
Protective clothing for abrasive blasting operations using granular abrasives

*Vêtements de protection utilisés lors des opérations de projection
d'abrasifs en grains*

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Foreword

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

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

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

ISO 14877 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

Annex ZZ provides a list of corresponding International and European Standards for which equivalents are not given in the text.

For the purposes of this International Standard, the CEN annex regarding fulfilment of European Council Directives has been removed.

Contents

	page
Foreword	vi
Introduction	vii
1 Scope	1
2 Normative References	1
3 Terms and definitions	2
4 Requirements	2
4.1 General	2
4.2 Requirements for protective gloves for abrasive blasting operations	2
4.2.1 General requirements	2
4.2.2 Abrasion resistance of glove materials	2
4.2.3 Blade cut resistance of glove materials	2
4.2.4 Tear resistance of glove materials	2
4.2.5 Puncture resistance of glove materials	3
4.2.6 Dimensions of gloves for abrasive blasting operations	3
4.2.7 Dexterity for abrasive blasting operations	3
4.3 Requirements for protective clothing for abrasive blasting operations	3
4.3.1 Types	3
4.3.2 General requirements for protective clothing for abrasive blasting operations (all types)	3
4.3.3 Additional requirements for abrasive blasting clothing of types 2 and 3	4
5 Testing	5
5.1 Sampling and conditioning	5
5.2 Test methods for protective gloves for abrasive blasting operations	5
5.2.1 Determination of the abrasion resistance of glove materials	5
5.2.2 Determination of the blade cut resistance of glove materials	5
5.2.3 Determination of the tear resistance of glove materials	5
5.2.4 Determination of the puncture resistance of glove materials	5
5.2.5 Determination of the dexterity of gloves	5
5.3 Test methods for protective clothing for abrasive blasting operations	5
5.3.1 Pretreatment	5
5.3.2 Dimensions of clothing materials	5
5.3.3 Breaking strength of clothing materials	6
5.3.4 Seam strength of clothing materials	6
5.3.5 Puncture resistance of clothing materials	6
5.3.6 Tear resistance of clothing materials	6
5.3.7 Resistance of the protective clothing material against abrasives	6
5.3.8 Flammability	8
5.3.9 Abrasion	8
5.4 Additional test to be carried out for abrasive blasting clothing of type 3	8
6 Marking and information supplied by the manufacturer	10
6.1 Marking	10
6.1.1 Marking of protective gloves for abrasive blasting operations	10
6.1.2 Marking of protective clothing for abrasive blasting operations	10
6.2 Information supplied by the manufacturer	10
6.2.1 Information supplied by the manufacturer for gloves for abrasive blasting operations	10
6.2.2 Information supplied by the manufacturer for protective clothing for abrasive blasting operations	10
Annex A (informative) Examples of protective clothing for abrasive blasting operations	11

Annex ZZ (normative) Corresponding International and European Standards for which equivalents are not given in the text	13
Bibliography	14

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Foreword

The text of EN ISO 14877:2002 has been prepared by Technical Committee CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

Annex A is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

In abrasive blasting, the worker is exposed to hazards caused by the abrasive (direct projection and rebounding abrasives) and substances produced during the abrasive blasting operation. Depending on the working conditions, the protection against these hazards requires suitable protective clothing as well as suitable respiratory protective equipment. For clothing connected to respiratory protective devices, this standard takes into account the specifications regarding respiratory protective equipment (CEN/TC 79).

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1 Scope

This European Standard specifies minimum requirements and test methods for protective clothing for abrasive blasting operations and for hand protection, for the treatment of surfaces with granular abrasives propelled by compressed air or by mechanical means. The protection against substances that develop during the blasting operation as well as connections between the protective clothing and the respiratory protective device are also covered.

This European Standard does not apply to steam blasting, jet blasting and flame blasting operations.

2 Normative References

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 270:1994, *Respiratory protective devices - Compressed air line breathing apparatus incorporating a hood - Requirement, testing, marking.*

EN 271, *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.*

EN 340:1993, *Protective clothing - General requirements.*

EN 388:1994, *Protective gloves against mechanical risks.*

EN 420:1994, *General requirements for gloves.*

EN 466:1995/A1, *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).*

EN 530, *Abrasion resistance of protective clothing material - Test methods.*

EN 863, *Protective clothing - Mechanical properties - Test method: Puncture resistance.*

ISO 1421, *Fabrics coated with rubber or plastics - Determination of breaking strength and elongation at break.*

ISO 3175-2, *Textiles - Dry cleaning and finishing - Part 2: Procedures for tetrachloroethene.*

ISO 3758, *Textiles - Care labelling code using symbols.*

ISO 4674, *Fabrics coated with rubber or plastics - Determination of tear resistance.*

ISO 6330, *Textiles - Domestic washing and drying procedures for textile testing.*

EN ISO 13934-1, *Textiles - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force - Strip method.*

EN ISO 13934-2, *Textiles - Tensile properties of fabrics - Part 2: Determination of maximum force - Grab method.*

EN ISO 13937-2, *Textiles - Tearing properties of fabrics - Part 2: Trouser method.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions of EN 340 and EN 420 and the following terms and definitions apply.

3.1

abrasive blasting operation

method for the treatment of surfaces by directing propelled abrasives onto the surface. During the blasting operation the abrasive blasting operator and the blasted material are in a confined room or outdoors. The abrasive blasting operator is directly exposed to the abrasive rebounding from the blasted material, the carrier medium and developing dusts

3.2

abrasives

granular materials that are directed onto the surface of the blasted material at a high speed for surface treatment

3.3

abrasive blasting combination

combination of protective clothing protecting against the risks arising in abrasive blasting operations and suitable respiratory protective equipment

4 Requirements

4.1 General

Materials that may come into direct contact with the wearer's skin shall not be known to be likely to cause skin irritation or any other adverse effect to health.

The finish of any part of the equipment likely to be in contact with the wearer shall be free from sharp edges and burrs.

4.2 Requirements for protective gloves for abrasive blasting operations

4.2.1 General requirements

Protective gloves for abrasive blasting operations shall comply with the requirements specified in EN 420:1994, 4.1, 4.2, 4.4, and 4.5.

The protective performance of the gloves shall be ensured evenly for all parts of the hand.

4.2.2 Abrasion resistance of glove materials

When tested in accordance with 5.2.1, the abrasion resistance of the glove material shall meet at least performance level 3 in accordance with EN 388:1994, clause 4. This corresponds to an abrasion resistance of 2 000 cycles.

4.2.3 Blade cut resistance of glove materials

When tested in accordance with 5.2.2, the blade cut resistance of the glove material shall meet at least performance level 1 in accordance with EN 388:1994, clause 4. This corresponds to a blade cut resistance of index 1,2.

4.2.4 Tear resistance of glove materials

When tested in accordance with 5.2.3, the tear resistance of the glove material shall meet at least performance level 3 in accordance with EN 388:1994, clause 4. This corresponds to a tear resistance of 50 N.

4.2.5 Puncture resistance of glove materials

When tested in accordance with 5.2.4, the puncture resistance of the glove material shall meet at least performance level 3 accordance with EN 388:1994, clause 4. This corresponds to a puncture resistance of 100 N.

4.2.6 Dimensions of gloves for abrasive blasting operations

When measured in accordance with EN 420:1994, 6.2.3 and 6.2.4, the glove dimensions shall at least comply with the requirements of 5.1.2 of EN 420:1994, with the following values for the minimum length:

Table 1 - minimum length of gloves for abrasive blasting operations

hand size	6	7	8	9	10	11
minimum length of gloves for abrasive blasting operations [mm]	295	305	315	325	340	350

4.2.7 Dexterity for abrasive blasting operations

When tested in accordance with 5.2.5, the dexterity shall meet at least performance level 1 in accordance with EN 420:1994. This corresponds to a pin diameter of 11 mm.

4.3 Requirements for protective clothing for abrasive blasting operations

4.3.1 Types

Three types of protective clothing for abrasive blasting operations shall be defined:

- type 1: Protective clothing that protects the body or parts of the body against the abrasive as well as materials produced by the abrasive blasting operation. This type of protective clothing is independent from respiratory protective equipment.
- type 2: Protective clothing that protects the body or parts of the body against the abrasive as well as materials produced by the abrasive blasting operation. This type of protective clothing is a combination with a suitable respiratory protective device.
- type 3: Protective clothing that protects the entire body of the user against the abrasive as well as materials produced by the abrasive blasting operation and that is dust-tight. This type of protective clothing is a combination with a suitable respiratory protective device.

4.3.2 General requirements for protective clothing for abrasive blasting operations (all types)

4.3.2.1 Dimensional changes of the clothing materials

When tested in accordance with 5.3.2, the dimensional change of the clothing materials shall meet the requirements specified in EN 340.

4.3.2.2 Breaking strength of the clothing materials

When tested in accordance with 5.3.3, the breaking strength of the clothing materials shall be at least 450 N in the two principal directions. This requirement does not apply to materials with an elongation at break exceeding 50 %.

4.3.2.3 Seam strength of the clothing materials

When tested in accordance with 5.3.4, the seam strength for the design of seams of the clothing materials shall be at least 200 N.

4.3.2.4 Puncture resistance of the clothing materials

When tested in accordance with 5.3.5, the puncture resistance of the clothing materials shall be at least 30 N.

4.3.2.5 Tear resistance of the clothing materials

When tested in accordance with 5.3.6, the tear resistance of the clothing materials shall be at least 30 N in the two principal directions.

4.3.2.6 Sizing of protective clothing

The specification of the sizes of the clothing shall comply with EN 340.

4.3.2.7 Care labelling

Care labelling shall comply with ISO 3758.

4.3.2.8 Resistance of the protective clothing material against the abrasive

When tested in accordance with 5.3.7, the material of the protective clothing for abrasive blasting operations shall not exhibit holes, ruptures etc.

4.3.2.9 Flammability

When tested in accordance with 5.3.8, the material shall not continue to burn for more than 5 s after it has been removed from the flame.

4.3.2.10 Abrasion resistance

When tested in accordance with 5.3.9 the clothing material from the elbow and knee areas shall not show any holes after 500 cycles.

4.3.3 Additional requirements for abrasive blasting clothing of types 2 and 3

In addition to the requirements in accordance with 4.3.2, abrasive blasting clothing of types 2 and 3 shall meet the following requirements:

The abrasive blasting clothing shall be tested in accordance with EN 271.

Type 3 protective clothing shall be vented. It shall be ensured that the air supplied flows off via the arm and leg openings of the clothing or via suitable valves with the test person in a crouched position with arms bent. Testing in accordance with 5.4 carried out during the practical performance test to EN 271.

For type 3 clothing, any openings shall be arranged so that no dusts can penetrate the abrasive blasting clothing. The protective clothing shall be designed without pockets. Testing in accordance with 5.3.7.

5 Testing

5.1 Sampling and conditioning

The samples taken shall be representative for the materials and design of the clothing or glove.

The number and sizes of the samples for the individual tests shall be in accordance with the relevant standards. Testing shall be carried out with the materials such as supplied, unless otherwise specified.

For all surface testing, the outermost surface shall be exposed.

5.2 Test methods for protective gloves for abrasive blasting operations

5.2.1 Determination of the abrasion resistance of glove materials

The abrasion resistance of protective glove materials shall be tested in accordance with EN 388.

If the sample consists of several layers that are not interconnected, a separate test shall be carried out for each individual layer. The classification shall be based on the total of the individual cycles.

5.2.2 Determination of the blade cut resistance of glove materials

The determination of the blade cut resistance of glove materials shall be carried out in accordance with the test method described in EN 388:1994, 6.2.

5.2.3 Determination of the tear resistance of glove materials

The determination of the tear resistance of glove materials shall be carried out in accordance with the method described in EN 388:1994, 6.3.

5.2.4 Determination of the puncture resistance of glove materials

The determination of the puncture resistance of glove materials shall be carried out in accordance with the method described in EN 388:1994, 6.4.

5.2.5 Determination of the dexterity of gloves

The determination of the dexterity shall be carried out in accordance with the method described in EN 420:1994, 6.3.

5.3 Test methods for protective clothing for abrasive blasting operations

5.3.1 Pretreatment

Before testing, the clothing material shall be washed five times in a front loading horizontal drum machine using 1 g/l IEC detergent in soft water and finally dried in accordance with the procedures of ISO 6330. Washing shall be carried out by procedure 2A (at $(60 \pm 3)^\circ\text{C}$) and drying by procedure E (tumble drying) unless otherwise specified in the care labelling. Materials which are labelled as dry cleanable only shall be dry cleaned five times in accordance with ISO 3175-2.

5.3.2 Dimensions of clothing materials

The testing of the dimensional change of the clothing materials shall be carried out in accordance with EN 340:1993, 5.3. and 5.4.

5.3.3 Breaking strength of clothing materials

The breaking strength shall be tested in accordance with ISO 1421 for coated materials and EN ISO 13934-1 for woven materials. In the case of difficulties when cutting off the threads at the edges, the test in accordance with EN ISO 13934-1 shall be repeated. The clamp shall move at a rate of (100 ± 10) mm/min.

5.3.4 Seam strength of clothing materials

The seam strength shall be tested in accordance with EN ISO 13934-2.

5.3.5 Puncture resistance of clothing materials

The puncture resistance of clothing materials shall be tested in accordance with the method described in EN 863.

5.3.6 Tear resistance of clothing materials

The tear resistance of woven clothing materials shall be tested in accordance with EN ISO 13937-2. The tear resistance of coated clothing materials shall be tested in accordance with ISO 4674, method A.2. The clamps shall move at a rate of (100 ± 10) mm/min.

5.3.7 Resistance of the protective clothing material against abrasives

5.3.7.1 Test Principle

The protective clothing and underwear is put on a test dummy and exposed to the abrasive with a specified pressure and from a specified distance, thus simulating the exposure of the protective clothing to abrasives.

5.3.7.2 Test apparatus

5.3.7.2.1 Test dummy

A suitable dummy made from smooth material with a Shore A hardness of ≥ 90 and a continuous surface.

5.3.7.2.2 Abrasive

Angular steel grit, with a grain size of 0,6 mm to 1,0 mm, which shall be used for no more than two tests.

5.3.7.2.3 Blasting nozzle

A venturi nozzle, in accordance with Figure 1.

NOTE Information on the supply sources of a suitable nozzle can be obtained from the secretariat of CEN/TC 79.

5.3.7.2.4 Supply of compressed air

Positive pressure of 4 bar at the outlet of the nozzle; a continuous flow shall be ensured.

5.3.7.2.5 Undergarment for the test dummy

White undergarment with long sleeves and long legs, made from a rib knitted cotton material with a weight of (160 ± 10) g/m².

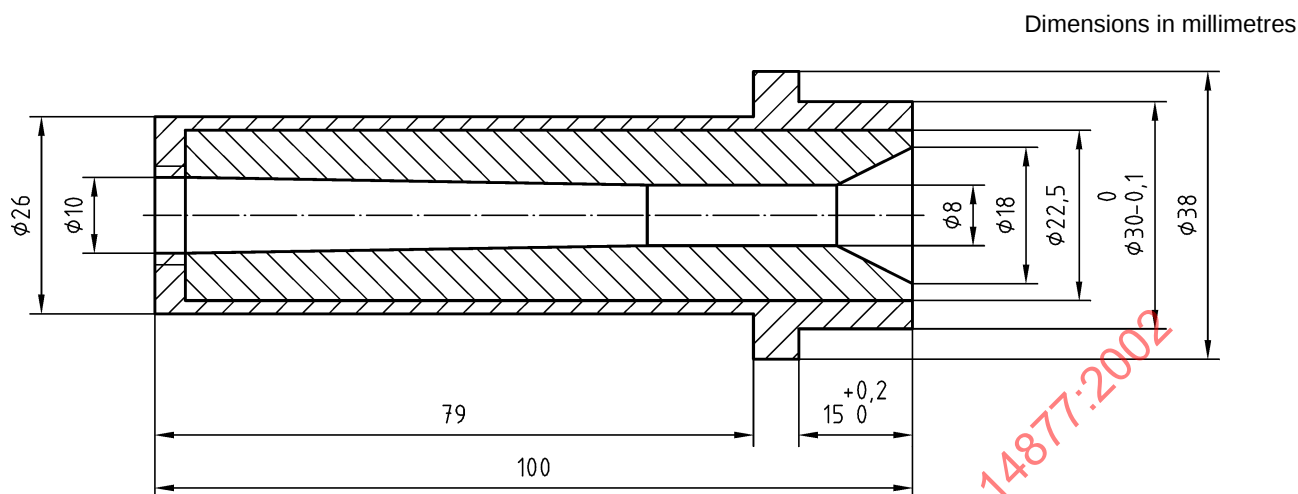


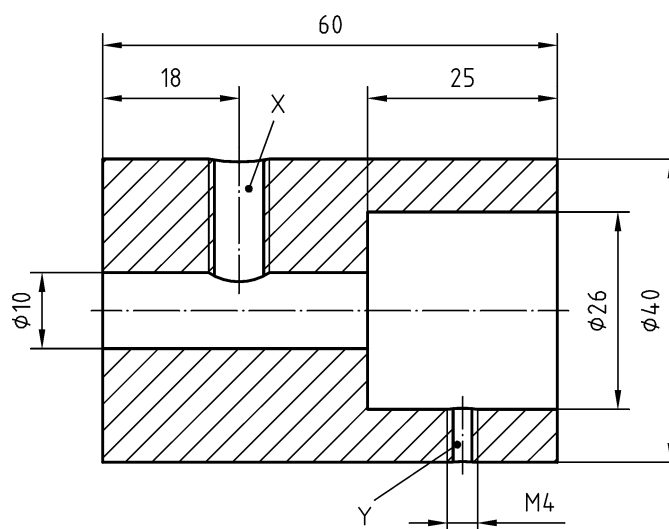
Figure 1 — Blasting nozzle

5.3.7.3 Procedure

Put the underwear and the protective clothing on the test dummy.

Prepare the nozzle(s), air supply and abrasive for operation. Fit the checking device (Figure 2) to the outlet of the nozzle (Figure 1) securing it with a screw at point Y. Using a gauge at point X of the checking device, measure the blasting pressure, and adjust the supply to give a reading of 4 bar. Remove the checking device before the test.

NOTE In order to ensure a constant flow of material, the jet should be turned away at an angle of 45° for 15 s prior to being directed at the test dummy.



Key

X Connection for the checking device

Y Location of locking screw for attachment to nozzle during pressure adjustment

Figure 2 — Checking device without screwed gauge

Fix the nozzle(s) at a distance of 3 m from the test dummy. Only those areas of the test dummy that are covered by the protective clothing shall be exposed to the jet of abrasives. The other areas shall be covered with a suitable guard. For the arrangement of the nozzles in relation to the specified height (visor centre, breast, lower body), see Figure 3.

Direct the jet of abrasives at the protective clothing for 2 min, using the positive pressure in accordance with 5.3.7.2.4.

Move the blasting nozzle to 1 m from the dummy, and blast again all critical exposed parts for 2 s, using the positive pressure in accordance with 5.3.7.2.4.

Check whether the protective clothing shows any visible damage (holes, ruptures etc.).

For type 3 protective clothing check whether the underwear shows any signs of dust.

5.3.8 Flammability

The flammability shall be tested in accordance with EN 270:1994, 7.5.

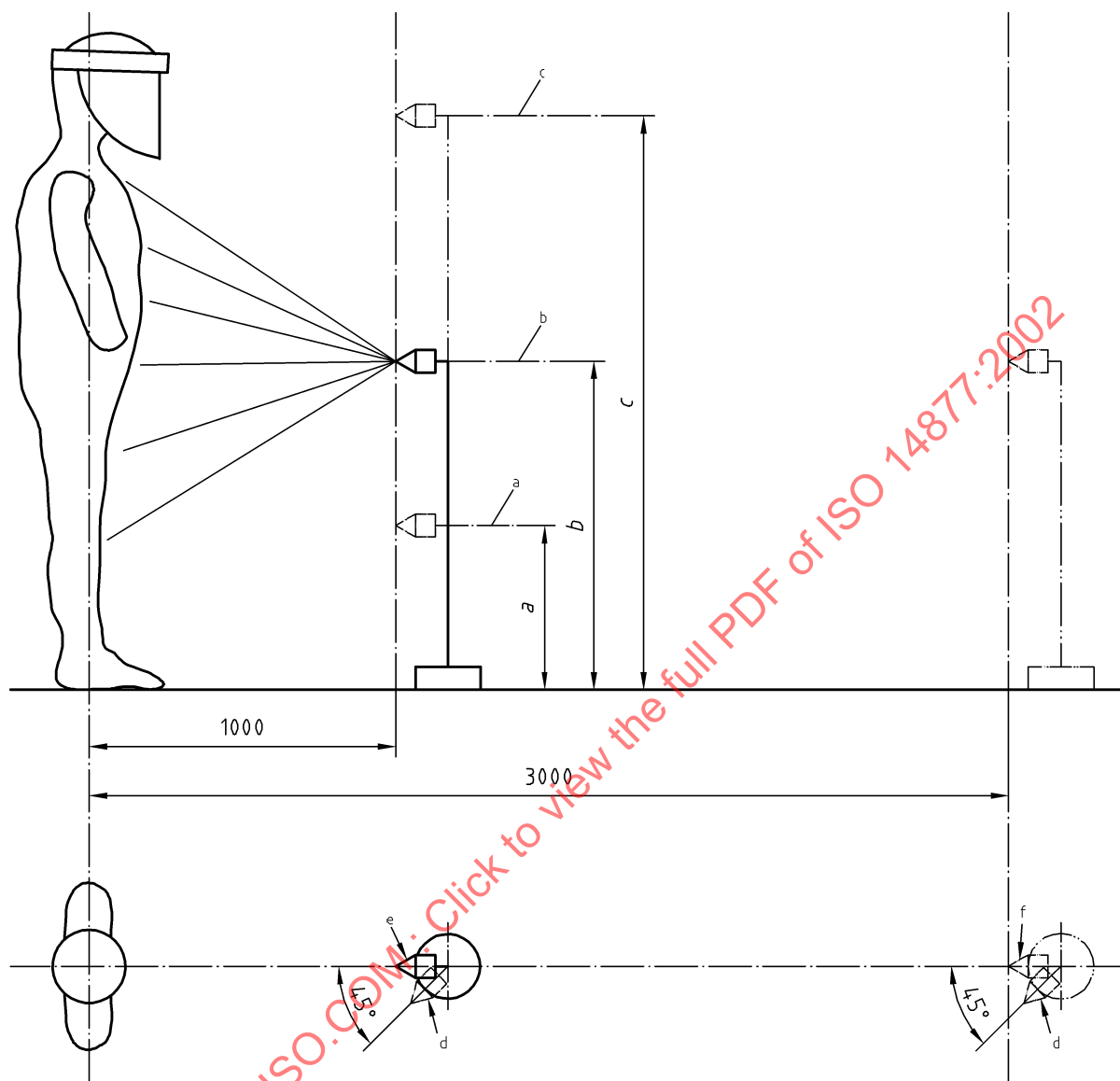
5.3.9 Abrasion

The abrasion shall be tested in accordance with procedure 1 in EN 530, with a pressure of 9 kPa and the details specified in EN 466:1995/A1.

5.4 Additional test to be carried out for abrasive blasting clothing of type 3

During the practical performance test in accordance with EN 271 check whether the air supplied flows off with the test person in a crouched position with arms bent.

Dimensions in millimetres



Key

- a Knee area
- b Visor centre less 450 mm
- c Visor centre
- d Before the test: Blasting 15 s
- e During the test: Blasting 2 s
- f During the test: Blasting 2 min

Figure 3 — Arrangements of nozzles for the testing of the resistance of the protective clothing material against abrasives

6 Marking and information supplied by the manufacturer

6.1 Marking

6.1.1 Marking of protective gloves for abrasive blasting operations

Protective gloves for abrasive blasting operations shall be marked in accordance with the requirements specified in EN 420:1994.

The pictogram for abrasive blasting operations (see Figure 4) shall be affixed at the gloves.

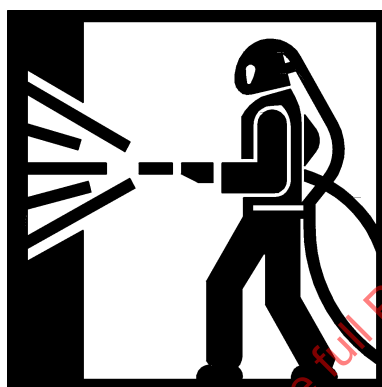


Figure 4 — Pictogram for abrasive blasting operations

6.1.2 Marking of protective clothing for abrasive blasting operations

The marking shall comply with EN 340. The marking shall include the designation of the type (type 1, type 2 or type 3).

The pictogram for abrasive blasting operations (see Figure 4) shall be affixed to the abrasive blasting clothing.

6.2 Information supplied by the manufacturer

6.2.1 Information supplied by the manufacturer for gloves for abrasive blasting operations

The information supplied by the manufacturer of gloves shall comply with EN 420.

6.2.2 Information supplied by the manufacturer for protective clothing for abrasive blasting operations

The information supplied by the manufacturer shall comply with EN 340.

For abrasive blasting clothing types 2 and 3 it shall contain the following additional information:

- „The abrasive blasting clothing is a part of an abrasive blasting combination and shall only be used when correctly fitted to the following respiratory protective devices with which it has been subjected to the testing: ... “.
- The information supplied with the respiratory protective device in accordance with EN 271 shall apply to the abrasive blasting combination.

Annex A (informative)

Examples of protective clothing for abrasive blasting operations

Protective clothing for abrasive blasting operations type 2

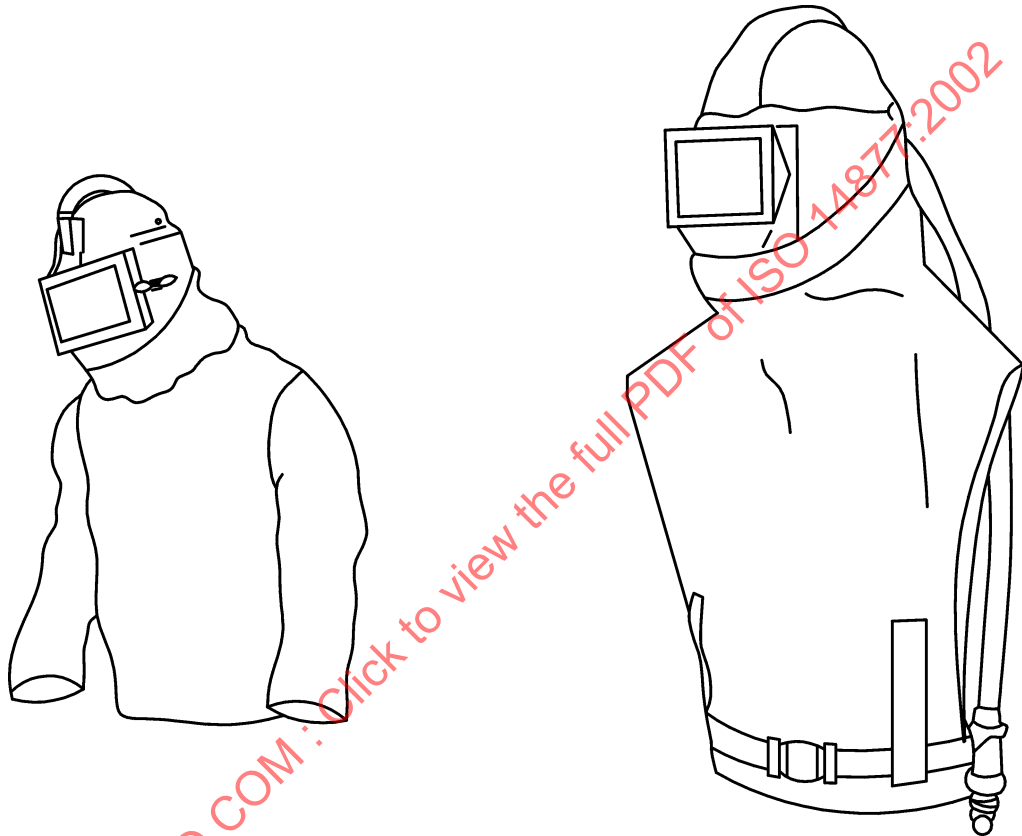


Figure A.1 - Examples of protective clothing for abrasive blasting operations type 2