manufacturers criticized the conditioning of helmets for the electrical insulation test according to clause 6.8.2 because it requires extremely costly manufacturing procedures.	*There is to be a ban on metallic helmet parts in order to reduce the risk of an electric shock during firefighting operations.*

Annex C
Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

C 4: Equipment for Hearing Protection

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
prEN 352-1 : 1993 Hearing protectors - Safety requirements and testing - Part 1: Ear muffs	**Combination of PPE** The issue of PPE combination is not sufficiently covered. Improvements could be made by introducing raised helmet edges or ear muffs which are flatter at the top. **Determination of the noise attenuation values in all possible wearing positions** Test costs could be reduced by abandoning the requirement to determine the noise attenuation values for universal earmuffs in all possible wearing positions.	*Compatibility of hearing protectors and protective helmets is covered in prEN 352-3:2000. No comments were made with regard to this item.*
prEN 352-3 Part 3: Ear muffs attached to an industrial safety helmet	**Combination of PPE** It is criticized that the existence of an EC type examination certificate is the only requirement specified for the helmet. The requirement of raising the edge of the helmet would offer a solution. Protective visors attached to the helmet and neck protection are not taken into consideration.	*Compatibility of hearing protectors and protective helmets is given sufficient consideration in prEN 352-3:2000.*
prEN 352-4 Part 4: Level-dependent ear muffs	**Cost increases due to test methods** The noise attenuation test for level-dependent hearing protectors is currently under discussion in ISO/TC 43 and CEN/TC 211, since there is not enough experience and further results have to be awaited. All parties are concerned that the specification of relevant test methods will increase the costs.	*Annex B of EN 352-4:2001 refers to a test method specified in ISO/DIS 11904-1 which is used in practice. No deficiencies were mentioned.*

C 5: Equipment for Protection against Falls from a Height

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 353-1 : 1992 Personal protective equipment against falls from a height - Guided type fall arresters on a rigid anchorage line	**Braking force** The restriction of the braking force to 6 kN is to some extent considered to be exaggerated from the point of view of safety.	*According to the respondents, this deficiency does not pose any problems.*
EN 353-2 : 1992 Personal protective equipment against falls from a height - Guided type fall arresters on a flexible anchorage line	**Static strength test** The static strength test is considered to be insufficient from the point of view of safety. Only the anchorage line, not the entire device, is tested. The dynamic strength test does not ensure consideration of safety factors. **Type of device designed for rescue purposes** There is no specification of a type of device for rescue purposes, such as a device for higher working loads.	*The deficiency in the static strength test has been eliminated.* *The inclusion of a type of device for rescue purposes is currently being discussed.*
EN 354 : 1992 Personal protective equipment against falls from a height - Lanyards	**Distinction between different types of construction** An insufficient specification of different types of construction was criticized. Specifications only refer to e. g. laid 3 strand ropes - there are no specifications for rope constructions of 4 or more strands. **Decrease of strength caused by UV radiation** It was recommended that a design requirement be included with regard to the resistance against the decrease of strength caused by UV radiation.	*Both deficiencies still exist. However, they are still being discussed; changes can be expected in the future.*
EN 358 : 1992 Personal protective equipment for work positioning and prevention of falls from a height - Work positioning systems	**Improvement of the test regime** It was recommended that the test regime be improved by taking a more systematic approach in particular with regard to dynamic testing.	*The recommendation that the dynamic test in the test regime be improved has been acted upon.*
EN 360 : 1992 Personal protective equipment against falls from a height - Retractable type fall arresters	**Additional testing for specific climatic conditions** The additional tests that are mandatory for specific climatic conditions are not considered to be appropriate from the point of view of the cost/benefit ratio.	*Although this deficiency was discussed, it was not considered in the amendment. As there are different opinions on this subject, it will be discussed again during the upcoming revision of the standard.*

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Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 361 : 1992 Personal protective equipment against falls from a height - Full body harnesses	**Finish of fittings** There are no requirements regarding the finish of fittings such as fall arrest attachment elements and their testing. **Specifications regarding the ends of straps** There are no specifications regarding the ends of straps. The ends should be secured (e. g. by seams).	*These points are currently not considered to be deficiencies because the standard covers essential requirements. The dynamic test, visibility test and functional test or qualified inspection cover everything else.*
EN 362 : 1992 Personal protective equipment against falls from a height - Connectors	**Scope** The scope needs to be expanded to include rings and fall arrest attachment elements. **Requirements for connectors** – Welded fittings should be excluded. – There is no requirement regarding the maximum gap between the closure cap and the body of the hook when secured.	*This point was not seen as a deficiency because the respondents feel that it is sufficient to test the rings and attachment elements on the equipment.* *These points are currently being discussed and will probably be taken into account in the revision of the standard.*
EN 365 : 1992 Personal protective equipment against falls from a height - General requirements on instructions for use and marking	**Insufficient requirements on information leaflets** The requirements specified for the information supplied by the manufacturer do not cover all requirements defined in Directive 89/686/EEC.	*This deficiency has been eliminated in prEN 365:2001.*
EN 795 : 1996 Protection against falls from a height - Anchorage devices - Requirements and testing	**Distinction between PPE and construction products** The distinction between PPE and construction products is not unambiguously defined. **Dynamic tests** The cost/benefit ratio was criticized because part of the dynamic testing is not considered to be necessary.	*These deficiencies no longer exist.*

C 6: Equipment for Foot and Leg Protection

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 344 : 1993 Requirements and test methods for safety, protective and occupational footwear for professional use	**Slip resistance** There are no requirements and no suitable test method for slip resistance. A suitable test method could not yet be agreed in Europe. International round-robin tests showed, however, that the currently applied test methods produce considerable differences in the measurements. **Problems in testing** As regards test methods elaborated in committees outside the PPE area, they are not always fully applicable and may cause questions about the exact test procedures. This is the case e. g. for the testing of the abrasion resistance of outsoles according to ISO 4649. **Interference caused by the combined use of different types of PPE** This problem was not taken into account in the standards. Problems may arise e. g. in the case of overshoes for the protection against weather conditions. They may reduce the water vapour penetration or change the slip resistance characteristics. When overshoes are used in clean-room conditions manufacturing problems may occur due to a decrease of the electrical resistance. In this case a build-up of electrostatic charges in explosive atmospheres can not be ruled out with certainty.	*This deficiency no longer exists because prestandard ENV 13287:2000 contains test methods and specifications concerning the slip resistance of safety, protective and occupational footwear for professional use.* *This deficiency no longer exists. The test methods developed outside the PPE committees are now rated positively.* *This deficiency still exists. In the respondents' opinion, it cannot be resolved because overshoes always alter the properties or requirements, e.g. comfort of the actual shoe.*
prEN 344-2 Safety, protective and occupational footwear for professional use - Part 2: Additional requirements and test methods	**Height of the upper for protection against cutting by hand-held chain saws** According to clause 4.3.1, only footwear of form C with a height of the upper of more than 195 mm, form D and form E is permitted. Some manufacturers and users regard this requirement as exaggerated to some extent, as in their point of view the protective trousers overlap the footwear. They are concerned that the required height of the upper of 195 mm might have a negative effect on the wearing character-	*This deficiency no longer exists.*

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
	istics of the footwear, especially for small sizes and for ladies' footwear. In the case of chain saw protective mountain footwear an excessive strain on the knee joints is feared. **Determination of water resistance** The determination of the water resistance in accordance with clause 5.1 is questionable with regard to the cost/benefit ratio. The test is subjective and time-consuming.	*This deficiency still exists. As well as the trough test, prEN ISO 20344: 2000 specifies an alternative machine-based method. Nonetheless, the subjectivity remains a point of criticism. The possibility of introducing new methods is currently being discussed.*

C 7: Protective Clothing

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 340 : 1993 Protective Clothing - General Requirements	**Quantification of ergonomic parameters** Due to a lack of suitable test methods for ergonomic parameters, the standard does not fully cover the basic safety requirements of Directive 89/686/EEC.	*This deficiency still exists because there are no suitable test methods.*
EN 510 : 1993 Specification for protective clothing for use where there is a risk of entanglement with moving parts	**Tear resistance of essential components** It has not proven possible to translate Clause 2.5 of Annex II of Directive 89/686/EEC, which requires essential components of the clothing to be tear resistant in order to reduce the risk of the PPE being caught up by moving objects, into a fixed requirement in the standard.	*This standard has not been revised as yet. Consequently, the deficiencies still exist.*
EN 1149-1 : 1995 Protective clothing - Electrostatic properties	**Conducting-core fibres** A suitable test method for woven fabrics made of conducting-core fibres does not yet exist.	*Work is currently underway on a test standard which will include a suitable test method for these woven fabrics.*

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 348 : 1992 Protective clothing - Test method: Determination of behaviour of material on impact of small splashes of molten metal	**Dispersion of test results** The dispersion of test results obtained by the different test institutes causes problems.	*This standard has not been revised as yet. Consequently, this deficiency still exists.*
EN 366 : 1993 Protective clothing - Protection against heat and fire - Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat	**Dispersion of test results** The dispersion of test results obtained by the different test institutes causes problems.	*prEN ISO 6942:1998 will replace the currently valid European standard EN 366:1993. Round-robin tests conducted for prEN ISO 6942:1998 showed that the results were reproducible to a good extent.*
EN 373 : 1993 Protective clothing - Assessment of resistance of materials to molten metal splash	**Grading of molten metal masses to be poured** Due to the grading of the molten metal masses poured onto the test object in steps of 10 g, the test method is criticized for its cost/benefit ratio. **PVC film** Problems exist e. g. with regard to the procurement and the ageing characteristics of the PVC film.	*This standard has not been revised as yet. Consequently, these deficiencies still exist.*
EN 532 : 1994 Protective clothing - Protection against heat and flame - Method of test for limited flame spread	**Surface flaming** The flaming time of 10 s for the surface flaming of materials or assemblies of materials was criticized. **Inexact test parameters** Test parameters e. g. for the gas pressure, the composition of the gas and the pressure for multi-layer materials as well as an inexact description of the test procedure give rise to criticism.	*This standard has not been revised as yet. Consequently, these deficiencies still exist.*
EN 469 : 1995 Protective clothing for firefighters - Requirements and test method for protective clothing for firefighters	**Number of classes** It is criticized that only one class has been defined for thermal requirements. **Visibility** There is no visibility requirement corresponding to warning clothing. **Water resistance and water-vapour permeability** These requirements are only recommendations.	*The deficiencies no longer exist (see prEN 469:2000).*

Annex C
Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 470-1 : 1995 Protective clothing for use in welding and allied processes - Part 1: General requirements	**Tear resistance and dimensional change of leather** The requirements regarding the tear resistance and the dimensional change of leather are considered to be too high. These requirements have caused welders' protective clothing made from leather to be ousted from the market. **Length of trouser-legs** There is no length requirement for trouser-legs to ensure that the trousers overlap the footwear.	*These deficiencies still exist.*
EN 531 : 1995 Protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing)	**Number of performance levels** The high number of performance levels is criticized as this renders it difficult to select clothing suitable for conditions in practice.	*This deficiency still exists but the number of performance levels is to be reduced in line with conditions in practice in the standard-revision process.*
EN 368 : 1992 Protective clothing for use against liquid chemicals - Test method: Resistance of materials to penetration by liquids	**Volatile chemicals** The gutter test method is not suitable for volatile chemicals.	*This standard has not been revised as yet. Consequently, the deficiency still exists.*
EN 369 : 1993 Protective clothing - Protection against liquid chemicals - Test method: Resistance of materials to permeation by liquids	**Insufficient size of the permeation cell** The test method is criticized because the permeation cell is not suitable for testing seams, glued areas or zips due to its restricted size.	*prEN ISO 6529:1998 will replace EN 369:1993 and thus improve this issue.*
EN 463 : 1994 Protective clothing . Protection against liquid chemicals - Test method: Determination of resistance to penetration by a jet of liquid (Jet Test)	**Insufficient definition of the procedure** Due to an inexact specification of parameters such as the number of test points and the angle of the jet, test results may vary due to subjective testing.	*This standard has not been revised as yet. Consequently, this deficiency still exists.*

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 468 : 1994 Protective clothing - Protection against liquid chemicals - Test method: Determination of resistance to penetration by spray (Spray Test)	**Dispersion of test results** The results of this test method are considerably dispersed. The verification of the protective function in the hood/neck area may not be sufficient.	*This standard has not been revised as yet. Consequently, this deficiency still exists.*
EN 465, EN 466 and EN 467 Protective clothing - Protection against liquid chemicals - Performance requirements	**Problems of compatibility** Problems of compatibility may arise due to a lack of harmonization of the permeation data for protective clothing, protective boots and protective gloves. **Variety of classes** It is criticized that the selection is complicated because of the variety of classes defined for the mechanical parameters.	*This deficiency still exists. One reason is that there are co-ordination problems between the different working groups.* *It is difficult to reduce the variety of classes because the standards are intended to cover a broad range of materials.*
prEN 1511, prEN 1512, prEN 1513 Protection against liquid chemicals - Performance requirements for limited use chemical protective clothing	**Differences compared to re-usable chemical protective clothing** Differences between the mechanical requirements specified (test methods, definition of classes) and those applicable to re-usable chemical protective clothing in accordance with EN 465, EN 466 and EN 467 were criticized. **Variety of classes** It is criticized that the selection is complicated because of the variety of classes defined for the mechanical parameters.	*The content of these draft standards will be taken into account in the revision of EN 465 and EN 466. It can be assumed that at least the first deficiency will then no longer exist.*
prEN 342 Protective clothing against cold	**High costs** The high costs of the test in accordance with SFS 5555/INSTA 355 are criticized.	*This deficiency still exists. There is presently no alternative to this test method with which the thermal properties of the entire clothing system can be tested.*
prEN 343 Protective clothing against foul weather	**Lower protective requirements** It is criticized that the protective requirements for the water-vapour permeability of performance level 1 are lower than they were in DIN 61539.	*This deficiency still exists because there are different views regarding clothing materials with a low level of water-vapour permeability.*

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Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
	Design requirements There are no design requirements for the clothing. Information regarding flaps to cover closures as well as design recommendations for the collar, closures and a hood would be helpful.	*This deficiency still exists There are plans to add a rain-resistance test to EN 343. This would also identify faults in the design of protective clothing.*
EN 412 : 1993 Protective aprons for use with hand knives	**Flexibility test** Flexibility requirements according to Clause 3.2.4 are not necessary for chain-mail aprons.	*This deficiency no longer exists.*
EN 471 : 1994 High-visibility warning clothing	**Positioning of reflective bands** The specification of the positioning of the reflective bands is criticized as being inexact. **Reduction of luminance factor** It is recommended that the requirements with regard to the ageing behaviour of the background material be extended. **Time for the determination of the specific reflexion coefficient of the reflective material after the rain test** The test method should specify the exact point of time at which the specific reflexion coefficient of the reflective material has to be determined after rainfall conditioning.	*This deficiency will be eliminated in the revision of the standard.* *This deficiency still exists. The relevant standards bodies are currently discussing this issue.* *This deficiency still exists. The relevant standards bodies are currently discussing this issue.*

C 8: Equipment for Hand and Arm Protection

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
EN 374-1 : 1994 Protective gloves against chemicals and micro organisms - Part 1: Terminology and performance requirements	Sampling procedures It is doubted that annex II of Directive 89/686/EEC is fully covered, when acceptable quality and examination levels according to ISO 2859 are applied.	*This deficiency still exists because it is not possible to rule out defects in a batch of gloves completely.*
EN 374-2 : 1994 - Part 2: Determination of resistance to penetration	Water leakage test The surface resistance of the test medium water should be defined.	*This deficiency still exists.*
EN 374-3 : 1994 Protective gloves against chemicals and micro organisms - Part 3: Determination of resistance to permeation by chemicals	Foreseeable intended conditions of use The permeation test does not fully reflect reality since the performance of the barrier depends upon chemical, mechanical and thermal stress. Degradation At present, no requirements or test methods are available for the determination of the degradation.	*This deficiency still exists because it is very costly to simulate the real conditions of use. A method for comparing the various glove materials with each other would be better.* *This deficiency still exists because there are not yet any suitable and reproducible test methods.*
EN 388 : 1994 Protective gloves against mechanical risks	Cut resistance It is doubted that the cut resistance test represents actual conditions. In addition, the test results are considerably dispersed. Abrasion resistance The step between performance levels 3 and 4 is too big. For some glove materials (e. g. rubber), testing of the abrasion resistance is not possible.	*The revised version, prEN 388:1999, includes some changes to the method for testing cut resistance. However, it is not yet possible to comment on the impacts of these changes because there have not been enough round-robin tests yet.* *The introduction of an additional performance level is still considered a useful idea.*

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Notes on Deficiencies in Standards Relating to the Different Types of PPE Identified in the First Study (Changes between March 1997 and October 2001)

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
	Impact-cut resistance There is no information on the determination of the measurement and limit values. **Specific resistivity** The value of 10^6 to 10^9 W × cm for the specific resistivity is too low.	*The test for impact-cut resistance is no longer included in prEN 388:1999.* *The test for specific resistivity is no longer included in prEN 388:1999.*
EN 407 : 1994 Protective gloves against thermal risks (Heat and/or fire)	**Radiant heat** The determination of heat transfer level 3 (t_3 value) is not sufficiently exact. It is recommended that the t_2 value of heat transfer level 2 be determined.	*This deficiency still exists. The test institutes have now agreed that they will determine the t_2 value.*
EN 420 : 1994 General requirements for gloves	**Allergens** The standard does not include a reference list for known allergens. **Dexterity** The dexterity test depends on the skill of the tester and is thus subjective. The cost/benefit ratio of the test method is considered to be inappropriate.	*This deficiency still exists because the CEN member states have not yet agreed on a common classification system for the allergens.* *There is no suitable alternative to this method at present.*
EN 421 : 1994 Protective gloves against ionizing radiation and radioactive contamination	**Climatic conditions** The climatic conditions for the water-vapour permeability test should be harmonized with those of the test method according to EN 420.	*This deficiency still exists. There is currently considered to be no need for the standard to be revised.*
EN 659 Protective gloves for firefighters	**Pictogram** A separate pictogram should be used for firefighters' protective gloves in order to avoid confusion with other protective gloves.	*This deficiency no longer exists.*

C 9: PPE for Prevention of Drowning

Standard/draft standard	Deficiency acc. to first study (03/97)	Notes (10/01)
Lifejackets and buoyancy aids: **EN 393 : 1993** Buoyancy aids 50 N **EN 395 : 1993** Lifejackets 100 N **EN 396 : 1993** Lifejackets 150 N **EN 399 : 1993** Lifejackets 275 N	**Ergonomics and innocuousness of the PPE** Clause 1.1 „Ergonomics" and Clause 1.2 „Innocuousness of the PPE" of Annex II of Directive 89/686/EEC might cause problems of interpretation, as provisions and limit values can hardly be evaluated. **CO_2 concentration under the spray hood** The test method, the flow rate of the surrounding air and the arrangement of the measurement devices for the determination of the CO_2 concentration under spray hoods should be precisely defined. **Structure of the standards** A change of the structure of the standards to consist of one standard for test methods plus individual standards covering the requirements relating to different types of equipment would improve the transparency of the standards and significantly reduce their length.	*This deficiency still exists. There is currently considered to be no way of eliminating it because the tests to establish compliance with the requirements are carried out by test persons.* *This deficiency still exists. There is no alternative test method at the moment.* *This deficiency no longer exists.*
prEN 1913-3 Immersion suits - Part 3: Test methods	**Determination of the clo value** The test methods described in Clause 3.5 "Thermal testing" are very costlyand doubts are expressed as regards their suitability.	*This deficiency still exists. However, it can be assumed that these concerns will be taken into consideration in the next revision of prEN ISO 15027-3:2000.*