BRITISH STANDARD

BS EN
751-1 : 1997

Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water

Part 1. Anaerobic jointing compounds

The European Standard EN 751-1 : 1996 has the status of a British Standard

ICS 91.140.40; 91.140.60

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PSE/2, Jointing materials and compounds, upon which the following bodies were represented:

Asbestos Information Centre Ltd.
British Adhesives and Sealants Association
British Compressed Gases Association
British Hydromechanics Research Group
Chartered Institution of Water and Environmental Management
Energy Industries Council
Industrial Water Society
LP Gas Association
Water Services Association of England and Wales

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Contents

National foreword

This Part of BS EN 751 has been prepared by Technical Committee PSE/2, and is the English language version of EN 751-1 : 1996, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds*, published by the European Committee for Standardization (CEN).

It supersedes BS 6956 : Part 7 : 1992 which is withdrawn.

Cross-references

International standards	Corresponding British Standard
ISO 7-1	BS 21 *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*
ISO 228-1	BS 2779 *Specification for pipe threads for tubes and fittings where pressure-tight joints are not made on the threads (metric dimensions)* BS 5380 *Specification for hydraulic port and stud coupling using 'O'-ring sealing and 'G' series fastening threads*
EN ISO 2160	BS EN ISO 2160 *Petroleum products, Corrosiveness to copper. Copper strip test*
EN 437	BS EN 437 *Specification for test gases, test pressure and categories of appliance, for gas appliances*
EN 10242	BS EN 10242 *Threaded pipe fittings in malleable cast iron*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 8, an inside back cover and a back cover.

EUROPEAN STANDARD
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EN 751-1

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English version

Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds

Matériaux d'étanchéité pour raccords filetés en contact des gaz de la 1ère, 2ème et 3ème famille et de l'eau chaude – Partie 1: Composition d'étanchéité anaérobie

Dichtmittel für Gewindeverbindungen in Kontakt mit Gasen der 1., 2. und 3. Familie und Heißwasser – Teil 1: Anaerobe Dichtmittel

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 108, Sealing materials and lubricants for gas appliances and gas equipment, the secretariat of which is held by NNI.

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 June 1997, and conflicting national standards shall be withdrawn at the latest by June 1997.

This European Standard consists of the following Parts:

– Part 1: *Anaerobic jointing compounds*
– Part 2: *Non-hardening jointing compounds*
– Part 3: *Unsintered PTFE tapes*

This European Standard 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).

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

Contents

Introduction

This European Standard specifies requirements and test methods for anaerobic jointing compounds for metallic threaded joints. These liquid, gellike or pasty sealants cure inside the gap of the threaded joint by the absence of oxygen catalyzed by contact with the metal of the threaded joint. By the curing reaction, which is time and temperature dependent, a polymeric material is formed, which fills the gap and micro-imperfections of the thread and binds strongly to the metal surfaces thus sealing and bonding the threaded joint.

Anaerobic jointing compounds can be formulated to harden to different strength levels. Users of such materials should therefore consult the manufacturer's information to ensure that the grade is suitable for the application e.g. the size of the thread, the materials of the joints, and whether the joint needs to be dismantled.

Since not only the mechanical strength of the threaded joint but also the sealing properties of the anaerobic sealing material are influenced by the preparation of the threads and other factors, the application instructions provided by the manufacturer of the sealing material should be followed. It is important that only 'Competent Persons' should be working on gas installations.

For applications outside the scope of this Standard the manufacturer should be consulted prior to use.

It is important to note that threaded joints once finally assembled should never be adjusted. Where it proves necessary to dismantle the joints, they should be unscrewed completely, cleaned and assembled once again using fresh jointing compound.

A universally applicable jointing compound may be used for all gas, potable water, and hot water installations.

In respect of potential adverse effects of the jointing compounds covered by this European Standard on the quality of water intended for human consumption this Standard provides no information as to whether the jointing compounds may be used without restriction in any of the Member States of the EU or EFTA. The use and characteristics of the jointing compounds should comply with current regulations, where they exist, depending on the acceptance of verifiable European criteria.

1 Scope

This European Standard specifies requirements and test methods for anaerobic jointing compounds (hereafter referred to as 'jointing compounds') suitable for sealing threaded metallic joints such as those specified in ISO 7-1. These jointing compounds are for use in contact with 1st family gases (town gas), 2nd family gases (natural gas) and 3rd family gases (liquefied petroleum gases (LPG) not including LPG in the liquid form) and hot water of heating systems according to table 1.

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.

ISO 7-1	*Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*
ISO 228-1	*Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*
EN ISO 2160	*Petroleum products — Corrosiveness to copper — Copper strip test* (ISO 2160 : 1985, including Corrigendum 1 : 1993)
EN 437	*Test gases — Test pressures — Appliance categories*
EN 10242	*Threaded pipe fittings in malleable cast iron*
prEN 10255	*Carbon steel tubes suitable for welding or threading*
prEN 12164	*Copper and copper alloys — Rod for free machining purposes*

Table 1. Application of anaerobic jointing compounds

Fluid	Temperature range °C	Pressure-limit bar	Typical application
1st, 2nd, 3rd family gases[1)]	−20 to 125	5	gas appliances gas equipment installation
hot water[2)]	up to 130	7	heating systems

[1)] Some jointing compounds can be used for other applications. For such applications, which are outside the scope of this European Standard, the purchaser should consult the manufacturer.

[2)] Sealing properties and mechanical strength are influenced by various factors such as nature of metal, form, roughness and size of thread, cleanness of the joint from cutting oil, etc. Non-hardening sealing materials in the form of e.g. jointing compounds paste are covered by EN 751-2 and in the form of PTFE-tapes are covered by EN 751-3.

3 Definitions

For the purposes of this European Standard the following definitions apply:

3.1 anaerobic jointing compound (referred to hereafter as jointing compound)

Sealing material applied as a liquid, gel or paste to the threads (without the addition of sealant supporting bases) which cures inside the gap of the threaded joint in the absence of oxygen and catalysed by metal ions.

3.2 gas family

For further information on types of gases see EN 437.

3.3 batch

Any quantity of jointing compound manufactured in a single mix at one time.

4 Classification of jointing compounds

There are two classes of anaerobic jointing compounds suitable for fine (I) and coarse (H) threads according to table 2.

Table 2. Classification of anaerobic jointing compounds

Class	Thread	Nominal Size
I	ISO 7-1 taper/parallel and taper/taper	DN $\leq$ 10 [1)]
H	ISO 7-1 taper/parallel and taper/taper	10 < DN $\leq$ 50

[1)] Class I anaerobic jointing compounds may also be used for other dimensions when the number of turns of the thread is 7,5 cm^{-1}.

5 Requirements

5.1 Requirements to be met by the jointing compound as received

5.1.1 *Visual quality*

The jointing compound shall be of a homogenous liquid to pasty consistency easily applicable to threads. It shall also be free of lumps or other deleterious materials when tested in accordance with the method described in **7.1.1**.

5.1.2 *Chemical stability*

The jointing compound shall have a gel time not less than 5 min at 100 °C when tested in accordance with the method described in **7.1.2**.

5.1.3 *Corrosive properties*

The jointing compound shall not cause corrosion of aluminium, brass, copper, low carbon steel or zinc surfaces when tested in accordance with **7.1.3**. The appearance of copper and brass test strips shall give a classification 3 or less in accordance with EN ISO 2160.

5.1.4 *Storage properties*

The storage life of the jointing compound shall be at least one year in its original unopened container when stored at a temperature less than 25 °C, indicated and declared by the manufacturer.

5.2 Requirements to be met by the jointing compound after assembly

5.2.1 *Sealing properties*

When tested in accordance with the methods described in **7.2.1** the jointing compound shall not disintegrate or flow out of the joint and shall not permit any leakage when each test assembly is tested in accordance with **7.2.1.2** to **7.2.1.6** in sequence.

5.2.1.1 *Soundness*

When pressurized within 1 h after preparation all the joints in the test assemblies shall not leak when tested in accordance with **7.2.1.2**.

5.2.1.2 *Resistance to gas condensates*

The sealing properties of the jointing compound shall not be impaired by liquid hydrocarbon gas condensate when tested in accordance with **7.2.1.3**.

5.2.1.3 *Resistance to hot water*

The sealing properties of the jointing compound shall not be impaired by hot water when tested in accordance with **7.2.1.4**.

5.2.1.4 *Resistance to temperature cycling*

The sealing properties of the jointing compound shall not be impaired by temperatures of $-(20 \pm 2)$ °C and (150 ± 2) °C when tested in accordance with **7.2.1.5**.

5.2.1.5 *Resistance to vibration*

The sealing properties of the jointing compound shall not be impaired by vibration when tested in accordance with **7.2.1.6**.

5.2.2 *Compatibility with foam forming leak testers*

The jointing compound shall not destroy the film of aqueous leak test fluids within 1 min when tested in accordance with **7.2.2**.

5.3 Re-test

If more than one joint in any test assembly shall fail, throughout the tests specified in **7.2.1.2** to **7.2.1.6**, no re-tests shall be permitted. Should one joint of a test assembly fail to comply with the requirements of any test, two further test assemblies shall be prepared using jointing compound from the same batch for re-test and each of them shall comply with the requirements of all tests. If any of the joints on the re-test assemblies fail, then it shall be deemed that the whole batch has failed.

6 Test material and documentation

6.1 Test material

The manufacturer shall submit sufficient quantities of the jointing compound from a single batch in original packing to the test laboratory.

6.2 Test documentation

The following documents shall be submitted to the test laboratory:

a) description of the jointing compound;

b) application and handling instructions (see **8.2**);

c) declaration that the storage requirements of **5.1.4** are met;

d) appropriate health and safety data sheet.

7 Test methods

7.1 Tests of the jointing compound as received

7.1.1 *Test of visual quality*

Approximately 1 g of the jointing compound is spread with a spatula in a thin film on a glass plate and inspected for homogeneity, consistency, lumps or other deleterious materials.

7.1.2 *Test of chemical stability*

Place approximately 5 g of jointing compound in a test tube of approximately 25 mm diameter. Hold the tube in boiling water at (100 ± 2) °C in a water bath and stir the contents gently and continuously with a glass rod.

Record the time from immersion of the tube until the jointing compound begins to gel or form lumps. If polymerization has not occurred after 10 min, discontinue the test and record the time as being greater than 10 min. Repeat the procedure with a new sample of the jointing compound and report the lower of the two results as the stability time at 100 °C.

7.1.3 *Test of corrosive properties*

Metal strips of commercial copper, brass, aluminium, low carbon steel and zinc not less than 0,5 mm thick are cut into pieces 75 mm long and 13 mm wide. Mechanically abrade each strip on the two faces and the edges to obtain a uniform finish free from defects. Polish each strip with emery paper (grade No. 400) and then clean with successive pads of cotton wool until a fresh pad remains unsoiled after use. Wash each strip with acetone and allow to dry. Use clean forceps for all further handling of the strips.

Two metal strips of the same material are coated with the jointing compound at times over a length of 30 mm on one side. The strips are then with the coated sides laid one upon the other with an overlap of 30 mm and loaded with a weight of 200 g. The metal strips are then stored for $(48 \,^{0}_{-2})$ h at (20 ± 5) °C. Thereafter both strips are separated from each other (if necessary after warming up) and the surface examined for etching, pitting, discolouration, bloom or corrosion deposits.

7.2 Test of the jointing compound after assembly

7.2.1 *Test of sealing properties*

7.2.1.1 *Preparation of test assemblies*

The test shall be performed on test assemblies prepared from new unused threaded joints.

The parts specified in table 3 are required for the preparation of the test assemblies, for jointing compounds of Class I.

Cut threads R ¼ in accordance with ISO 7-1 on both ends of the pipe sections. Use only pipes and fittings with threads without any defects visible to the naked eye. When screwing pipes and plugs by hand into the sockets used for preparing the test assemblies $(2 \pm ½)$ fully cut threads shall be visible. Clean male and female threads before assembly with absorbent tissue paper to remove any cutting oil.

Table 3. Parts list for test assemblies for Class I jointing compounds

Quantity	Part	Thread	Characteristics
4	Thread pipe	R ¼	brass[1)] tube - DN 6 Length: 250 mm
8	Socket	Rp ¼	prepared from a brass[1)] hexagon bar
8	Plug	R ¼	prepared from a brass[1)] hexagon bar

[1)] Free machining brass $CuZn_{40}Pb_2$ in accordance with prEN 12164.

Apply the jointing compound according to the manufacturer's instructions. Use a pipe vice (three- or four-point clamp) to assemble the parts.

Screw one socket to each end of the pipe sections and close one socket with a plug. Ensure that the full length of the outer threads is covered by the sockets but that at least a part of one fully cut thread is visible. Take care during assembly not to transmit the force to the joints already made.

Test assemblies for jointing compounds of Class H are prepared in a similar manner using the parts listed in table 4. In this case ($2\frac{1}{2} \pm \frac{1}{2}$) fully cut threads shall be visible when screwing pipes and plugs by hand into the sockets.

Use absorbent tissue paper to wipe off excess jointing compound in the direction of the thread.

All test assemblies are successively tested in accordance with **7.2.1.2** to **7.2.1.6**.

Table 4. Parts list for test assemblies for Class H jointing compounds

Quantity	Part	Thread	Characteristics
4	Thread pipe	R 1½	prEN 10255 - DN 40 - welded; medium series Length: 250 mm
4	Socket	Rp 1½	EN 10242
4	Socket reducing	Rp 1½ × ½	EN 10242
4	Plug	R ½	EN 10242
4	Plug	R ½	EN 10242

7.2.1.2 *Soundness test*

Pressurize the assemblies after preparation 0,5 h to 1 h after assembly with air or nitrogen to a pressure of ($7{,}5 \pm 0{,}3$) bar. Immerse in a water bath at (20 ± 5) °C for 5 min and inspect all the threaded joints for leakage. Gas leakage shall be determined by the appearance of bubbles during the immersion period, ignoring those noted during the first 15 s of immersion.

7.2.1.3 *Test of resistance to gas condensates*

Two test assemblies are filled to a level sufficient to cover the joints with a mixture of 70 parts iso-octane and 30 parts toluene, the other two test assemblies with n-pentane. All assemblies are closed with a plug and then stored vertically for $(72^{\ 0}_{-2})$ h at (20 ± 5) °C.

Drain the test assemblies and repeat the soundness test in accordance with **7.2.1.2**.

7.2.1.4 *Hot water resistance test*

The test assemblies are half filled with water and the reducing socket closed by a R ¼ or R ½ plug respectively using the jointing compound under test. Test assemblies are placed in a horizontal position in an oven at (20 ± 5) °C which is then heated to (130 ± 2) °C for $(168^{\ 0}_{-2})$ h.

NOTE. The oven temperature should be fitted with a safety cut-off set to 140 °C to avoid higher temperatures which might cause uncontrolled pressure increases in the test assemblies.

After having been left to cool to (20 ± 5) °C for at least 2 h the plugs are removed and the test assemblies are drained and tested for leaks in accordance with **7.2.1.2**.

7.2.1.5 *Temperature cycling test*

Place the test assemblies in an oven and expose them to five temperature cycles. During each 24 h test cycle put the test assemblies into an oven heated to (150 ± 2) °C for $(22^{\ 0}_{-0{,}5})$ h) and then cool down to (20 ± 5) for $(2^{\ 0}_{-0{,}2})$ h. After the last temperature cycle the test assemblies are put into a freezer (cold cabinet) cooled to $-(20 \pm 2)$ °C for $(4^{\ 0}_{-0{,}4})$ h and then subjected to the soundness test in accordance with **7.2.1.2** after warming up to (20 ± 5) °C.

NOTE. The individual cycles in this test need not take place consecutively.

7.2.1.6 *Vibration test*

Clamp the plugged sockets of the test assemblies successively in a rotating chuck (see figure 1). Screw a stud bolt threaded G ¼ B to ISO 228 - 1 (Class I) or G ½ B (Class H) into the other socket and secure a bearing (ball race) to it. Suspend a 1 kg mass for Class I and 5 kg mass for Class H respectively from a spring (spring constant approximately 5000 $N{\cdot}m^{-1}$) attached to the bearing. Rotate each test assembly at a rotation frequency of (700 ± 20) min^{-1} for a period of (30 ± 1) min. Repeat the soundness test in accordance with **7.2.1.2**.

7.2.2 ***Compatibility test with foam forming leak testers***

One test assembly which has completed the test in accordance with **7.2.1** is connected to an air supply of 0,1 bar. The joint between pipe and socket is loosened to give a leakage rate of (30 ± 5) $ml{\cdot}h^{-1}$. An aqueous detergent solution (1 % *m/m* of sodium salt of n-butylnaphthaline sulfonic acid) with a surface tension between 0,025 and 0,030 $N{\cdot}m^{-1}$ is applied to the leaking joint. Judge the formation of foam and its stability.

8 Marking and instructions

8.1 Marking on packages

Packages of jointing compound shall be clearly and indelibly marked in the language of the country of destination with the following information:

a) the manufacturer's or supplier's name and/or registered trade mark;

b) the type (e.g. H for anaerobic jointing compound for metal threaded joints) for use with coarse threads;

c) the quantity of jointing compound in the package;

d) a unique identification mark providing traceability (e.g. a batch number) and production date or 'use by' date;

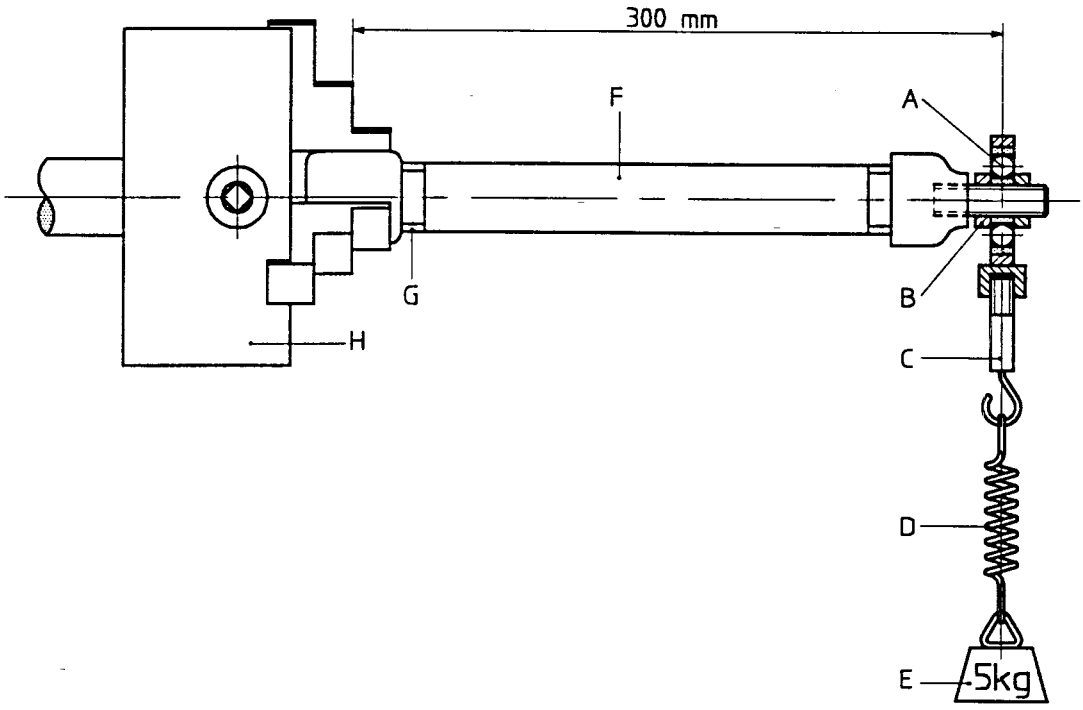
e) essential instructions for use storage and possible limitations;

f) appropriate handling and safety labelling.

8.2 Instructions

The data mentioned under a), b), e) and f) of **8.1** shall be included in the manufacturer's instructions and in the language of the country of destination.

At least one set of instructions shall be provided with each consignment.



A Ball race
B Nut
C Attachment
D Spring
E Mass
F Test piece, pipe length 250 mm
G Jointing compound to be tested
H Rotatable chuck

Figure 1. Vibration rig

List of references

See national foreword.

BSI — British Standards Institution

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