Materials for gaskets and weatherstrips for windows, doors, conservatories and curtain walling

Specification and performance requirements

Reference 345/2 October 2004

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Foreword

This specification has been prepared under the direction of the Windows and Doors Committee of the British Plastics Federation Windows Group in consultation with the Glass and Glazing Federation (GGF), the Council for Aluminium in Building (CAB), gasket and weatherstrip manufacturers and users. It is intended to complement BS EN 12365 by giving material requirements to enable agreement between the supplier and user (see BS EN 12365-1 clauses 5.3, 5.4 and 5.5) and to give guidance on the grades contained within that standard.

It applies to gaskets, co-extruded glazing beads, weatherstrips, cellular adhesive glazing tapes, sheathed cellular products, pile products and those incorporating fusion welded or moulded corner joints or any other appropriate method of jointing used in windows, doors, conservatories and curtain walling.

The performance of a gasket or weatherstrip is dependent on its design and the design of the system into which it is fitted. This is assessed by testing the performance of the complete assembly, for instance by testing to BS7412 for PVC-U windows. Similar tests may be necessary for windows of other materials.

This specification is intended to give the system designer and window fabricator information necessary to ensure the effective performance of the finished product.
1. Scope

This Trade Standard lays down the specification and the performance requirements for materials used in and the functionality of gaskets, co-extruded glazing beads, weatherstrips, cellular adhesive glazing tapes used in windows, doors, conservatories and curtain walling, primarily for domestic and residential use. It excludes butyl glazing tapes and other mastic materials, and any materials used in shutters. Methods of test are given in annexes A to D (normative), a method of assessing resistance to chemicals is given in annex E (informative) and information on environmental stress cracking is given in annex F (informative). Annex G gives guidance on the selection of grades from BS EN 12365-1:2003.

The requirements of this Trade Standard apply up the point of installation of the gasket or weatherstrip, provided the products have been stored and fitted in accordance with the manufacturer’s recommendations.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 903 : Part A33 Physical testing of rubber : Methods of test for staining in contact with organic materials

BS 903 : Part A43 Physical testing of rubber : Method for determination of resistance to ozone cracking (dynamic strain test).

BS 6100 Glossary of building and civil engineering terms

BS 7116 : Parts H and L Specification for double sided pressure sensitive adhesive tapes

BS 7386: 1997 Specification for Draughtstrips for the draught control of existing doors and windows in housing (including test methods)

BS 7412 Plastics windows made from unplasticized polyvinyl chloride (PVC-U) extruded hollow profiles – specification

BS EN 12608 : 2003 Unplasticized polyvinyl chloride (PVC-U) profiles for the fabrication of windows and doors – Classification, requirements and test methods

BS EN 681-1 :1996 Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber


BS EN 12365 : 2003 Building hardware. Gasket and weatherstripping for doors, windows, shutters and curtain walling.

   Part 1 : Performance requirements and classification
   Part 2 : Building hardware. Gasket and weatherstripping for doors, windows, shutters and curtain walling. Linear compression force test methods
   Part 3 : Building hardware. Gasket and weatherstripping for doors, windows, shutters and curtain walling. Deflection recovery test method
   Part 4 : Building hardware. Gasket and weatherstripping for doors, windows, shutters and curtain walling. Recovery after accelerated ageing test method
3. Definitions

for the purposes of this standard the definitions given in BS EN 12365-1 and in BS 6100 generally apply together with the following :

3.1 cellular adhesive glazing tape
flexible cellular strip, self adhesive on one or both surfaces, used as a glazing gasket

3.2 co-extruded
a product formed from two or more separate elements fused together within the extrusion process

3.2.1 flexible/rigid
a product where at least one element is rigid and at least one element is flexible

3.2.2 multiple hardness
a product where all elements are flexible but of more than one hardness

3.3 partial fusion
a co-extrusion process in which the elements are designed to be separated by tension, applied manually

3.4 full fusion
a co-extrusion process in which the elements are designed not to be separated by tension applied manually

3.5 co-extruded glazing bead or main frame profile
profile in which a flexible weatherseal or glazing gasket (q.v.) is fused to a main frame or ancillary profile

3.6 glazing gasket
pre-formed resilient material used to seal a fixed joint between glass (or other infilling) and frame and/or between glass/infilling and glazing bead

3.7 minimum working temperature
temperature below which performance deterioration due to temperature can be expected. The minimum working temperature is declared by the manufacturer

3.8 pile
product consisting essentially of filaments secured to a rigid or flexible backing

4. Performance requirements

All glazing gaskets and weatherstrips shall be classified in accordance with BS EN12365-1 : 2003, and with Table 1 of this specification. Annex G gives guidance on the grades contained within BS EN 12365-1 : 2003
The manufacturer shall declare into which category the product falls.

5. Coding

BS EN 12365-1 : 2003 clause 4.1 requires gaskets and weatherstripping to be classified using a six digit coding system. In some cases, products may overlap the grades given in BS EN 12365-1 : 2003. In these cases the coding shall include all relevant grades.
<table>
<thead>
<tr>
<th>Material Characteristic</th>
<th>Extruded and Moulded</th>
<th>Pile</th>
<th>Sheathed cellular</th>
<th>Co-ex multiple hardness</th>
<th>Co-ex flexible/rigid</th>
<th>Cellular adhesive tape (External use)</th>
<th>Cellular adhesive tape (Internal use)</th>
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</thead>
<tbody>
<tr>
<td>UV Resistance</td>
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<td></td>
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<tr>
<td></td>
<td>When tested in accordance with BS EN 12608 Clause 5.8.3, there shall be no cracking or crazing. Products shall exhibit a colour change of no more than ?E*=5</td>
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<tr>
<td>Colour fastness¹⁾</td>
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<td>Where colour change due to artificial weathering forms part of the contract, products shall be tested in accordance with BS EN 12608 Clause 5.8.3 and the limiting colour change agreed between supplier and customer</td>
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<td>No requirement</td>
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<tr>
<td>Staining and migration²⁾</td>
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<td>When tested in accordance with annex A there shall be no contact or migration stain and the average mass gained shall be no more than 5 mg.</td>
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<tr>
<td>Reversion</td>
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<td></td>
<td>When tested in accordance with annex C, there shall be no more than 2% shrinkage in length</td>
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<td></td>
<td>When tested in accordance with BS EN 12608 clause 5.5 the maximum reversion shall be no more than 2% for co-extruded main frame profiles and 3% for co-extruded ancillary profiles</td>
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<tr>
<td>Wear resistance</td>
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<td>Where wear resistance forms part of the contract between supplier and user, weatherseals are tested in accordance with BS 7386 clause A.8 (test surface PVC-U) compressed/deflected to the manufacturer's recommended compression/deflection levels and visually examined. There shall be no loss of product integrity and any reduction of working range shall not exceed the values given in BS EN 12365-1:2003 clauses 4.6/4.7</td>
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<td></td>
<td>No requirement</td>
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<tr>
<td>Property</td>
<td>Requirement</td>
<td>Testing Requirement</td>
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</table>
| **Adhesion**                  | No requirement                                                               | When tested in accordance with annex B the tear on all samples shall not propagate along the interface between component elements for a distance of more than 5mm at any one point.  
|                               |                                                                               | When tested in accordance with BS 7116 : Appendix H the minimum tensile adhesion at 23 °C shall be a minimum of 26 N/cm².  |
| **Ozone resistance**          | When tested in accordance with BS 903:Part A43 with conditions in accordance with BS EN 681-1 clause 4.2.9 the test pieces shall show no cracking after 96 h. |  |
| **Water absorption**          | No requirement                                                               | When tested in accordance with annex D there shall be no increase in weight/vol. Greater than 3%  |
| (open cell products only)     |                                                                               |                                                                                      |
| **Dynamic shear**             | No requirement                                                               | When tested in accordance with BS 7116 : Appendix L at 23 °C the dynamic shear strength shall be a minimum of 14 N  |
| **Chemical resistance**       | Assessed in accordance with annex E                                           |                                                                                      |
| **Environmental stress cracking** | Assessed in accordance with annex F                                               |                                                                                      |

1) Where colour consistency is important it should be agreed between supplier and customer
2) Only the migration test is carried out on cellular adhesive tapes
3) Partial fusion co-extrusions are excluded from the tear test requirements
4) All component interfaces to be tested
5) The adhesion test for cellular adhesive tapes is not designed to assess enhanced security. For these aspects reference should be made to BS 7950 and PAS24
Note. The manufacturer should provide details of any requirements concerning chemical and ozone resistance
Annex A Migration and staining (normative)

A.1 Apparatus

An electrically heated oven, thermostatically controlled, with re-circulating fan, set at 70 ± 2 °C.
Glass plates with dimensions of approximately 70 mm x 30 mm x 4 mm.
A desiccator.
A balance capable of weighing to ± 0.0001 g.
(500±5) g weights.

A.2 Test pieces

Ten pieces of framing material are required to make up the test sandwiches. They should be prepared from window profile to present rectangular flat surfaces of 10 mm x 20 mm for the migration test (four pieces required) and of 20 mm x 30 mm for the staining test (four pieces required). The remaining two pieces, 20 mm x 30 mm, are retained as controls.

Four flat rectangular pieces of flexible gasket material (hereinafter known as test samples) shall be prepared with dimensions (10 ± 0.5) mm x (20 ± 0.5) mm x (1 ± 0.2) mm.

A.2.1 Migration test pieces

Two test samples shall each be sandwiched between two of the 10 mm x 20 mm frame pieces prepared as above.

A.2.2 Staining test pieces

Two test samples shall each be sandwiched between two of the 20 mm x 30 mm frame pieces prepared as above.

A.3 Procedure for the migration test

Condition the test pieces of frame material and flexible material for (24 ± 0.5) h at (23 ± 2) °C and (50±20) % RH. Separately weigh them using the balance, assemble them into the two test sandwiches and weigh the control pieces. Place the two test sandwiches in the oven between the glass plates and place a load of (500 ± 5) g centrally on each assembly. Place the two control test pieces face to face in the oven and place a load of (500 ± 5) g on top.

Leave the assemblies in the oven at (70 ± 2) °C for (20 ± 0.5) h, then remove the loads and take out the sandwiches and controls, separate them and allow to cool in the desiccator at (23 ± 2) °C for (24 ± 0.5) h and (50±20) % RH. Weigh again the component parts. Calculate the average mass gained by each pair of test pieces (M1) and correct the figure by subtracting the total change in mass of the two controls (M2). Record the result which is the average corrected change in mass of the two test sandwiches.

Note 1. The loss in weight of the flexible material during the test can be due to both migration and evaporation.

Note 2. No other material shall be present in the oven during the test which might be absorbed by the frame pieces or by the flexible material.
A.4 Migration test report

The test report shall show the following:

(a) The migration result average for the two components per sandwich.
(b) The correction figure - total control change in weight.
(c) The average change of each flexible test piece.
(d) The corrected result (M1 - M2).

A.5 Procedure for the staining test

Condition the test pieces of frame material and flexible material for (24 ± 0.5) h at (23 ± 2) °C and (50±20) % RH and assemble them into the test sandwiches. Place the sandwiches in the oven at (70 ± 2) °C between glass plates and place a load of (500 ± 5) g centrally on the assembly. Position the two control test pieces face to face between glass plates in the oven similarly surmounted by a (500 ± 5) g load. Remove the load after (24 ± 0.5) h and remove all the test and control pieces. Separate them and allow to cool for (24 ± 0.5) in the desiccator at (23 ± 2) °C.

Expose the test pieces with the faces formerly in contact with the flexible material, along with the controls, facing towards the source for (120 ± 5) min under the mercury arc lamp using their radiation conditions defined in BS 903 : Part A 33.

Record any staining and whether it is contact staining or migration staining. Staining is determined by visual comparison with the controls.

Note 1. Reference to the size of the original flexible components will establish whether the staining, is contact or migration, i.e. if the staining does not exceed beyond the limits of the flexible element with which it is contact; if the staining extends beyond the area of contact with the flexible element then the staining is migration.

Note 2. Care should be taken to ensure that nothing is present in the oven which might cause extraneous staining during the test.

A.6 Staining test report

The test report shall include the following

(a) The presence of any staining.
(b) Whether any staining is contact or migration.
Annex B Tear test (normative)

B.1 Apparatus

*electrically heated thermostatically controlled oven with air circulating fan,* set at \((70 \pm 2)\)°C. The heating capacity shall be such that, after insertion of the test specimens, the test temperature is regained within 15 min.

B.2 Test pieces

Six test pieces \((200 +5, -0)\) mm long shall be taken from the component.

B.3 Conditioning

The test pieces shall be conditioned for at least 30 min at \((23 \pm 2)\)°C prior to testing.

B.4 Procedure

Place three test pieces in the oven for \((30 +5, -0)\) days.

Remove the samples from the oven and allow to cool at \((23 \pm 2)\)°C for at least 24 h.

With a thin bladed knife, cut all of the six test pieces as close to the interfaces as possible, for a distance of \((25 \pm 1)\) mm from one end. Grip each free end of the component and apply a tensile force perpendicular to the plane of the section (see figure B.1). Continue until either the component elements are fully parted, or until either of the component elements tear off during the test.

![Figure B.1 tear test](image-url)
Annex C Reversion (normative)

C.1 Apparatus

A thermostatically controlled electrically heated air oven with circulating fan the whole interior of which is controlled at the maximum temperature. The heating capacity shall be such that after insertion of the test pieces, the maximum working temperature is regained within 15 min.

A talc dusted stainless steel plate not exceeding 2mm thick.

A glass plate not exceeding 4 mm thick

A fine felt tip pen

A distance measuring device capable of reading to an accuracy of at least 0.1 mm.

C.2 Test pieces for products other than cellular foam tapes

Three test pieces, (1000 – 0 + 10) mm long, shall be taken. Lines shall be drawn across the face of each test piece (10 ± 1) mm from the ends of the samples.

C.3 Test pieces for cellular foam tapes

Three test pieces, (300 - 0 + 10) mm long, shall be taken. They shall be stuck onto the glass plate. Lines shall be drawn across the face of each test piece (10 ± 1) mm from the ends of the samples.

C.3 Conditioning

The test pieces shall be conditioned at (23 ± 2) °C for at least 30 min prior to testing.

C.4 Procedure

Measure the distance between the mid-points of the lines on each face within ± 1 mm.

Place the samples horizontally in the oven. The products other than cellular foam tapes shall be placed in a position that will ensure the minimum contact with the talc-dusted shelf.

NOTE 1. This part of the process is extremely important to ensure accuracy and consistency. It is recommended that drawings or sketches are produced which show the point contacts so that the test is carried out the same way every time.

Heat for (336 +5 -0) h at the maximum working temperature. The test time shall commence when the maximum working temperature is regained.

Remove the plate with the samples and allow to cool at room temperature until the profile surface temperature has reached (23 ± 2) °C, exercising care in handling.

Measure the distance between the mid-points of the lines on each face and calculate the reversion as follows:

\[
\text{% reversion} = \frac{\text{measured difference}}{\text{original measured length}} \times 100
\]

Record the individual values for each face of each of the three samples and calculate the mean reversion for each of the three samples.
C.5 Test report

The test report shall show the percentage reversion of each test piece and the test temperature.
Annex D Water absorption test for self adhesive cellular glazing tapes (normative)

D.1 General

This annex gives a method of test to determine the absorption of water by self adhesive expanded flexible cellular foam material.

D.2 Apparatus

De-ionised water

Micrometer capable of measuring to ± 0.01 mm

Absorbent paper

Analytical balance capable of weighing to ± 100 µg

D.3 Test pieces

Laminate pieces from the cellular adhesive tape into three test specimens 50 ± 1.0 mm square by between 12 mm and 15 mm thick.

D.4 Conditioning

Condition the test specimens at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 2 h before testing.

D.5 Procedure

Accurately measure the volume and weight of each specimen. The samples shall then be placed and retained in a suitable container which is filled with de-ionised water to give a 50 mm head of water above the sample.

After immersion for (24 ± 0.5) h, using the absorbent paper, remove the specimens and carefully blot any excess surface water from the surfaces of the specimens.

Re-weigh the specimens and calculate the weight of water absorbed (w) in g. Determine the volume (v) in cc of the specimen. Determine the water absorption (W) of each specimen expressed as a percentage weight/volume by using the following formula:

\[ W = \frac{w \times 100}{v} \] (\%)
Annex E: Assessment of Chemical Resistance (informative)

E.1 General
In use, gaskets may be called upon to resist exposure to chemicals such as those used for the cleaning of building façades. The risk of damage to the gasket material should be based on experience of the chemicals when used in similar situations. Where such experience is not available, the following tests of chemical resistance may give guidance to those responsible for the building’s continued functionality.

It is emphasised that the tests listed below are qualitative in nature. An adverse reaction to any one of the tests should prelude either more quantitative testing or a search for an alternative cleaning process.

A practical difficulty which may compromise the result lies in the acquisition of samples representative of the installed gaskets, both in terms of equivalence of chemical composition and in ageing exposure to UV or atmospheric pollution. A result giving no adverse reactions therefore, whilst offering encouragement to “proceed with caution”, cannot be taken as a guarantee of satisfactory performance in use.

The assessment process involves exposing a representative sample of gasket material to the chemical under investigation, followed by a series of qualitative assessments.

E.2 Test Specimens
2 pieces of the gasket material not less than 50mm in length taken either from the installed lengths or selected from representative stock.
4 pieces of frame material cut from window profile, representative of the installed profiles and of dimensions appropriate to ensure contact between each and the gasket sample over its full length, when sandwiched between them.

E.3 Procedure
• Apply a thin coat of the chemical onto the surface of the first gasket sample in a manner in which it would normally be applied in practice e.g.: by the use of a brush, rag, etc. Observe the drying time of the chemical and record any effects on the component after drying. Mark the inoculated sample for later identification.
• Assemble two test sandwiches each using one of the two gasket samples and the pieces of frame material. Place the sandwiches in the oven between glass plates and place a load of (500 ± 5) g centrally on the assembly.
• Leave the assembly in the oven at (70 ± 2) °C for (20 ± 0.5) h,
• Remove the loads and the sandwiches, separate the sandwich components, and allow them to cool in the dessicator at (23 ± 2) °C for (24 ± 0.5) h.
E.4 Assessment

The likely effects to assess are:

<table>
<thead>
<tr>
<th>Effect to be assessed</th>
<th>Description</th>
<th>Recommended Method of Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaching</td>
<td>- where the chemical’s effect might be to cause the gasket to stain contacting materials;</td>
<td>Examine the two contact faces of the frame material components of the Test sandwich to ensure that no discolouration has occurred which might be due to migration of components from the gasket material, after exposure to the chemical under investigation. Compare with the components of the control sandwich.</td>
</tr>
<tr>
<td>Discolouration</td>
<td>The gasket undergoes a marked and permanent colour change;</td>
<td>Carry out a visual comparison of the sample and the control gaskets.</td>
</tr>
<tr>
<td>Degradation</td>
<td>The surface quality of the gasket would be permanently impaired (e.g.: become tacky);</td>
<td>Carry out a tactile comparison of the sample and the control gaskets.</td>
</tr>
<tr>
<td>Swelling</td>
<td>The gasket’s cross-sectional area increases so as to impair its functionality or installed appearance.</td>
<td>Carry out a visual comparison of the sample and the control gaskets.</td>
</tr>
<tr>
<td>Embrittlement</td>
<td>The chemical dramatically accelerates the ageing process; the gasket becomes ineffective through loss of resilience.</td>
<td>Carry out a tactile comparison of the sample and the control gaskets.</td>
</tr>
</tbody>
</table>

E.5 Result

Since these assessments are qualitative in nature, it would be prudent for the outcome to be agreed between the parties and the agreement recorded.
Annex F Environmental stress cracking (informative)

Gasket materials intended for applications which may bring them into contact with plastic sheet materials formed from polycarbonates (PC), poly methyl methacrylates (PMMA), acrylo-nitrile butadiene styrenes (ABS) and other sheet materials and should be assessed for their propensity to induce environmental stress cracking (ESC) in these sheet materials.

Method 832A of BS2782: part 8: 1991 (now known as BS EN ISO 4599:1997) is the method of test that is recommended. Gasket suppliers should use typical samples of the sheet materials, specifying their provenance in any test results.

ESC resistance is known to vary with sheet formulation, and gasket users are therefore advised to confirm acceptable ESC performance by requiring the gasket supplier to test the performance of his product when in contact with a specific sheet. If based on EN ISO 4599, the in-house method of test used by a sheet manufacturer will probably suffice for this pre-use test.
Annex G Selection of grades from BS EN 12365-1 : 2003 (informative)

This annex is intended to give guidance to the system designer and/or fabricator on the selection of appropriate grades from BS EN 12365-1 : 2003. Selection of inappropriate grades can lead to poor product performance and/or costly over-specification.

Category of use

Some products will be designed either for gaskets applications or for weatherstripping. However, some products are designed to fulfil both functions and will be marked accordingly.

Working range

The working range of the gasket is determined by the design of the overall system. Factors for consideration include the size of the gap to be filled taking into account nominal gap size, manufacturing tolerances, hardware and its adjustability, wear, seasonal variations, wind load deflections, installation tolerances.

Linear compression force

Closing and operating forces, glazing method and other factors may influence the selection of linear compression force by the system designer.

Working temperature range

For normal climatic conditions in the UK, grade 2 is considered appropriate but certain micro-climatic conditions may exist, for instance in un-ventilated conservatories in direct sunlight, which may require higher performance grades.

Note. The maximum working temperature identified is also used as test temperatures for other performance aspects.

Deflection recovery

There is no way of defining specific deflection recovery values for all applications, but generally, static glazing gaskets can perform with lower deflection recoveries than dynamic applications such as weatherstrips. Higher deflection recovery may improve the long term performance of the finished product.

Recovery after ageing

There is no way of defining specific recovery after ageing values for all applications, but generally, static glazing gaskets can perform with lower recovery after ageing than dynamic applications such as weatherstrips. Higher recovery after ageing values may improve the long term performance of the finished product. Certain types of gasket and weatherstripping materials cannot be made into the tubes required by BS EN 12365-4. For the purposes of BS EN 12365-1 section 4.7, such products will be classified grade 1 : no requirement. However, this does not imply that such products perform poorly for recovery after ageing and alternative, equivalent recovery after ageing tests should be sought.