BRITISH STANDARD

BS 7955:1999

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Containment nets and sheets on construction works — Specification for performance and test methods

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91.220

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee B/514/27, Nets and sheets, upon which the following bodies were represented:

Construction Confederation
Construction Health and Safety Group
Construction Industry Training Board
Cordage Manufacturers Institute
English Net Manufacturers Association
Health and Safety Executive
Institution of Structural Engineers
Made-Up Textiles Association
National Association of Scaffolding Contractors
National Federation of Roofing Contractors

This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1999

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The following BSI references relate to the work on this standard:
Committee reference B/514/27
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Contents

Foreword

This British Standard has been prepared by Technical Committee B/514, Nets and sheets, and supersedes performance specifications contained within BS 8093:1991 annexes D and E. It supersedes the recommended perfomance specification for containment nets and sheeting contained in BS 8093.

The flammability tests given in annex C are reproduced verbatim from the Loss Prevention Council Standard (LPS) LPS 1215.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 13 and a back cover.

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1 Scope

This British Standard specifies requirements and test methods for containment nets and sheets intended for use on construction works.

It covers flame retardant and non-flame retardant containment nets and sheets.

It also specifies test methods and performance specifications for ties used in conjunction with nets and sheets. It does not cover safety nets, barrier nets or temporary roofs. It does not cover installation and use.

This British Standard does not specify ageing requirements.

2 Normative references

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

BS 476-12:1991, *Method of test for ignitability of products by direct flame impingement.*

BS 2576:1986, *Method for determination of breaking strength and elongation (strip method) of woven fabrics.*

BS EN ISO 13468-1:1997, *Single-beam instrument.*

3 Definitions

For the purpose of this British Standard, the following definitions apply.

3.1

containment net

net intended to restrain small objects, or tools and debris, to restrict dust, to reduce the effects of weather, to provide protection for persons from falling objects and to reduce the risk of persons falling from scaffold platforms

3.2

containment sheet

impervious sheet intended to protect a structure from inclement weather, to contain dust and other pollution, to prevent small objects, tools and debris from falling, and to reduce the risk of persons falling from scaffold platforms

3.3

ties

means used to join nets or sheets into larger configurations and to secure them in position

3.4

attachment points

designated points within nets and sheets through which ties can be threaded

3.5

form factor

constant factor, characteristic of each different containment material, relating the wind speed to the wind pressure that would be exerted on the material

4 Tests

4.1 Impact test

The net or sheet and tie shall be tested in accordance with annex A.

4.2 Puncture test

The net or sheet and tie shall be tested in accordance with annex B.

4.3 Tensile strength

The tensile strength of the net or sheet shall be determined in both directions by testing in accordance with BS 2576. Samples for testing shall be cut from the same roll as used for samples tested in annexes A and B.

4.4 Attachment point strength

The tensile strength of the attachment points shall be determined in accordance with BS 2576:1986. Samples for testing shall be cut from the same roll as used for samples tested in annexes A and B. The net or sheet shall be attached to the test apparatus as shown in Figure 1.

4.5 Tie strength

The tensile strength of the ties shall be determined in accordance with BS 2576:1986. Samples for testing shall be of the same type and specification as those used for tests given in annexes A and B. The tie shall be attached to the test apparatus as shown in Figure 2.

5 Performance requirements

5.1 General

The nets or sheets shall meet the following requirements.

a) When tested in accordance with annex A, the length of either 50 mm conditioning cut shall not increase in length to more than 100 mm.

b) When tested in accordance with annex A and annex B, here shall be no failure, except that described in a).

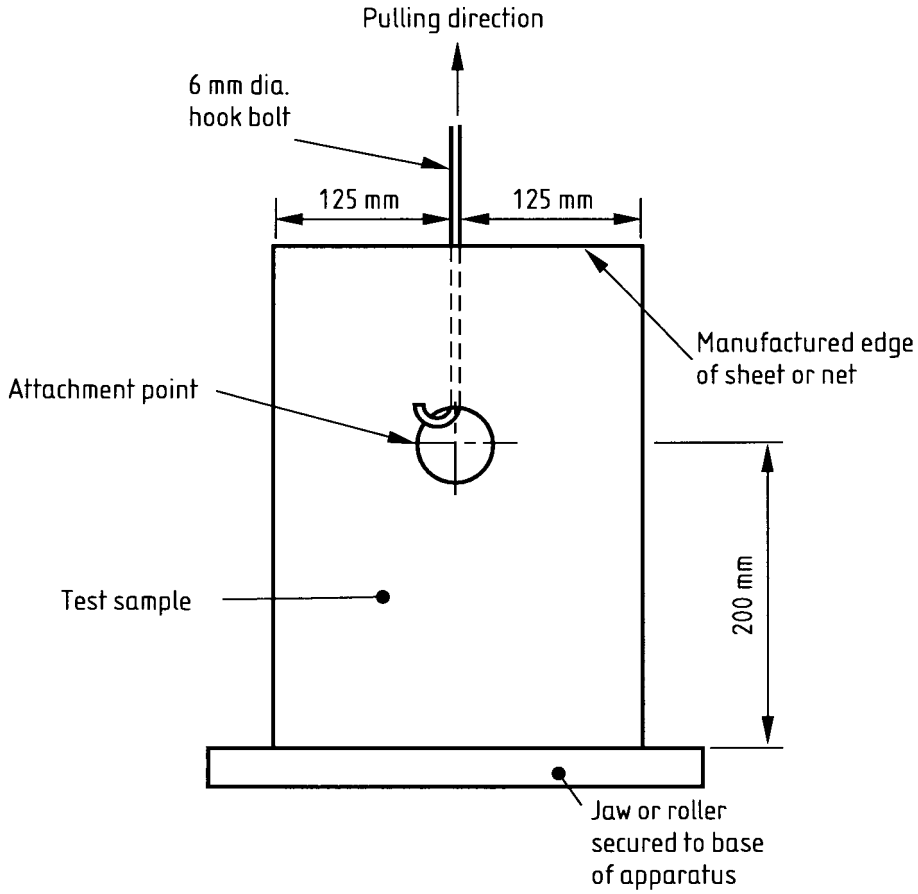
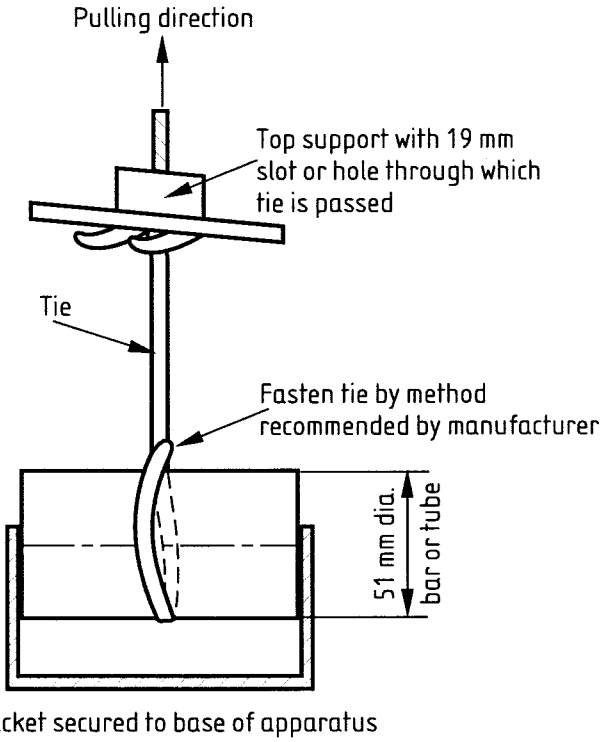
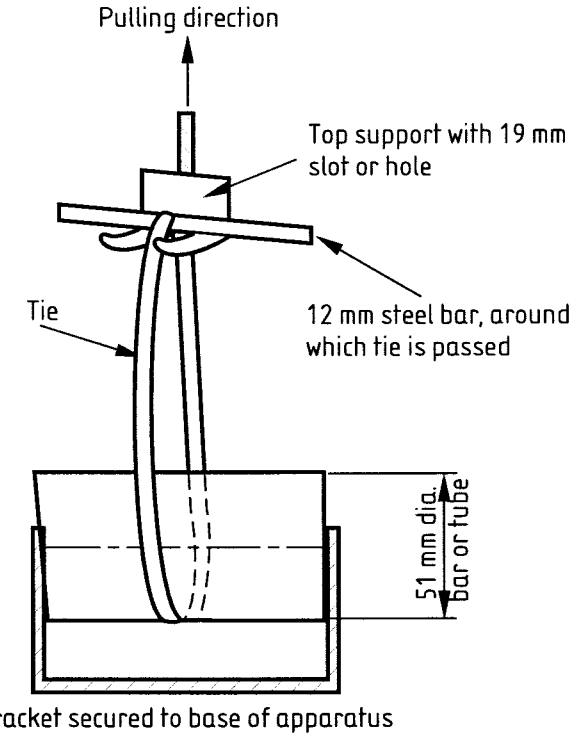


Figure 1 — Attachment point strength test



a) Ties with integral bar



b) Ties without integral bar

Figure 2 — Tie strength test

5.2 Tensile strength

When tested in accordance with **4.3**, nets or sheets shall have a minimum tensile strength of 630 N. The actual performance shall be stated.

5.3 Attachment point strength

When tested in accordance with annex A and annex B, the attachment point shall maintain the connection between tie and net/sheet. When tested in accordance with **4.4**, the minimum tensile strength shall be 500 N. The actual performance shall be stated.

5.4 Tie strength

When tested in accordance with annex A and annex B, the tie shall not fail. When tested in accordance with **4.5**, the minimum tensile strength shall be 500 N. The actual performance shall be stated.

6 Flammability

When tested in accordance with annex C, the nets and sheets shall be resistant to fire at a rate set by the appropriate flame tests. Nets and sheets conforming to annex C shall be regarded as flame retardant.

7 Permeability

When tested in accordance with annex D, the nets shall have a form factor of not less than 0.4.

8 Light transmission

When tested in accordance with BS EN ISO 13468-1:1997, light transmission properties shall conform to the requirements in that standard and shall be designated in accordance with Table 1 of that standard.

9 Marking

9.1 Nets and sheets

9.1.1 *Nets and sheets*

Nets and sheets shall be either marked directly or manufactured with the relevant identification strand or tape as stated in a) and b) as follows.

a) If marked directly, this shall be with letters not less than 25 mm high. The information shall be repeated at regular intervals along the entire length of the roll. The marking shall not be obscured by any overlapping sections, when fixed according to the manufacturer's recommendations. The following information shall be stated:

1) the manufacturer's or supplier's name, trade mark or identification mark;

2) the number and year of this British Standard, BS 7955:1999.

b) If manufactured with a strand or tape, this shall be a Royal blue[1)] identification strand or tape supported by an attached label. The strand and tape shall be continuous along the entire length of the roll and shall not be obscured by overlapping sections when fixed according to the manufacturers' recommendations. Fire resistance nets shall have two tapes. The minimum width of the tapes shall be 25 mm. The distance between the two tapes shall be 25 mm. The following information shall be stated:

1) the manufacturer's or supplier's name, trade mark or identification mark;

2) the number and year of this British Standard, BS 7955:1999.

9.1.2 The following information shall be stated on the packaging:

a) the manufacturers' or supplier's name, trade mark or identification mark;

b) the number and year of this British Standard, BS 7955:1999;

c) the dimensions of the net or sheet;

d) the weight of the net or sheet;

e) the manufacturers' or supplier's recommended type of tie;

f) designated attachment points.

9.2 Ties

The following information shall be stated on a label attached to the product or its packaging:

a) the manufacturers' or supplier's name, trade mark or identification mark;

b) the number and year of this British Standard, BS 7955:1999;

c) the net or sheet with which the tie has been tested in clauses **4** and **5** of this British Standard.

9.3 Additional information

The following additional information shall be supplied on the packaging or separately on an information sheet:

a) tensile strength of net or sheet, determined by the test in **4.3**;

b) tensile strength of the attachment point, determined by the test in **4.4**;

c) tensile strength of the tie, determined by the test in **4.5**;

d) flame retardancy, determined by the tests in annex C;

e) light transmission, determined by testing, as described in clause **8**;

f) for nets, the wind coefficient, determined by the test in clause **7**.

[1)] If the net is of a blue colour, then the band should be in red.

Annex A (normative)
Impact test

A.1 Principle

The net or sheet is subjected to impact from a soft body impactor, capable of being swung at the sample to determine the resistance to impact.

A.2 Sampling

Test specimens for any given material shall be identical in type, construction, composition, nominal thickness and manufacture to the material to be assessed. A test sample shall contain 5 net or sheet test specimens and sufficient ties as described in **A.5** for each test.

A.3 Preparation of test specimens

Prior to the test the net or sheet and ties shall have been stored at a relative humidity of (50 ± 5) % and an air temperature of (23 ± 2) °C for 24 h. Each net or sheet test specimen shall be rectangular, with nominal dimensions of 1 000 mm wide × 2 000 mm high, as shown in Figure A.1. The actual size shall be calculated from the eyelet positions nearest to the nominal size. The actual dimensions of the test specimen shall be a minimum of 150 mm beyond the eyelet, or the edge of the net or sheet, if this dimension is less than 150 mm at the time of manufacture. One long side of the test specimen shall be the manufactured edge of the net or sheet (see Figure A.1).

Each net or sheet test specimen shall be prepared by cutting two 50 mm long cuts in the material at the point of impact as described in **A.4** and as shown in Figure A.1. One cut shall be made in the machine direction of the material, the other in the transverse direction. The two cuts shall intersect at their central point.

Where nets or sheets are manufactured by welding or otherwise joining together, the test specimen shall be prepared from a section containing a joint where each piece either side of the joint is of approximate equal dimensions.

The sample shall be installed on the test frame hand tight without any slack.

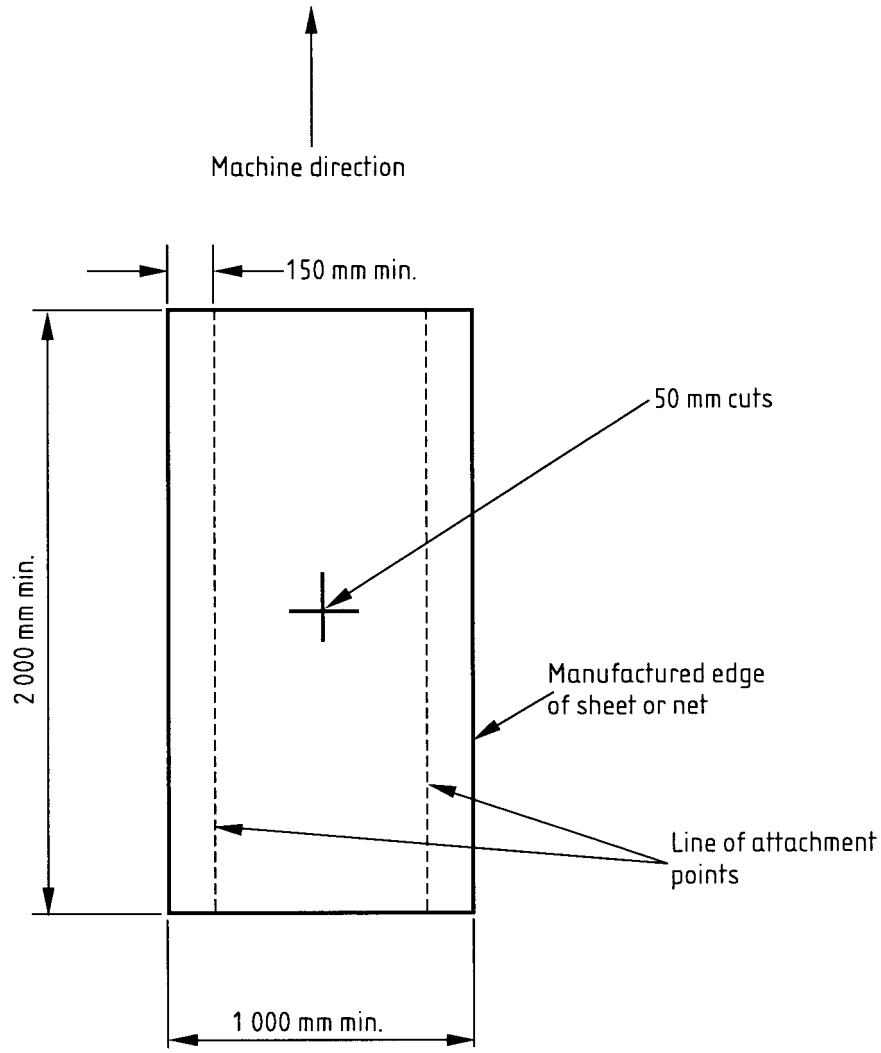


Figure A.1 — Preparation of sample sheet or net for impact test

A.4 Test apparatus

The test apparatus shall consist of the following.

A.4.1 *A test frame*, constructed from standard scaffolding components (see Figures A.2 and A.3), of a construction suitable for the test specimen to be attached in the same manner as it would be fixed on site and in accordance with the manufacturer's recommendations.

A.4.2 *A bag*, of (50 ± 1) kg capacity, the largest diameter of which, when hanging at rest, is not more than 25 mm from the surface of the test specimen and which is suspended from an overhead support.

A.4.3 *An overhead support*, the length of which is to be adjusted so that the bag, at its greatest diameter, is of equal distance from the top and bottom eyelets of the test specimen and equal distance from each side eyelet.

A.4.4 *Means to prop up the bag at an angle to the test specimen*, to allow a calculated impact force to be applied to the test specimen.

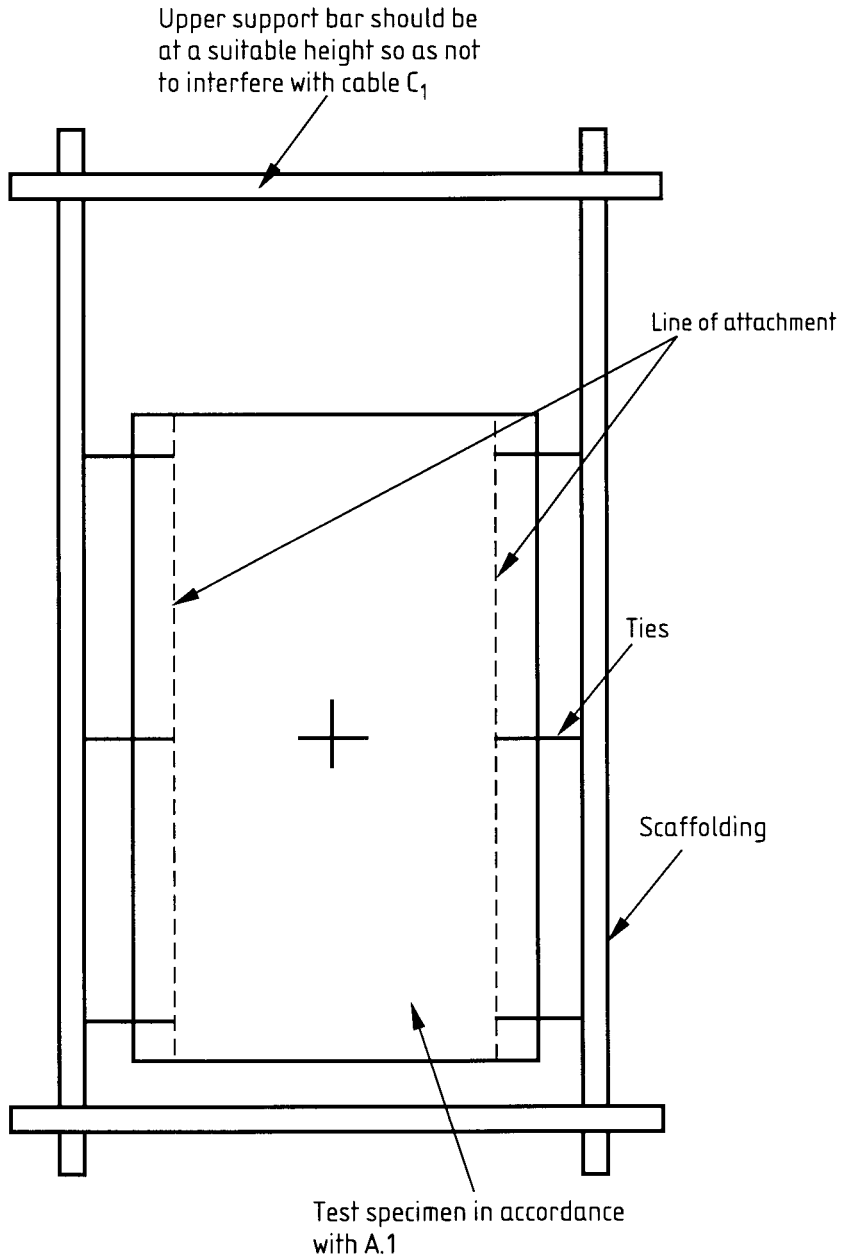
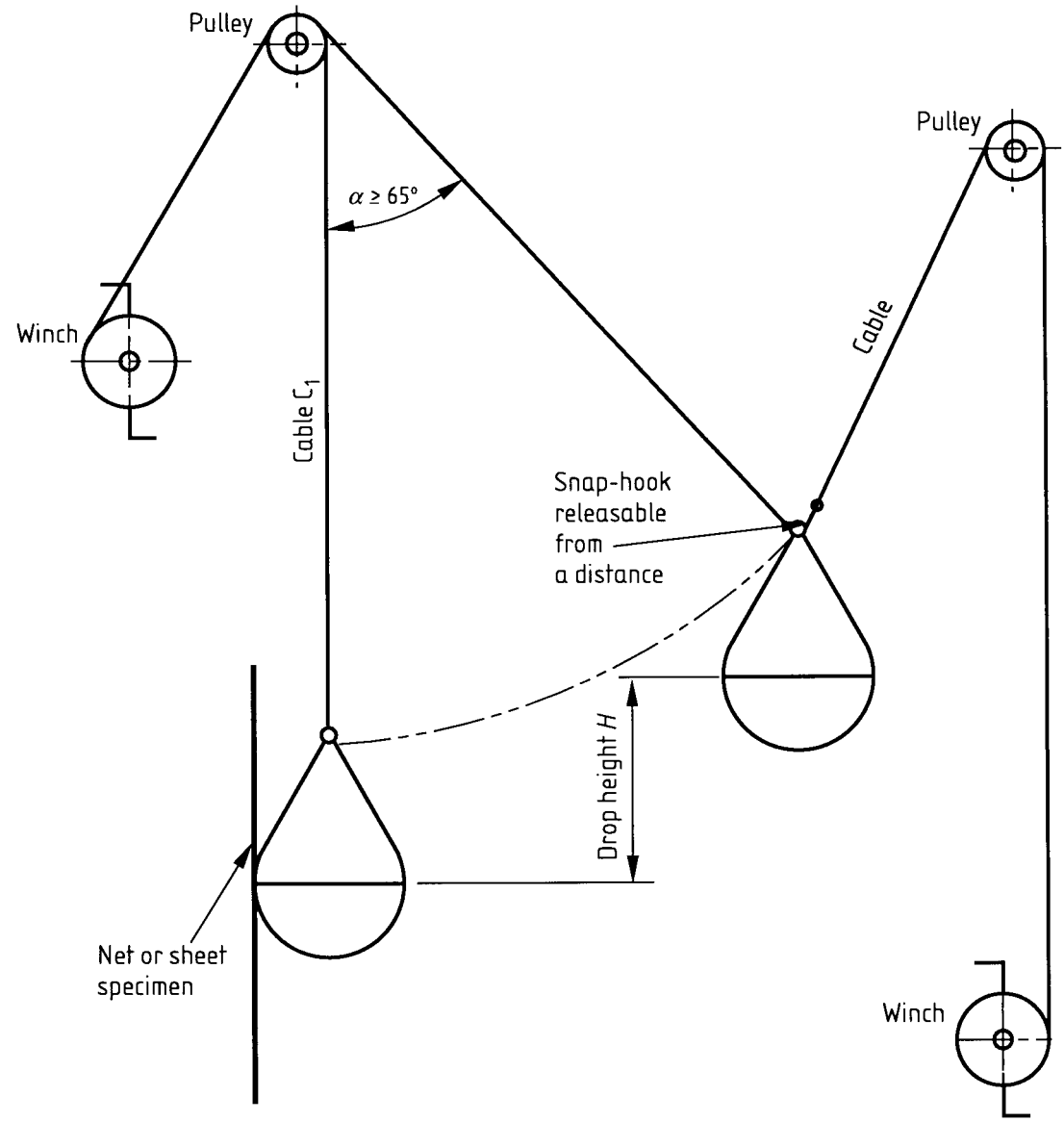


Figure A.2 — Impact test — Test rig



NOTE Cable C_1 should be made as light as possible.

Figure A.3 — Impact test — Test apparatus

A.5 Test procedure

Perform the test at a temperature of (20 ± 5) °C. Fix the test specimen to the frame. Use the minimum number and type of ties, and means of fixing these, as recommended by the manufacturer or supplier of the sample.

Fix the test specimen to the frame on the opposite side to that of the bag. Raise the bag using the winch to a drop height *H*, calculated to produce a minimum energy of 150 Nm, and secure the line.

NOTE A 50 kg bag from a drop height of 306 mm imparts a kinetic energy of approximately 150 Nm.

Release the line allowing the bag to impact the test specimen.

Repeat the test on the remaining four test specimens.

A.6 Test report

The test report shall include at least the following information:

a) identification of the net or sheet;

b) identification of the tie used;

c) date of sampling;

d) a reference to this standard and method used;

e) failure of any tie;

f) failure of any eyelet;

g) the amount of any increase in length of the two cuts;

h) failure of the net or sheet material except as in g).

Annex B (normative)
Puncture test

B.1 Sampling

Test specimens for any given material shall be taken from a production run and be identical in type, construction, composition, nominal thickness and manufacture to the material to be assessed. A test sample shall contain 5 net or sheet test specimens and sufficient ties as described in **B.4** for each test.

B.2 Preparation of test specimens

Prior to the test the net or sheet and ties shall have been stored at a relative humidity of (50 ± 5) % and an air temperature of (23 ± 2) °C for 24 h. Each net or sheet test specimen shall be rectangular, the nominal size shall be 1 000 mm wide by 2 000 mm high, as shown in Figure B.1. The actual dimensions shall be calculated from the eyelet positions nearest to the nominal size. The actual size of the test specimen shall be a minimum of 150 mm beyond the eyelet, or the edge of the net or sheet, if this dimension is less than 150 mm at the time of manufacture. One long side of the test specimen shall be the manufactured edge of the net or sheet (see Figure B.2).

B.3 Test apparatus

B.3.1 *A test frame*, constructed from standard scaffolding components similar to that described in **A.4**, but in a horizontal position, allowing the test specimen to be hung from the support frame. There shall be sufficient clearance below the frame to allow for deflection of the test specimen during the test.

B.3.2 *Means of supporting a 63 mm diameter steel ball*, with a mass of 1 kg and held 2 000 mm centrally above the test specimen.

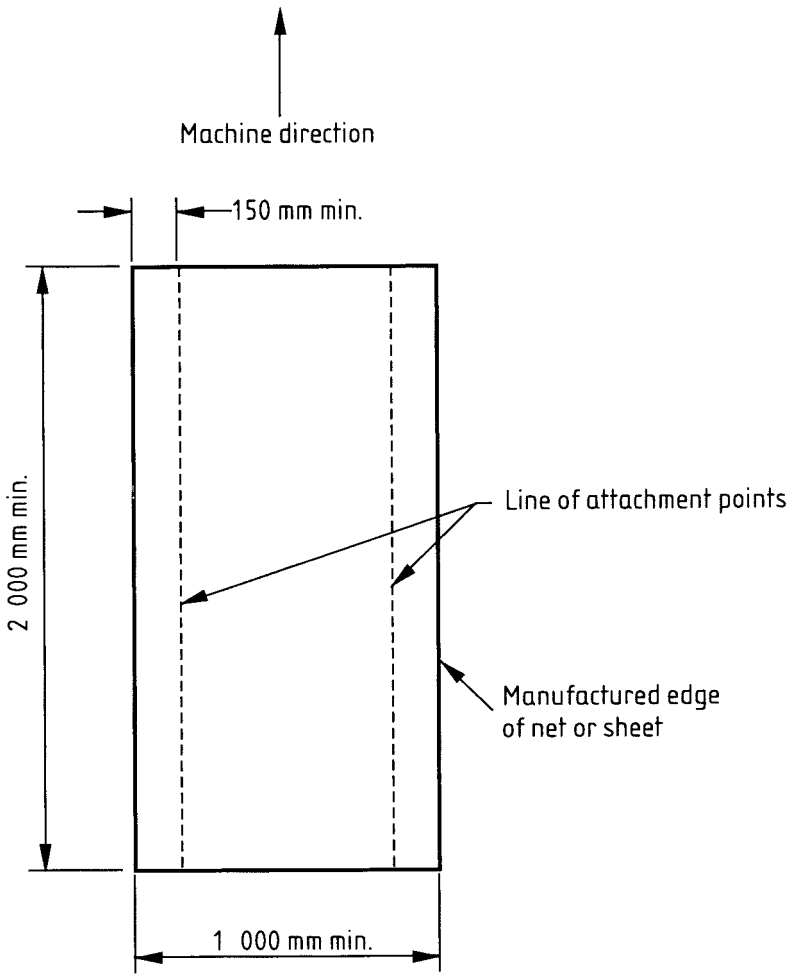


Figure B.1 — Preparation of sample sheet or net for puncture test

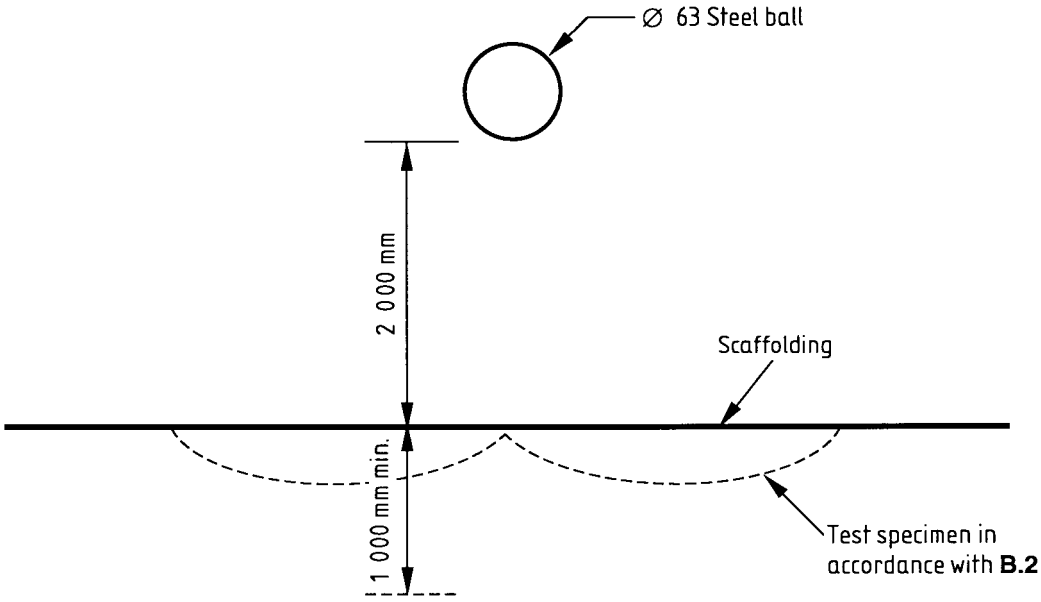


Figure B.2 — Puncture test — Test apparatus

B.4 Test procedure

Perform the test at a temperature of (20 ± 5) °C. Fix the test specimen to the frame as shown in Figure B.2. Use the minimum number and type of ties, and means of fixing these, as recommended by the manufacturer or supplier of the sample. The test specimen shall be below the support frame.

Allow the ball to fall onto the test specimen, impacting at a central point between the eyelets. Repeat the test on the remaining four test specimens.

B.5 Test report

The test report shall include at least the following information:

a) identification of the net or sheet;

b) identification of the tie used;

c) date of sampling;

d) a reference to this standard and method used;

e) comments on the failure of any tie;

f) comments on the failure of any eyelet;

g) comments on the failure of the net or sheet material.

Annex C (normative)

Flammability

See clause **6**.

The text in this annex is the complete text of the Loss Prevention Standard LPS 1215, *Flammability requirements for scaffolding cladding materials*. (Issue 2). It is reproduced verbatim by permission of the Loss Prevention Council and is LPC copyright.

C.1 Scope

This standard describes methods of tests and performance requirements with regard to flammability. The requirements set are those which should ensure that scaffold cladding materials, such as sheeting and netting used externally during construction, refurbishment or demolition of buildings should not add to the fire risk. The standard does not cover other features required of scaffold cladding materials, such as resistance to wind or rain penetration.

This standard does not cover internal protective coverings for floors, walls and furnishings used during construction or refurbishment of buildings; these are covered in LPS 1207.

C.2 Product specification

The manufacturer of the scaffold cladding material shall supply a complete and full description of the product or products to be tested as follows:

a) the colour and type of material from which the product is made;

b) a statement on whether it is flexible or stiff sheet;

c) if it is single or multi-layered, the thickness and description of each layer;

d) the overall thickness and weight (g/m^2);

e) if it is reinforced, state the reinforcement material and the dimension of the scrim;

f) if the material has cavities or indentations, state whether they are continuous and give their dimensions;

g) the method of fixing the scaffold cladding to the scaffold.

C.3 Test methods and performance requirements

The range of product variations that need to be tested shall be decided by the certification authority in consultation with the manufacturer. Testing may include each thickness and colour in the product range. All the flammability tests shall be carried out in essentially draught-free conditions.

C.3.1 *Flammability*

C.3.1.1 *Small flame test*

Three samples are to be tested for each flame application time on surface and edge.

C.3.1.1.1 The test shall be as described in BS 476-12:1991. The test details specific to these materials are as follows.

a) Ignition source: C.

b) Specimen size: 300 mm × 300 mm.

c) Flame application: surface and edge.

d) Flame application time: 5 s, 10 s and 20 s.

C.3.1.1.2 The requirements for the small flame test for any of the samples shall be:

a) transient ignition: maximum of 10 s flaming after flame removal;

b) no flaming droplets or flaming debris[2)] 10 s after flame removal;

c) no flaming reaching any edge of the specimen during application of the ignition source;

d) spread of flame not to reach the edge of the specimen at any point within the 10 s of the end of flame application time.

C.3.1.2 *Medium flame test*

C.3.1.2.1 The test shall be as described in BS 476-12:1991. Three samples shall be tested at each flame application time on surface and edge. The test details specific to these materials are as follows.

a) Ignition source: G.

b) Specimen size: 500 mm × 750 mm.

c) Flame application: surface and edge.

d) Flame application time: 20 s, 40 s and 60 s.

C.3.1.2.2 The requirements for the medium flame test on any of the samples tested shall be:

a) transient ignition zero: no flaming after 10 s from flame removal;

b) no flaming droplets or flaming debris[2)] 10 s after flame removal;

c) there shall be no flaming reaching any edge of the specimen during application of the ignition source;

d) spread of flame not to reach the edge of the specimen at any point within the 10 s of the end of flame application time.

C.3.1.3 *Flammable liquid test*

NOTE This test has been developed by LPC to represent a large ignition source, for example when a flammable liquid is encountered.

C.3.1.3.1 *Test sample*

Only one sample of each product needs to be tested. For test purposes the size of the protective scaffold cladding shall not be less than 2 m × 2 m. The cladding shall be tested in the vertical orientation. The bottom edge shall be positioned 150 mm above the top of the tray of fuel. The material for test shall be supported by a suitable arrangement of scaffold tubes and fixed with the manufacturer's recommended fixings.

C.3.1.3.2 *Test method*

a) Position a tray so that it is below the bottom edge and mid-width of the product and that one half of the tray is on one side of the product and the other on the other side.

b) The tray shall be made from steel 1.6 mm thick and be 300 mm diameter and 100 mm high. It shall be filled with water to a depth of 10 mm and then add 0.50 l of heptane.

c) Ignite the heptane, start the timing device and record the general behaviour of the material throughout the test, making particular note about the distance of flaming of the material under test if that occurs. Continue the test for at least 1 min after the heptane stops burning (approximately 6 min).

C.3.1.3.3 The requirements for the large flame test are:

a) transient ignition: shall be for a maximum of 10 s flaming after heptane stops burning;

b) there shall be no flaming droplets or flaming debris[3)] 10 s after heptane stops burning;

c) no flaming shall reach any edge of the specimen during application of the ignition source;

d) spread of flame shall not reach the edge of the specimen at any point within 10 s of the end of the flame application time.

C.4 Test report

The test report shall include details as required in each of the above tests, and shall also report the results in relation to the requirements for each test. The report shall fully describe the material that is tested (see **C.2**).

[2)] For the purposes of this test, flaming debris shall be taken as any burning material on the floor or base of test equipment.

[3)] For the purposes of this test, flaming debris shall be taken as any burning material on the floor.

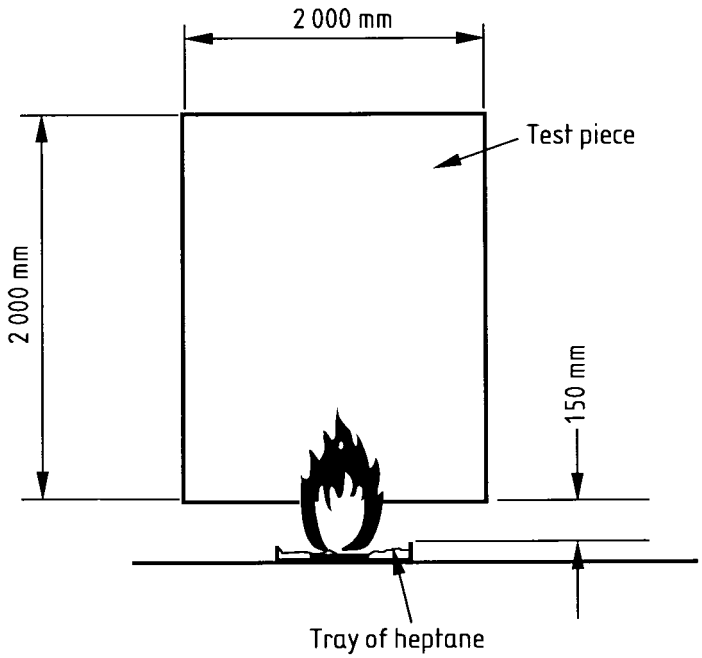


Figure C.1 — Arrangement for flammable liquid test

Annex D (normative)

Wind tunnel test to establish the permeability of nets used for cladding

D.1 Principle

To establish a form factor based on the rate of volumetric flow of air through a netting sample using a static reference pressure drop of 0.98 mbar (98 Pa).

D.2 Sampling

Test specimens for any given material shall be identical in type, construction, composition, nominal thickness and manufacture to the material being assessed. A test sample shall contain three test specimens.

D.3 Preparation of test specimens

Prior to the test, the netting shall have been stored at a relative humidity of (50 ± 5) % and an air temperature of (23 ± 2) °C for 24 h. Each test specimen shall be 300 mm × 300 mm. For netting with repeating patterns or discontinuities that would affect the permeability, the test specimen shall be cut and oriented in the wind tunnel so that the percentage amount of discontinuity was the same as in a "unit area" sample.

NOTE To obtain representative sample areas, including the discontinuities at pattern repeats, the percentage area occupied by the repeat discontinuity in a "unit square area" of side length equal to the repeat length should be calculated.

D.4 Test apparatus

D.4.1 Open-circuit suction wind tunnel, with a bell mouth inlet and a variable speed fan. Before testing, the flow profile of the tunnel shall be determined using a Pitot-static device connected to a micro-manometer. A working section shall be selected so as to be representative of the whole flow profile.

D.5 Test procedure

Clamp the test specimens, between the flanges of the bell-mouth inlet and working section, ensuring that it is as taut as possible and that the appropriate proportion of discontinuity is included.

Activate the suction fan to draw air through the test specimen and adjust the rotational speed until the static pressure drop across the specimen recorded on the differential micro-manometer is 0.98 mbar (10 mm water). Once the static pressure drop is achieved, stabilize for 30 s and then measure and record the upstream static pressure. Test each material in the test sample and calculate the average permeability value as follows.

Read the permeability value off the regression line, $\log_{10}$ permeability v $\log_{10}$ FF (H_c), given in Figure D.1 and note the form factor, FF (H_c).

D.6 Test report

The test report shall give the form factor.

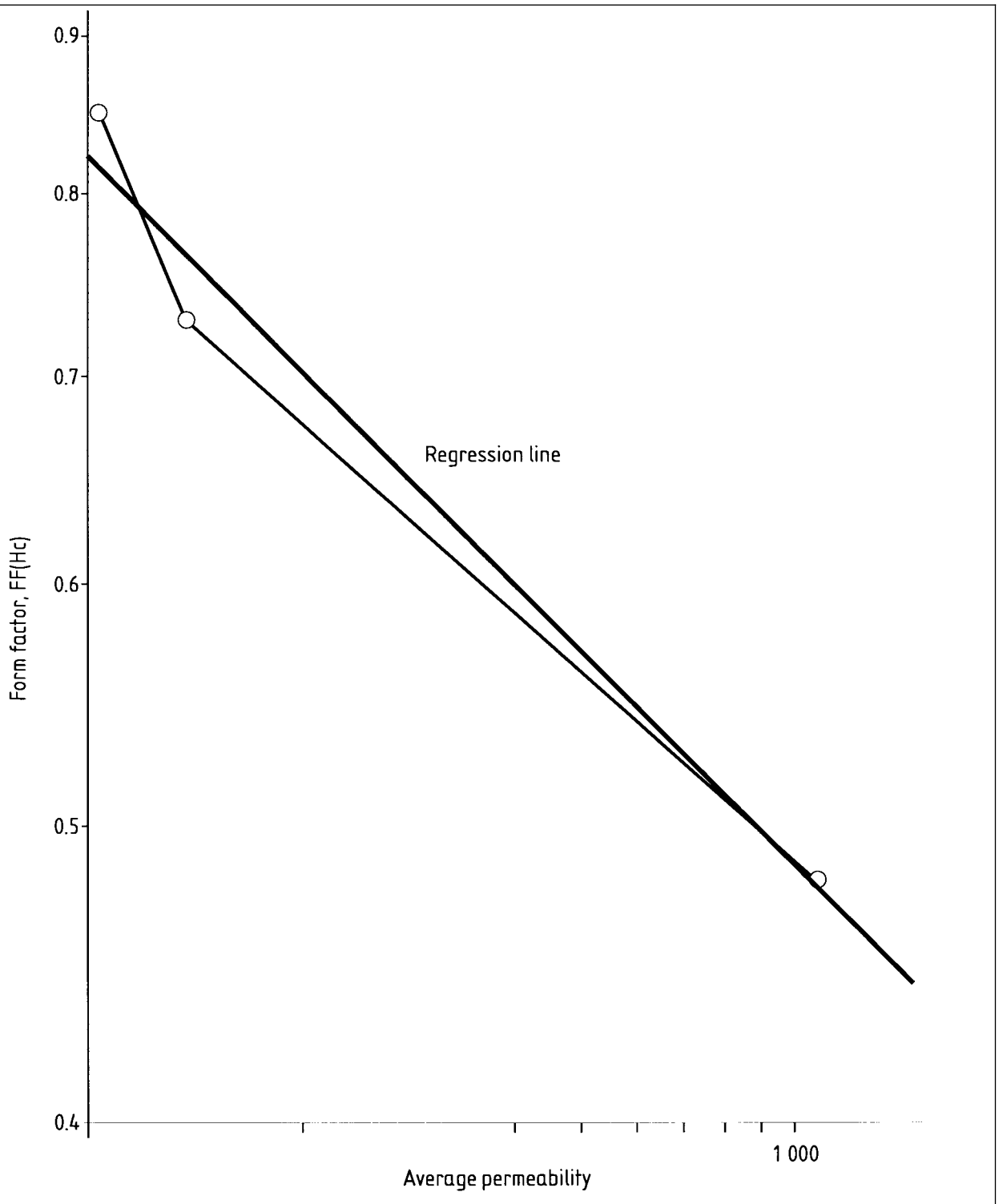


Figure D.1 — Log_{10} permeability v log_{10} form factor

Bibliography

LPS 1207 Issue 1 1994, *Fire requirements for protective covering materials.*
LPS 1215 Issue 1 1996, *Flammability requirements for scaffold cladding material.*

BSI — British Standards Institution

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