BRITISH STANDARD

BS EN
407:2004

Protective gloves against thermal risks (heat and/or fire)

The European Standard EN 407:2004 has the status of a British Standard

ICS 13.340.40

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 407:2004. It supersedes BS EN 407:1994, which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PH/3, Protective clothing, to Subcommittee PH/3/8, Protective gloves, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 407

September 2004

ICS 13.340.40

Supersedes EN 407:1994

English version

Protective gloves against thermal risks (heat and/or fire)

Gants de protection contre les risques thermiques (chaleur et/ou feu)

Schutzhandschuhe gegen thermische Risiken (Hitze und/oder Feuer)

This European Standard was approved by CEN on 24 June 2004.

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Foreword

This document (EN 407:2004) 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.

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of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

This document supersedes EN 407:1994.

This document includes a Bibliography.

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.

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1 Scope

This document specifies requirements, test methods, information to be supplied and marking for protective gloves against heat and/or fire. It should be used for all gloves which protect the hands against heat and/or flames in one or more of the following forms: fire, contact heat, convective heat, radiant heat, small splashes or large quantities of molten metal.

This standard is only applicable in conjunction with EN420.

There are other standards relevant to specific applications, as for example fire-fighting or welding.

Product tests may only give performance levels and not protection levels.

2 Normative references

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

EN 348, *Protective clothing — Test method: Determination of behaviour of materials on impact of small splashes of molten metal.*

EN 367, *Protective clothing - Protection against heat and fire - Method of determining heat transmission on exposure to flame.*

EN 373, *Protective clothing — Assessment of resistance of materials to molten metal splash.*

EN 388, *Protective gloves against mechanical risks.*

EN 420, *Protective gloves - General requirements and test methods.*

EN 702, *Protective clothing — Protection against heat and flame — Test method: Determination of the contact heat transmission through protective clothing or its materials*.

EN ISO 6941, *Textile fabrics — Burning behaviour — Measurement of flame spread properties of vertically oriented specimens (ISO 6941:2003).*

EN ISO 6942:2002, *Protective clothing — Protection against heat and fire — Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat (ISO 6942:2002).*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

after flame time

time in seconds from the removal of the ignition source until the extinction of the flame in the test specimen

3.2

after glow time

time in seconds from the extinction of the flame up to the cessation of glowing. If the sample is not ignited by the ignition source, but it glows after the removal of the ignition source, then the after glow time is measured from the time of removal of the ignition source

3.3

melting

liquefaction of the material under the influence of heat

3.4

dripping

detachment of molten droplets during the melting process

4 General requirements

4.1 General

The protective gloves according to this standard shall meet all the applicable requirements of EN 420.

4.2 Sizes

The gloves shall correspond to the relevant requirements of EN 420. Unless otherwise requested, protective gloves of performance levels 3 and 4 in all tests described in 5.1 to 5.6. shall be manufactured so that they can easily be removed in case of emergency. There is no test method for industrial protective gloves. Annex B gives an example of a test method and requirement applicable to fire-fighters gloves.

4.3 Abrasion

Using the test method 6.1 the material of the protective gloves shall correspond to at least performance level 1 of the relevant clause in EN 388.

4.4 Tear resistance

Using the test method 6.2 the material of the protective gloves shall correspond to at least performance level 1 of the relevant clause in EN 388.

5 Thermal performance

For each of the following test methods the defined performance level depends upon the intended field of application of the glove. Only the tests which are relevant to the risks in the intended end-use application shall be carried out.

5.1 Burning behaviour

Using test method 6.3 the material shall correspond to the requirements of Table 1.

Table 1 — Performance levels for burning behaviour test

Performance level	After flame time s	After glow time s
1	≤ 20	no requirement
2	≤ 10	≤ 120
3	≤ 3	≤ 25
4	≤ 2	≤ 5

If it melts, the material shall not drip. Furthermore the innermost surface of the glove shall be inspected. It shall show no sign of melting, otherwise it fails the test.

The seam shall not come apart after an ignition time of 15 s in the test area.

5.2 Contact heat

Using the test method 6.4 the material shall correspond to the requirements of Table 2.

Table 2 — Performance levels for contact heat test

Performance level	Contact Temperature T_c °C	Threshold time t_t s
1	100	≥ 15
2	250	≥ 15
3	350	≥ 15
4	500	≥ 15

For contact heat performance levels of 3 or 4, the burning behaviour according to 6.3 shall be performed. The product shall record at least level 3 in the burning behaviour test, otherwise the maximum contact heat performance that shall be reported is level 2.

5.3 Convective heat

Using the test method 6.5 the material shall correspond to the requirements of Table 3.

Table 3 — Performance levels for convective heat

Performance level	Heat transfer index HTI s
1	≥ 4
2	≥ 7
3	≥ 10
4	≥ 18

A level of performance in convective heat shall only be reported if a performance level 3 or 4 is obtained in burning behaviour.

5.4 Radiant heat

Using the test method 6.6 the material shall correspond to the requirements of Table 4.

Table 4 — Performance levels for radiant heat

Performance level	Heat transfer t_{24} s
1	≥ 7
2	≥ 20
3	≥ 50
4	≥ 95

A level of performance in radiant heat shall only be reported if a performance level 3 or 4 is obtained in burning behaviour.

5.5 Small splashes of molten metal

Using the test method 6.7 the number of droplets which produce a temperature rise of 40 °C, shall correspond to the requirements of Table 5.

Table 5 — Levels of performance for the test of small splashes of molten metal

Performance level	Number of droplets
1	≥ 10
2	≥ 15
3	≥ 25
4	≥ 35

A level of performance in small splashes of molten metal shall be reported only if a performance level of 3 or 4 is obtained in burning behaviour.

5.6 Large quantities of molten metal

Using the test method 6.8 the PVC foil skin-simulant shall not exhibit any smoothness or other changes to the grained surface with the relevant quantities of molten iron used. See Table 6.

Table 6 — Levels of performances for the test of large quantities of molten metal

Performance Level	Molten iron g
1	30
2	60
3	120
4	200

The test is failed if steel droplets remain stuck to the specimen, or the specimen ignites or is punctured.

This test only applies to molten iron. Other metals shall be tested as required. The corresponding test results shall be given on the information supplied by the manufacturer (clause 8).

6 Test methods

For multilayered gloves, the tests are carried out simultaneously on all layers, even if these in some circumstances are no longer connected. This applies to test methods described in 6.3, 6.4, 6.5, 6.6, 6.7, and 6.8.

6.1 Abrasion

Test according to EN 388.

6.2 Tear resistance

Test according to EN 388.

6.3 Burning behaviour

Test method according to EN ISO 6941 with the following modification:

— the glove is mounted vertically so that the point A (Figure 1) is at the mid point of the lower edge.

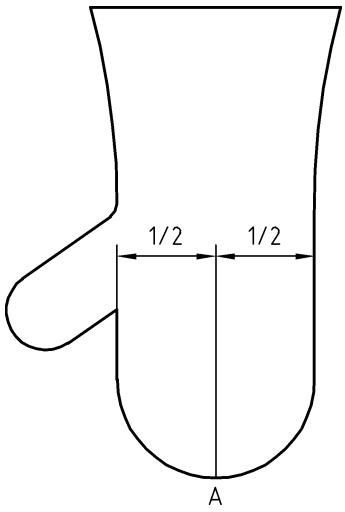

Figure 1 – Mounting of test glove

The burner is placed below the glove so that it is in a plane with the vertical middle line of the glove or the middle finger and is perpendicular to the surface of the glove. The burner is mounted at an angle of 30°± 3° to the vertical. The distance between the tip of the burner and the lower edge of the glove or the middle finger shall be 20 mm ± 2 mm.

One glove shall be tested for each ignition time, i. e. for 3 s and 15 s. The after flame time and after glow time shall be recorded for each ignition time (see Table 1).

6.4 Contact heat

Test method according to EN 702.

From each palm area of three gloves one sample shall be taken with a diameter of 80 mm ± 8 mm.

If a reinforcement is added to the palm of the gloves, then the samples taken shall be without reinforcement. The manufacturer may additionally report test results from the parts of the glove with reinforcement in the information in clause 8. However, it shall be checked that the reinforcement is made of a material that does not melt at the test temperature.

From the three single values for the threshold time t_t the arithmetic mean shall be calculated and stated to the nearest whole second.

6.5 Convective heat

The test method is according to EN 367 with the following modifications:

The size of the test specimen shall be (140 ± 5) mm × (140 ± 5) mm. If it is not possible to take such a specimen from a glove then a material sample shall be used, provided it was produced in the same way as the glove and includes any seam present. The specimens shall be taken from or representative of the palm and the back of the glove.

Samples of multilayered assemblies shall correspond to the usual order of the layers.

For each material type or material assembly, three specimens shall be tested. The arithmetic mean is calculated from the three single values and stated to the nearest whole second.

6.6 Radiant heat

The test method according to EN ISO 6942:2002, method B, with the following modifications:

Two specimens of (80 ± 5) mm × (170 ± 5) mm shall be taken from the back of the glove of a pair of gloves.

Heat flux density q_o = 20 kW/m²

The arithmetic mean of $RHTI_{24}$ shall be expressed to the nearest second and determines the performance level.

6.7 Small drops of molten metal

Test method according to EN 348.

The test shall be carried out on four specimens. Specimens shall be taken from each palm and back of pair of gloves. The specimen size is (120 ± 5) mm × (20 ± 5) mm.

The arithmetic means of the two values respectively of the palm area and of the back area shall be calculated and stated to the nearest whole number of drops. The performance level is based on the lowest of the mean values.

6.8 Large quantities of molten metal

The test method is given in EN 373 with the following modifications:

The test shall be carried out with each three specimens of (120 ± 5) mm × (120 ± 5) mm for the required quantity of metal. If it is not possible to take specimens of this size from the gloves a sample of material shall be tested, provided that the manufacture of the sample material is identical with that of the glove and include any seam present. The specimens shall be taken from or be representative of the back of the glove.

7 Marking

The marking shall be in accordance with the relevant clause of EN 420.

Main pictogram for protective gloves against thermal risks (i. e. pictogram "Heat and/or Fire") where the performance levels shall be given in the following order.

Example

EN 407

3	2	1	X	X	X

Burning behaviour

Contact heat

Convective heat

Radiant heat

Small splashes of molten metal

Large quantities of molten metal

The sign X, instead of a number, means that the glove is not designed for the use covered by the corresponding test.

8 Information supplied by the manufacturer

The information supplied by the manufacturer shall be according to the appropriate clause of EN 420.

The manufacturer shall indicate in his information supplied with the gloves:

— A **clear warning** that the glove must not come in contact with a naked flame, if the glove has a performance level 1 or 2 in burning behaviour;

— Where applicable, the metal and corresponding level of performance for other materials than iron, tested according to 6.8.;

— For multilayer gloves that can be separated, indication that the performance levels are only applicable to the whole glove including all layers.

Annex A
(informative)

Uncertainties of measurement and results interpretation

For each of the required measurements performed in accordance with this standard, a corresponding estimate of the uncertainty of measurement should be evaluated. This estimate of uncertainty should be applied and stated when reporting test results, in order to enable the user of the test report to assess the reliability of the data.

Annex B
(informative)

Example of test method for emergency removal of fire-fighters gloves

The following test method and requirement are only informative. They are quoted in EN 659. It is recognised that they are adapted to protective gloves designed for fire-fighters, but might not be appropriate to gloves designed for industrial applications.

Time for the removal of gloves :

Three pairs of gloves shall be donned and then removed by a test subject, after conditioning at least 24 h at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

The time for removal of each pair shall be recorded. The mean value shall be calculated and rounded to the nearest whole second.

This procedure shall be repeated after wet conditioning of three new pairs of gloves according to the relevant clause of ISO 15383 (without putting a pressure of 3,5 kPa).

The mean value time for removal of a pair of gloves, whether they are dry or wet, shall not be greater than 3 s.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA — Correspondence between this European Standard and Directive 89/686/EEC

Clauses/subclauses of this EN	Essential Requirements (ERs) of Directive 89/686/EEC, Annex II	
4.3 ; 4.4	3.3	Protection against physical injury (abrasion, perforation, cuts, bits, etc.)
5	1.1.2.2	Classes of protection appropriate to different levels of risks
5 ; 6	3.6	Protection against heat and fire
7	2.12	PPE bearing identification marks related to health and safety
8	1.4	Information supplied by the manufacturer

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

Bibliography

EN 659, *Protective gloves for firefighters.*

ISO 15383, *Protective gloves for firefighters — Laboratory test methods and performance requirements.*

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