BS EN 1021-2:2014

BSI Standards Publication

Furniture — Assessment of the ignitability of upholstered furniture

Part 2: Ignition source match flame equivalent

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National foreword

This British Standard is the UK implementation of EN 1021-2:2014. It supersedes BS EN 1021-2:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FW/6, Flammability performance and fire tests for furniture.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 80943 9

ICS 13.220.40; 97.140

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2014.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1021-2

August 2014

ICS 97.140; 13.220.40

Supersedes EN 1021-2:2006

English Version

Furniture - Assessment of the ignitability of upholstered furniture - Part 2: Ignition source match flame equivalent

Ameublement - Évaluation de l'allumabilité des meubles rembourrés - Partie 2 : Source d'allumage : flamme équivalente à celle d'une allumette

Möbel - Bewertung der Entzündbarkeit von Polstermöbeln - Teil 2: Eine einem Streichholz vergleichbare Gasflamme als Zündquelle

This European Standard was approved by CEN on 28 June 2014.

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Foreword

This document (EN 1021-2:2014) has been prepared by Technical Committee CEN/TC 207 “Furniture”, the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by February 2015 and conflicting national standards shall be withdrawn at the latest by February 2015.

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

This document supersedes EN 1021-2:2006.

The main changes in relation to the 2006 edition of EN 1021-2 are:

— The standard has been aligned with EN 1021-1;

— A tolerance has been added to the temperature of the gas flame;

— Clarification of the gas supply required to production ignition source 1.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard is one of a series of standards concerned with the ignitability of upholstered furniture using various ignition sources. The ignition source used in this European Standard is a gas flame equivalent to a match flame.

1 Scope

This European Standard specifies a test method to assess the ignitability of material combinations, such as covers and fillings used in upholstered seating, when subjected to a small flame as an ignition source.

The test measures only the ignitability of a combination of materials used in upholstered seating and not the ignitability of a particular finished item of furniture incorporating these materials.

2 Terms and definitions

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

2.1
progressive smouldering
exothermic oxidation, not accompanied by flaming, that is self-propagating, i.e. independent of the ignition source. It may or may not be accompanied by incandescence

2.2
flaming
undergoing combustion in the gaseous phase with the emission of light

2.3
flammability
ability of a material or product to burn with a flame under specified test conditions

2.4
ignitability
measure of the ease with which a material, product or component can be ignited so as to flame or progressively smoulder

2.5
ignition source
source of energy used to ignite combustible materials or products

2.6
outer cover
outer layer of the upholstery

2.7
inner cover
layer of material used between the outer cover and the upholstery filling whose nominal thickness is less than or equal to 2 mm

Note 1 to entry: Any inner cover nominally greater than 2 mm thick is considered an upholstery filling.

2.8
filling
main upholstery material contained by the outer cover and (if used) the inner cover which may consist of several different materials, including any inner cover nominally greater than 2 mm thick

3 Criteria of ignition

3.1 Progressive smouldering ignition

For the purposes of this European Standard, all the following types of behaviour are considered to be progressive smouldering ignitions:

a) any test assembly that displays escalating combustion behaviour so that it is unsafe to continue and test and active extinction is necessary;

b) any test assembly that smoulders until it is largely consumed within the test duration;

c) any test assembly that smoulders to the extremities of the specimen, viz. upper or lower margins, either side or to its full thickness, within the duration of the test;

d) any test assembly that smoulders after one hour from the application of the ignition source;

e) any test assembly that, on final examination (see 9.3) shows evidence of progressive smouldering.

NOTE In practice it has been found that there is usually a clear distinction between materials which may char under the influence of the ignition source but which do not propagate further (non-progressive combustion) and those where smouldering develops in extent and spreads (progressive combustion).

3.2 Flaming ignition

For the purposes of this European Standard, all the following types of behaviour are considered to be flaming ignitions:

a) any test assembly that displays escalating combustion behaviour so that it is unsafe to continue the test and active extinction is necessary;

b) any test assembly that burns until it is essentially consumed within the test duration;

c) any test assembly on which any flame front reaches the lower margin, either side or passes through its full thickness within the duration of the test;

d) any flaming which continues for more than 120 s after removal of the burner tube.

4 Principle

To subject an assembly of upholstery materials to a gas flame ignition source. The assembly is arranged to represent in stylised form a junction between a seat and back (or seat and arm) such as might occur in a typical chair. The ignitability of an assembly is determined by applying a gas flame equivalent to a burning match. The test method measures the ignitability of the overall composite of materials, i.e. outer cover, inner cover, filling etc., as constructed on the test rig. The tests give an indication of, but cannot guarantee, the ignition behaviour of the finished item of furniture. The results shall not be stated as being applicable to the general behaviour of any individual component (see also Annex A).

NOTE Test specimens prepared from materials taken from furniture that has been used may give different results to the same materials before use.

5 Health and safety of operators

5.1 General

The test method specified in this European Standard presents a considerable hazard; suitable precautions shall be taken.

5.2 Enclosure

For safety, the test should be conducted in a non-combustible fume cupboard. If such a cupboard is not available, a test enclosure should be constructed (see 6.2) so that the operator is protected from the fumes.

5.3 Extinguishers

Adequate means of extinguishing the assembly should be provided, bearing in mind that some combinations may produce severe flaming during the test. A hand and/or fixed water spray which can be directed over the burning area can be useful. Other means such as suitable fire extinguishers, fire blankets and a bucket of water will assist.

In some cases smouldering may be difficult to extinguish completely and complete immersion in water may be necessary.

6 Apparatus

6.1 Test rig

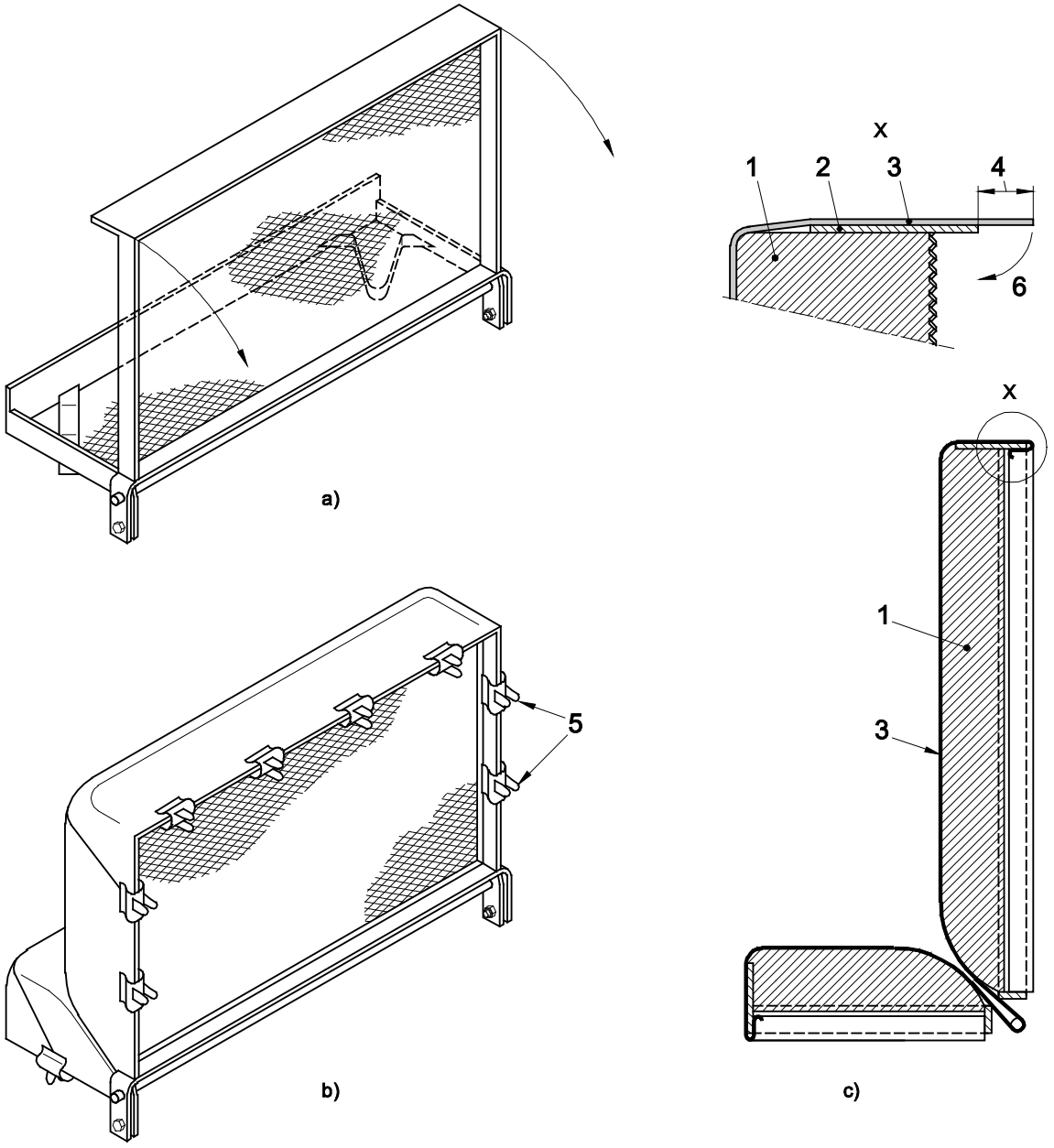
A suitable test rig is illustrated in Figures 1 and 2. It shall consist of two rectangular frames hinged together and capable of being locked at right angles to each other.

The sides and hinge edges of the frames shall be made from nominal 25 mm x 3 mm flat steel bar and shall securely hold mesh steel platforms set (6 ± 1) mm below the top edge of the frames (mesh size should be such that an open mesh area of approximately 15 mm^2 to 150 mm^2 exists).

The upper edge of the vertical frame and the front edge of the horizontal frame shall be steel end plates 450 mm x 65 mm x 3 mm to prevent the test filling moving during the assembly of the test specimen (see Figures 1 and 2).

The internal width and height of the back frame shall be (450 ± 2) mm x (300 ± 2) mm and the width and depth of the base frame (450 ± 2) mm x (150 ± 2) mm. A standard edging section may be used around the mesh steel platform to give protection and greater rigidity.

The sides of the frame shall extend beyond the back of each frame to provide for the hinge holes and to form the back legs. The hinge rod shall be of nominal 10 mm diameter steel, continuous across the back of the rig and its axis (22,5 ± 0,5) mm beyond the back member of each frame.



Key

a) test rig

b) test rig with cover and fillings

c) vertical section

X detail of fitting cover to frame

1 filling

2 end plate of frame

3 cover

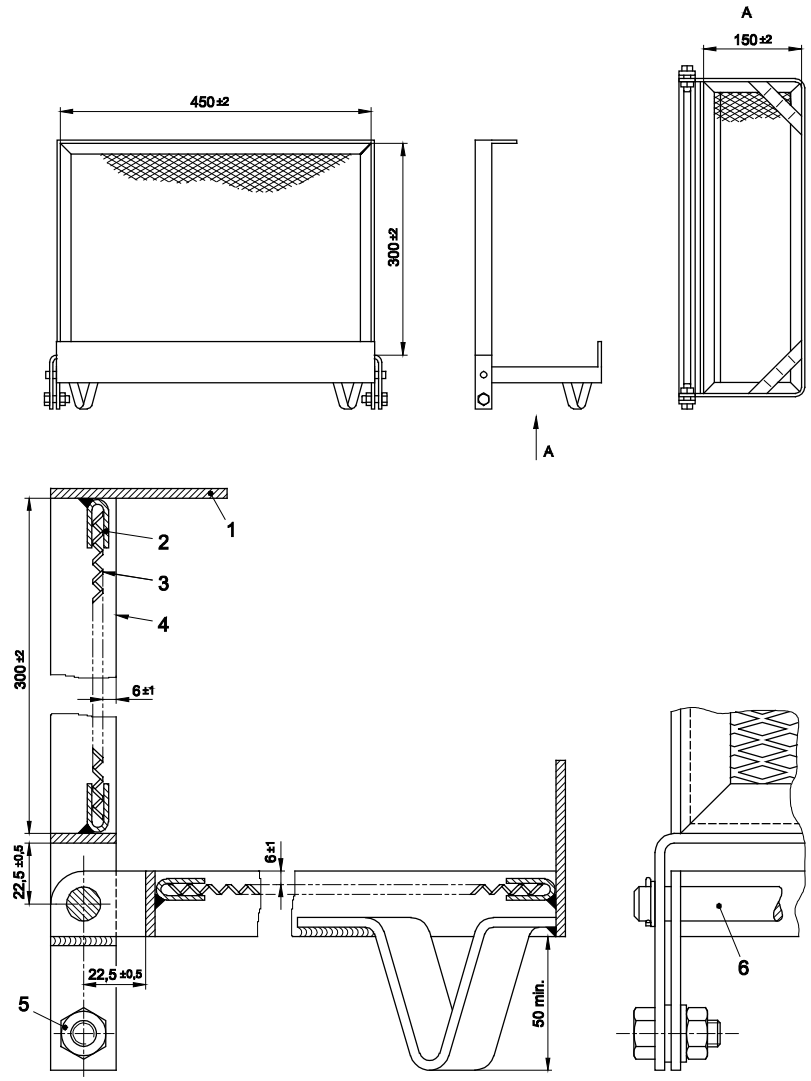
4 overlap 20 mm

5 clips

6 fold cover overlap under frame to touch the steel mesh supporting the filling and fasten with clips as below

Figure 1 — Test rig assembly

Dimensions in millimetres



NOTE 1 Unless tolerances are indicated, dimensions are nominal.

NOTE 2 All parts are made of steel.

Key

1 end plate of frame 65 mm x 3 mm

2 edging section

3 expanded metal mesh size 28 mm x 6 mm (see 6.1)

4 side member of frame 25 × 3 mm

5 M10 bolt, nut and washers

6 Ø 10 hinge rod

Figure 2 — Test rig detail

The frames shall be lockable at right angles by a bolt or pin through each of the pairs of members forming the back legs. The front legs may be welded across the front corners of the base frame. The height of the legs shall be such as to leave a gap not less than 50 mm high between the base and frame and the supporting surface.

For the tests, the rigs shall be sited within the enclosure (see 6.2) and the testing shall be performed in a basically draught-free environment permitting an adequate supply of air and removal of smoke from the area of the apparatus.

6.2 Test enclosure

The test enclosure shall consist of either a room with a volume greater than 20 m^3 (which contains adequate oxygen for testing) or a smaller enclosure with a through flow of air. Inlet and extraction systems providing an air speed rate of less than 0,2 m/s in the locality of the rig provide adequate oxygen without disturbing the burning behaviour.

6.3 Clock

The clock shall be capable of measuring for a period of at least 1 h with an accuracy of 1 s.

6.4 Ignition source: gas flame ignition source 1, match-flame equivalent

NOTE 1 This source has been designed to give a calorific output approximating to that of a burning match.

A burner tube consisting of a length of stainless steel tube [(8 ± 0,1) mm outside diameter, (6,5 ± 0,1) mm internal diameter and (200 ± 5) mm in length] is connected by flexible tubing to a cylinder containing butane via a flowmeter, fine control valve, on-off valve (optional) and cylinder regulator providing outlet pressure of nominal 2,8 kPa[1)]).

Where tubing of these dimensions is not readily available, stainless steel tubing of approximately similar dimensions may be used provided that the 50 mm length at the 'flame' end of the tube is machined to the given size. To facilitate positioning the tube, a suitable handle may be fitted to it at least 100 mm from the flame end of the burner tube.

A calibrated flow metre shall supply butane gas at a flow rate of (45 ± 2) ml/min at (25 ± 3) °C. The flexible tubing connecting the output of the flowmeter to the burner tube shall be 2,5 m to 3 m in length with an internal diameter of (7 ± 1) mm.

NOTE 2 This corresponds to a flame height of approximately 35 mm.

6.5 Gas flow control

It is essential that the rate of supply of gas to the burner tube conforms to the flow rate specified. Some difficulties have been reported with the supply and measurement of the gas, particularly where the gas cylinder has, of necessity, to be stored in an environment cooler than the defined test conditions and/or at some distance from the test rig.

In these cases, and other situations where difficulties occur, it is important that there should be sufficient length of tubing inside the controlled environment (10 °C to 30 °C) to ensure that the gas equilibrates to the required temperature before flow measurement. One way to assist this is to pass the gas (before flow measurement) through a metal tube immersed in water maintained at a constant temperature such that the gas temperature at entry to the flow metre is (25 ± 3)°C, so that flow corrections for temperature variations can be avoided.

Great care also needs to be exercised with the measurement and setting of the flow rate of the gas. Direct reading flowmeters, even those obtained with a direct gas calibration, need to be checked when initially installed and also at regular intervals during testing by a method capable of accurately measuring the absolute gas flow at the burner tube. One way of doing this is to connect the burner tube with a short length of tubing (about 7 mm inside diameter) to a soap bubble flowmeter, such that the upward passage of a soap film

1) 1kPa = 10^3 N/m^2 = 10 mbar

meniscus in a glass tube of calibrated volume (e.g. a burette) over a known period of time gives an absolute measurement of the flow.

7 Preparation and conditioning

7.1 Preparation

All outer covers and inner covers that have been chemically treated to reduce their ignitability shall be subjected to the water soaking and drying procedure described in Annex D prior to being conditioned according to 7.2. This requirement applies to all methods of treatment, including back coating, which are applied to covers that are finished in all other respects. It does not apply when the cover material is manufactured from materials that are formulated to be, or are inherently, flame retardant (e.g. fabric woven from flame retardant yarns, PVC) provided it is not further treated as a finished cover material.

Where it is not known whether the material has been so treated or not, the water soaking and drying procedure shall be carried out.

7.2 Conditioning

The materials to be tested shall be conditioned for at least 24 h immediately before the tests in the following atmosphere;

— temperature: (23 ± 2) °C;

— relative humidity: (50 ± 5) %.

7.3 Atmosphere for testing

The test shall be carried out in an atmosphere having a temperature between 10 °C and 30 °C and a relative humidity between 15 % and 80 %.

8 Test assembly

8.1 General

The test assembly materials shall be representative samples of the cover, inner cover, filling and other components, which may be used in a real assembly.

The test assemblies may be made up with identical materials in the horizontal and vertical sections.

8.2 Cover materials

The outer cover (2.6) size needed for each test shall be

$$800\ ^{+10}_{0}\text{mm} \times 650\ ^{+10}_{0}\text{mm}$$

Any cover that has been subjected to the water soaking procedure shall be cut to these dimensions after the soaking procedure.

The long dimensions shall be cut parallel to the machine direction. The cover may be constructed from smaller pieces of material, provided that the location of the resulting seams does not occur within 100 mm of the area likely to be affected by the test.

The cover shall have cut-outs 325 mm from one end on both sides. The cut-outs shall be positioned so that when assembled on the test rig, the lay of the pile is down the back assembly and from the hinge to the front

of the base frame. The size of these cut-outs shall be approximately 50 mm base width x 100 mm height x 25 mm top width.

Where an inner cover, 2.7 is used, it shall be cut to the same dimensions and in the same orientation as the outer cover, for fitting to the test rig under the cover.

Some special products may consist of fabrics bonded to sub-layers of flexible padding etc. When these are to be tested, the material shall be cut to the cover size. The lower layers shall be considered to be part of the filling (see 8.3) and the thickness reduced to ensure the total thickness complies with the specification limits.

8.3 Upholstery filling

Two pieces of filling are necessary for each test, with the following dimensions:

a) one piece (450 ± 5) mm x (300 ± 5) mm x (75 ± 2) mm thick;

b) one piece (450 ± 5) mm x (150 ± 5) mm x (75 ± 2) mm thick.

The filling shall reproduce the upper 75 mm of the cushioning assembly except that the upper layer(s) shall not be continued over and round the edges of the assembly.

Where the total thickness of filling materials (see 2.8) beneath the cover(s) exceeds 75 mm, the lower part of the filling shall be removed to give a filling thickness of 75 mm.

Where the filling is less than 75 mm thick, the test assembly shall be built up to the required thickness by adding a further layer(s) of the bottom material to the underside.

Some kinds of loose filling materials, e.g. foam crumb, feathers, may be evaluated by this test method. In these cases the loose filling shall be built up beneath the covering materials to reproduce the 75 mm thickness of the assembly at a realistic packing density. Where necessary, a finer grid material or air-porous fabric may be laid over the expanded metal of the test rig to retain the filling.

If the loose filling is enclosed in an inner cover (or ticking), it is acceptable to make up two bags of inner cover material, suitably filled and to the overall dimensions given above for use as the upholstery filling beneath the cover(s).

The method is unsuitable and cannot be used with composites where the loose filling material flows out of the assembly during the test and either extinguishes, moves, or adversely affects the burning of the ignition source.

9 Ignition source application

9.1 Preparation

9.1.1 General

The application of the ignition source should be within 20 min of removing the test materials from the conditioning atmosphere (7.2). If there is a significant distance between the conditioning room and the room where testing is carried out, the materials should be protected against de-conditioning during transfer between rooms. If possible, the assembly should be prepared inside the conditioning room.

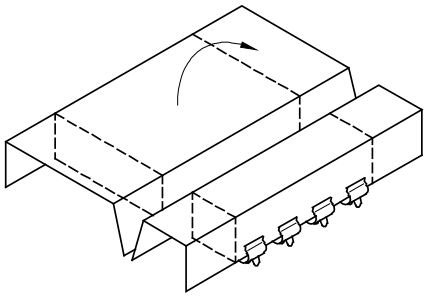
9.1.2 Open out the clean test rig (see Annex C) and thread the cover and inner cover, if any, behind the hinge bar.

9.1.3 Place the filling samples under the cover and inner cover, if any, locating them in the frame recesses.

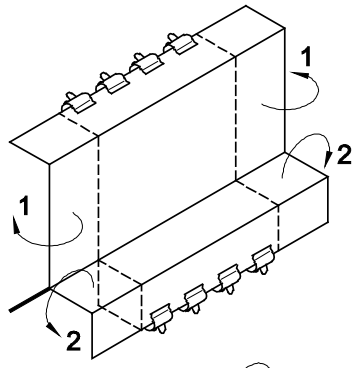
9.1.4 Allowing a 20 mm overlap on the rear edges, fasten the fabric over the top and bottom of the frame using at least 4 clips for each. The clips shall be at least 60 mm long and located at regular intervals on the top edge of the vertical and the front edge of the horizontal parts of the test rig (see Figure 3).

NOTE This action places the cover under some tension and it may be found easier to carry out if the frames are folded together to compress the upholstery partially.

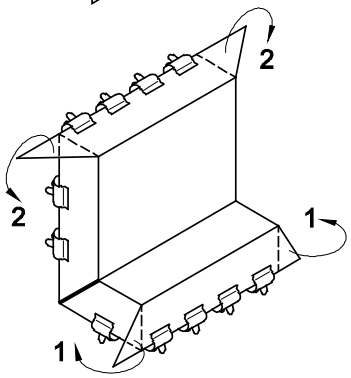
9.1.5 Ensure that the cover and inner cover are secure and under even tension. Then lock the frames at right angles by the bolts or pins. Readjust the clips on the top and the front to ensure that the cover, inner cover and filling are in close contact with each other while maintaining the 20 mm overlap (9.1.4). Fold the cover(s) over the filling at the sides and clip to the side frames, again allowing a 20 mm overlap and at least 1 clip on each side of the horizontal frame and two clips on each side of the vertical frame. Excess cover materials at the corners should be folded back and clipped to the side frames (see Figure 3).



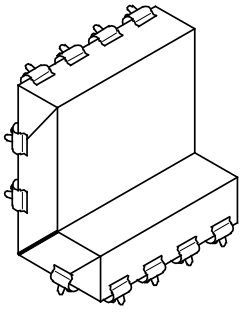
Stage 1: With test rig opened out flat and fillings in position, thread cover behind hinge pin and clip to top and bottom of the frame. Raise the larger frame to the vertical position.



Stage 2: Lock frames at right angles. Fold excess cover down and back to the sides of the rig.



Stage 3: Clip cover to sides of frame. Fold corners down and back to sides of frame.



Stage 4: Clip corners to sides of frame.

Key

1 fold back

2 fold down

Figure 3 — Assembling materials on test rig

9.2 Ignition source application

9.2.1 Light the gas emerging from the burner tube, adjust the gas flow to the specified rate (see 6.4) and allow the flame to stabilize for at least 2 min.

9.2.2 Within 20 min of removing the materials from the conditioning room, position the burner tube axially along the junction between the vertical and horizontal parts of the test assembly so that the flame is not less than 50 mm from one of the side edges and simultaneously start the clock.

9.2.3 Allow the gas to burn for a period of (15 ± 1) s, then terminate the ignition process by carefully removing the burner tube from the test piece.

9.2.4 Observe the progress of combustion, and record any evidence of progressive smouldering or flaming in the interior and/or cover. Disregard any flames or smouldering that cease within 120 s of the removal of the burner tube.

9.2.5 If progressive smouldering ignition (see 3.1 a), b), c), d)) or flaming ignition (see 3.2) of the upholstery components is observed, extinguish the test assembly and record this. In these circumstances discontinue testing and complete the test report (see Clause 10).

If progressive smouldering ignition or flaming ignition is not observed, repeat the test in a fresh position not less than 50 mm from the opposite side edge of the test assembly and from any marks left by any previous tests.

9.2.6 If progressive smouldering ignition (see 3.1 a), b), c), d)) or flaming ignition (see 3.2) is observed in the second test, extinguish the test assembly and record this. Discontinue testing and complete the test report (see Clause 10).

If progressive smouldering ignition (see 3.1 a), b), c), d)) or flaming ignition (see 3.2) is not observed in this retest, repeat the test a third time in a fresh position in the middle of the test assembly not less than 50 mm from any previous test damage.

9.2.7 If progressive smouldering ignition or flaming ignition is observed in the third test, extinguish the test assembly and record this. Discontinue testing and complete the test report (see Clause 10).

If progressive smouldering ignition or flame ignition is not observed in this third test, record this and carry out the final examination (see 9.3).

9.3 Final examination

Cases of progressive smouldering ignition undetected from the outside have been reported. Immediately after completion of the test programme on the assembly, dismantle it and examine it internally for progressive smouldering ignition (see 3.1 e)). If this is found, extinguish the test assembly, and record a failed result and complete the test report (see Clause 10). For safety reasons ensure that all smouldering has ceased before the rig is left unattended.

If no internal progressive smouldering ignition is found, record non-ignition and complete the test report (see Clause 10).

10 Test report

The test report, of which the form shown in Annex B is an example, shall give the following information:

a) reference to this European Standard, i.e. EN 1021-2;

b) description of the materials tested;

c) whether or not the water soaking procedure was carried out on the cover(s);

d) whether ignition or non-ignition occurred in each test. If ignition occurred with at least one of the flame applications, the overall result is taken as ignition;

e) if ignition occurred, whether it was progressive smouldering ignition or flaming ignition, and the measurements or observations relevant to the criteria for ignition.

The report shall also include the words “The above test results relate only to the ignitability of the combination of materials under the particular conditions of test; they are not intended as a means of assessing the full potential fire hazard of the materials in use.”

Annex A
(informative)

Guidance notes for designers and specifiers

A.1 This European Standard specifies methods for examining the ignitability, in defined circumstances, of an assembly of upholstery materials. These materials are combined together in a way intended to be generally representative of their end use in upholstered seating and the ignition sources are selected so that most may be related to everyday sources.

Thus the potential ignitability of a particular cover, filling and inner cover in combination can be assessed.

However, there are two important limitations, as follows.

a) the tests are concerned only with ignitability and any controls of fire hazard have to consider, in addition, other aspects of fire performance such as rate of fire development, heat output, rate and quantity of smoke production and toxic gas evolution. Ideally, any attempts to reduce ignitability ought not to affect these other properties adversely;

b) the limitation detailed in Clause 1 occurs because design features of the furniture can greatly affect its fire properties, any ignitability tests of a piece of furniture would therefore need to be carried out on the actual item and not on component materials or mock-ups. However, limited information on ignitability, more specifically related to an intended design, may be obtained as indicated in A.2 and A.3.

A.2 All ornamental edging and other decoration are removed from the material to be tested.

If an item of furniture does not have an upholstered back and upholstered arm rests, the materials in the test rig are mounted as if the item had an upholstered back composed of the same material as used in the seat.

If an item of furniture has an upholstered back and upholstered arm rests, but not an upholstered seat, the material in the test rig is mounted as if the item had an upholstered seat composed of the same material as used in the back or arm rests. This applies if the seat is in contact with the upholstered parts of the back or arm rests. If a part (seat, arm rests or back) of an item of furniture is upholstered and covered in a different material from that used in the rest of the item of furniture, each part is tested as if the entire item of furniture had been upholstered and covered with these materials. This does not apply to upholstered parts that have been tested already.

If decorative seams or stitches are included as part of the design of the fabric, at least one such seam need to be included in each test. The seam is placed so as to cross the intersection between seat and back at an approximate right-angle, and is placed so as to be located at least 50 mm from the nearest edge. The ignition source is placed so that it crosses the seam at the angle between seat and back.

A.3 This European Standard specifies laboratory tests for an assembly of materials. They give an indication of, but cannot guarantee, the ignition behaviour of the finished item of furniture. Where more specific information is required, for example tip-up seats or in critical areas of end use, the principles may be applied to complete items or sub-assemblies of furniture or to suitably modified test assemblies, some examples of which are given below. In such cases the source described in 6.4 may be applied at positions which, as a general rule, correspond to those where the hazard of ignition occurs in use.

EXAMPLE 1 If a chair has a gap between the seat and back cushions, the placing of ignition sources in the angle of the test apparatus is inappropriate. Instead, face ignition, where the source is placed on the horizontal and vertical surfaces, is more meaningful.

EXAMPLE 2 The test apparatus may be used to model the junction of any vertical and horizontal surfaces so that both arm and back constructions, if different, may be tested separately in conjunction with the seat.

EXAMPLE 3 The use of different materials in a back and seat of a chair may be reproduced in the test, two different cover fabrics being joined by sewing or with staples behind the hinge bar.

A.4 The ability of cover material to provide protection against ignition can be indicated by testing it in a combination with a substrate of known flammability. Similarly, the role of a filling can be established by using it in conjunction with covers with different types of behaviour. Such information about the individual materials does not eliminate the need to test the actual combination, but it can help in the short-listing of material combinations and so reduce the overall amount of testing required.

Annex B
(informative)

Model test report form

Issuing authority..... Test No. .....

Sample..... Date ..... Company .....

Test report in accordance with EN 1021-2 **(confidential)**

Assessment of ignitability: Ignition source: match flame equivalent

Materials tested..... …….

A water soaking procedure was/was not carried out on the cover because……

Test results (non-ignition, smouldering ignition, flaming ignition):……..

	Match flame equivalent			**Comments**
	1	2	3	
Smouldering criteria	*	*	*	
Unsafe escalating combustion (3.1 a)				
Test assembly consumed (3.1 b)				
Smoulders to extremities (3.1 c)				
Smoulders through thickness (3.1 c)				
Smoulders more than 1 hour (3.1 d)				
In the final examination, presence of progressive smouldering (3.1 e)				
Flaming criteria				
Unsafe escalating combustion (3.2 a)				
Test assembly consumed (3.2 b)				
Flames to extremities (3.2 c)				
Flames through thickness (3.2c)				
Flames longer than 120 s (3.2d)				
*Enter ‘YES’ if criteria exceeded or ‘NO’ if criteria not exceeded				

Signed: .....

(Any extraordinary events should be reported overleaf)

The above test results relate only to the ignitability of the combination of materials under the particular conditions of test; they are not intended as a means of assessing the full potential fire hazard of the materials in use.

Annex C
(informative)

Cleaning of a rig

It is important that the rig should be kept clean to ensure that test assemblies do not become contaminated with the residues left from earlier tests. It is particularly important that the hinge bar shall be kept clean. This may be facilitated by using a hinge bar which can be removed to minimize contamination as well as to aid cleaning. A hinge bar which is held in place by split pins has been found to be acceptable.

Cleaning of the test rig can be done with solvents or by burning the residues off the rig. Care needs to be taken to ensure that the rig does not become distorted when removing residues by burning. When solvents are used, care should be taken to prevent test assemblies becoming contaminated with solvents. Normal safety procedures should be followed, particularly when flammable and/or toxic solvents are being used.

Annex D
(normative)

Water soaking procedure

D.1 Reagents

D.1.1 Water

A supply of water with a degree of hardness of 8 dH to 10 dH (80 mg/1 CaO to 100 mg/1 CaO).

If the water is harder than 10 dH, demineralised water shall be added until the required degree of hardness is achieved. The quantity of demineralised water to be added to 1 l of water with a degree of hardness D (>10 dH) is

$$(D - 9)/9 \text{ l}$$

EXAMPLE 1 To 5 l water with a degree of hardness 13,4 dH, 5 × (13,4 – 9)/9 = 2,44 l demineralised water needs to be added to obtain 7,44 l water with a degree of hardness of 9 dH.

If the water is softer than 8 dH, salts needs to be added in order to increase the hardness. Two solutions need to be prepared:

Solution I:

Dissolve 3,91 g calcium chloride ($CaCl_2 \cdot 6H_2O$) in 1 l demineralised or distilled water.

Solution II:

Dissolve 3,00 g sodium bicarbonate ($NaHCO_3$) in 1 l demineralised or distilled water.

The quantity of these two solutions to be added to 1 l water of a degree of hardness of D(<8 dH), is

$$12{,}2\ (9 - D) \text{ ml}$$

EXAMPLE 2 To 10 l water with a degree of hardness 7,0 dH, 10 × 12,2 (9 – 7) = 244 ml of solution I and an equal amount of solution II need to be added to obtain 10,488 l water with a degree of hardness of 9 dH.

D.1.2 Wetting agent

Any non-ionic wetting agent.

NOTE The exact nature of this reagent is not critical.

D.2 Apparatus

Flat bottomed dish of sufficient size to enable the test specimens to be completely immersed.

D.3 Specimens

Use sufficient cover material to permit subsequent preparation of a test specimen of the dimensions described in 8.2.

NOTE Depending on the dimensions of the flat bottomed dish (D.2) the specimen may require folding.

D.4 Procedure

Using a liquor ratio (sample mass: water mass) of 1:20, completely immerse each specimen in water (D.1.1) containing 0,5 g/l of non-ionic wetting agent (D.1.2) in the flat-bottomed dish (D.2) at an initial temperature of (40 ± 1) °C. Ensure the specimen remains completely immersed.

After 30 min, remove the specimen, rinse in water (D.1.1) using a liquor ratio of 1:20 for 2 min and then dry the specimen by hanging it vertically from the shorter edge nearest to the cut outs so that it is not in contact with other specimens, materials or surfaces. After drying it shall then be conditioned for a minimum of 24 h at 23 °C/50 % RH. If the specimen has been folded during immersion, refold before rinsing.

Drying time will vary with different covers but a time of 48 h in indoor ambient conditions should be satisfactory for most fabrics.

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