The Sealant Manufacturers Group within the **British Adhesives and Sealants Association (BASA)** has undertaken to promote the use of ISO 11600 for the mutual benefit of the manufacturers and users of sealants in construction and glazing. BS EN ISO11600, together with BS 6093 (Design of Joints and Jointing in Building Construction), BS 6213 (Selection Constructional Sealants), BS 8000. Pts 7 and 16 (Workmanship on Building Sites) form a powerful suite of standards, which if applied properly, will promote high quality products, increase sealant durability and improve site practice. At the same time poor products and application will be marginalised.

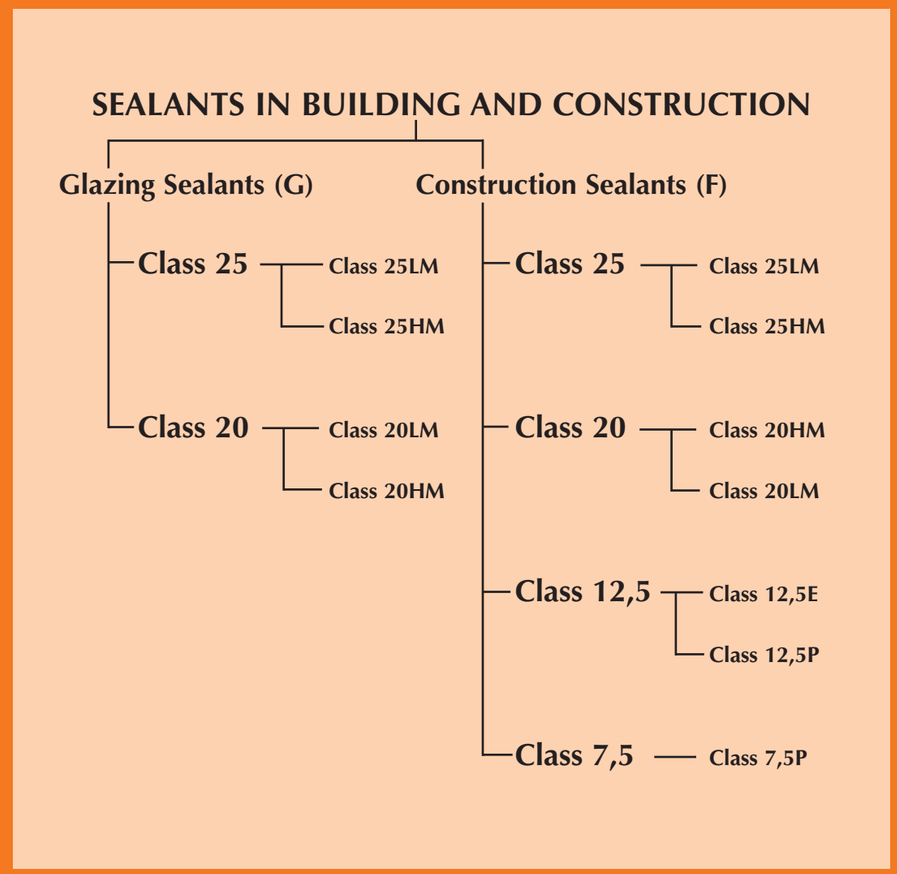
BASA is committed to raising standards in the industries it represents. In addition to this Guidance Note, the sealant manufacturing companies in BASA offer lectures and seminars on the selection of sealants.

For further information contact The Secretary.

BASA British Adhesives & Sealants Association
33 Fellowes Way, Stevenage, Herts, SG2 8BW.
Telephone: 01438 358514
or see details on the BASA web site **www.basa.uk.com**

Printed 1999

The BASA Guide to the ISO 11600 Classification of Sealants for Building Construction



The British Adhesives & Sealants Association

The Classification of Sealants for Construction and Glazing

The BASA Guide to BS EN ISO 11600 and its Application

Introduction

Part One: User Guide

Part Two: Determining Parameters for Sealant Classification (Test methods)

NOTES

with a room temperature tensile modulus greater than 0,4Nmm^{-2} is classed as high modulus (**HM**). Sealants of 0,4 Nmm^{-2} or less are classed as low modulus (**LM**).

These suffixes are used only with the high movement classes of elastic sealant (20 and 25), i.e. modulus is a more significant property in sealants used to seal joints likely to move a lot or rapidly. High modulus sealants used in these circumstances may place considerable stress on the building substrate and on the adhesive bond between sealant and substrate.

The modulus of a sealant can increase considerably at lower temperatures. Hence, BS EN ISO 8339 also measures the tensile modulus at -20°C. At this temperature a sealant with a tensile modulus greater than 0,6Nmm^{-2} is classed as high modulus, even if it tested as low modulus at room temperature.

Other factors in ISO 11600

i) Substrates and primers

The designation given to the sealant following classification indicates what substrates were used **in the testing** and if primers were used in the testing. This information will be shown on the sealant packaging. The specifier has to be satisfied that the sealant testing was relevant to the actual substrates to be sealed and, if necessary, ask for additional testing on specific substrates.
There are three standard substrates used in ISO 11600 tests, mortar, glass and anodized aluminium.

ii) Flow. Test method: BS EN ISO 7390.

ISO 11600 applies only to sealants used *in vertical joints*, i.e. non-slump products. This does not prevent the specifier from asking for a self levelling version of a particular ISO 11600 class sealant. The supplier will have to carry out a suitable test for self levelling.

iii) Loss of volume and mass. Test method: BS EN ISO 10563

There is a test for loss of volume and mass aimed primarily at water based and solvent based sealants.

iv) Adhesion

ISO 11600 looks at one of the key performance properties of sealants: **adhesion**.

In testing for recovery and movement capability, the sealant is examined for loss of adhesion.
There are tests which specifically look for the adhesive strength of the bond between sealant and substrate under a variety of conditions, such as after water immersion (**BS EN ISO 10590)** or after exposure to UV light, heat and water **(BS EN ISO 11431).**

Thus, in specifying a sealant using ISO 11600 the specifier can be confident there is no *serious* weakness in the adhesion of the sealant (primer) system. However, further assurances should be sought from the supplier, backed by case histories, that the *long term adhesion of the system is also proven.* In particular clear reference should be made to the adhesion of the particular grade of sealant to the specific substrates to be sealed

Introduction

Until 1993 there was no UK system of classification for the sealants used in construction and glazing. Sealants were specified using the standards for polysulfide and silicone sealants, including sealants of other chemical types. Nowhere in these standards was there a method to determine the movement capability of a sealant.

Earlier attempts to introduce a classification scheme for sealants were unsuccessful and so in 1993 BSI adopted the newly published ISO 11600, 'Building construction - Sealants - Classification and requirements'. The associated methods of test were also adopted, including a method which enables the producer to obtain a measure of the movement capability of a sealant. For a number of reasons, including the absence of promotion, BS ISO 11600 :1993 was not widely used and the old generic standards prevailed.

With the issue of an improved version and its adoption by Europe as a CEN standard, ISO 11600 is the recommended choice for the selection of sealants across the EU. However, it is because it works and is easy to apply that makes ISO 11600 acceptable to the industry. It allows the architect to describe the sealant for the designed joint by the use of some basic parameters (movement capability, elasticity and modulus) without the need to understand the underlying chemistry of the available products. Once the basic description is in place, the final choice of sealant is a cooperative process involving the sealant specifier and the sealant suppliers.

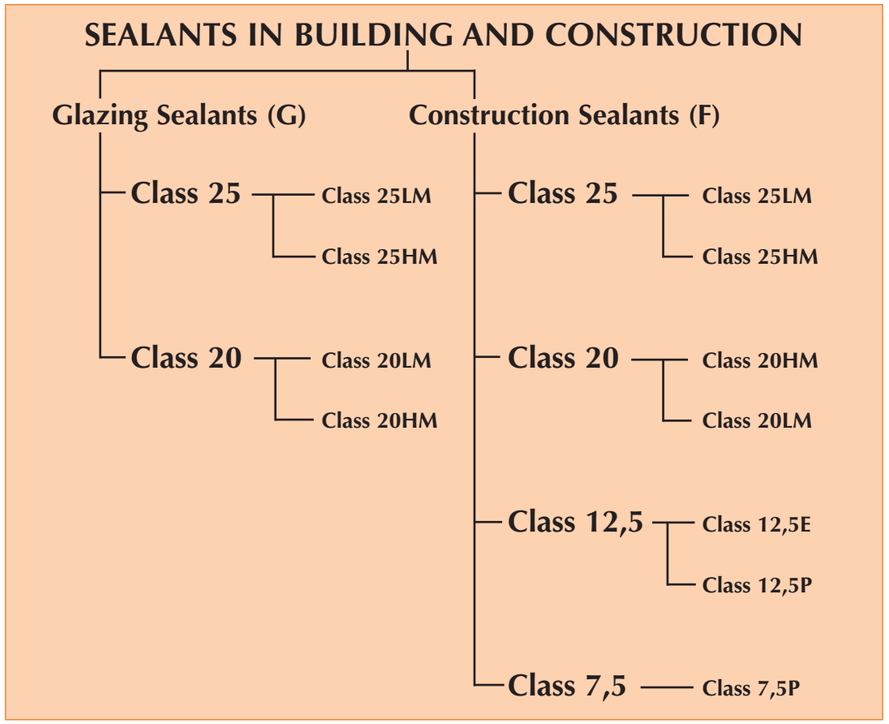
Part One: User Guide

The ISO 11600 Sealant Classes

There are 11 classes of sealant covered by the current ISO 11600 classification scheme.

- Four describe glazing sealants (Type G)
- Seven describe construction sealants (Type F - standing for Facade)

The 11 classes are:



In all classes the *number* refers to the movement capability.

The higher movement capability sealants (classes 25 and 20) are by definition elastic in their characteristics. The suffix E (for elastic) is only used with the class 12,5E sealants in order to distinguish them from products with little or no elastic characteristics, 12,5P (plastic) sealants. There are no elastic sealants in the 7,5 class.

The higher movement capability sealants are subdivided by modulus, being either low modulus(LM)or high modulus(HM)

recoveries, some with nearly 100% recovery. *For fast cyclic movement the specifier should consider the highly elastic products.*

Sealants with elastic recovery of less than 40% are classified as **plastic** (suffix **P**). Only the lower movement capability sealants carry this suffix.

In ISO 11600 much emphasis is placed on the elasticity of sealants. Whilst this is an important property for rapidly moving joints, it is not essential in all joints, for example joints which move once and are then subject only to small daily and seasonal thermally induced movement. These situations are often better served by the *stress relaxing*, elastoplastic sealants, a category not considered by ISO 11600. Specifiers should bear this in mind when considering their requirements

Movement capability

Test Methods: BS EN ISO 9046 and BS EN ISO 9047

In most sealant selection processes, movement capability is the key parameter, and so it is in ISO 11600. It is determined by subjecting the sealant to cycles of extension and compression. Elastic sealants are cycled through extension at -20°C and compression at 70°C to various amplitudes. Sealants classified as plastic (**P**) are cycled through extension and compression at various amplitudes, but at room temperature only.

The highest amplitude of the extension and compression that the sealant can survive under these test conditions is the **Movement Capability** of that sealant. In ISO 11600 the highest classification for movement capability an elastic sealant can claim is 25%, i.e. it survives intact having been tested at an amplitude of extension and compression of 25%. In reality there are many commercial sealants capable of obtaining a higher rating (e.g. 37.5% or 50%) and **BS EN ISO 9047 can be used to determine a sealant's ability to achieve these higher movement capabilities.**

However, the ISO sealant Committee took the decision to put the official upper limit for movement capability, for the time being, at 25%. The reason for this decision was one of caution. If sealants with higher movement capability are specified to seal narrow joints, then the margin for error is reduced and undue pressure is put on the builder to meet accurate tolerances in building components and construction. In addition, unless the sealant supplier can claim with confidence that the movement capability for the specified sealant will remain more or less unchanged *throughout the claimed life expectancy of the sealant*, it is better to build a margin for change in to the sealant/joint design. In future revisions, as experience and confidence in the ISO sealant classification scheme grows, it is anticipated these higher classes will be formally recognised.

Modulus

Test method: BS EN ISO 8339

The modulus of the sealant loosely equates with the cured hardness. In ISO 11600, the modulus is the force required to extend a sealant by a fixed amount, e.g. 100%. This is known as the tensile modulus. The units are newtons (N) per mm^2. A sealant

Part Two: Detailed description of the parameters used in determining the classification of a sealant according to ISO 11600

End Use (Type)

Sealants are separated into two categories by end use:

Type G Sealants for use in glazing, for example sealing glass into window frames.

Type F Sealants for use in building construction joints other than glazing, i.e. sealants designed for high movement joints, low movement joints, joints subject to cyclical movement, joints subject to one off movement, joints between the same or different substrates.

Many of the tests and requirements are similar for each of the two types.

However, only the higher movement class sealants are specified for glazing. *Plastic sealants, and elastic sealants with low movement capability, are excluded from the Type G classes.* Also, Type G sealants are subjected to a relatively short , but rigorous UV-water test (**BS EN ISO 11431**), which would prove difficult for a number of commercial glazing products of low performance and durability.

The Type F sealants encompass a much wider range of sealant types, from highly elastic/ high movement capability products to those which are plastic with low movement capability. Thus, within the Type F class, there is plenty of scope for the specifiers and the sealant producers, encompassing as it does all the commercial types of sealant currently on the market.

Elasticity

Test method: BS EN ISO 7389

As a prelude to determining the movement capability, the elastic recovery of the sealant is determined. In this test the sealant is extended by 100% or 60% and held in this extended position for 24 hours. It is then released from extension and allowed to recover naturally.

It is in the nature of polymer based compositions that most products will not totally recover their original dimensions. The degree to which they do is called **elastic recovery**. A sealant's elasticity determines its ability to perform in a continuously moving joint.

Sealants with an elastic recovery greater than or equal to 40% are classified as **elastic** (suffix **E**), but for the highest classes the elastic recovery has to be greater than 70%. Within these higher classes there will be sealant products with a range of elastic

The ISO 11600 Designation

In the sealant selection process the specifier matches his requirements to the products available on the market. Sealants classified using the ISO 11600 scheme are described in the producers' technical literature and on packaging labels using a designation which indicates the following:

- END USE - construction (F) or glazing (G)
- MOVEMENT CAPABILITY - in the range 7.5% to 25%
- MODULUS - high (HM) or low (LM) as defined in ISO 11600
- ELASTICITY - elastic (E) or plastic (P)

In addition, the types of SUBSTRATES used in the testing of the sealant are clearly shown and if a PRIMER or surface conditioner was used on those test substrates. This allows the specifier and end user to judge whether the substrates used in the testing were representative of the materials making up the actual joint to be sealed. There are three standard substrates used in ISO sealant testing, mortar, glass and anodised aluminium, but the specifier can request all tests (or specific ones) be carried out on the actual substrate materials to be sealed.

Thus in trade literature and on labels a sealant will be designated in one of two ways:

1 **Sealant ISO 11600** – TYPE – Movement Capability – Modulus or Elasticity – Test Substrates – Primer(s) Used

Example: Sealant used in glazing (glass into frames etc.) might carry the designation

Sealant ISO 11600 - G -20HM - glass, anodised aluminium

2 **Sealant ISO 11600** – TYPE – Movement Capability – Modulus or Elasticity

Tested on Substrates (using Primer(s))

Example: Sealants for use in fast moving joints in vertical structures might carry the designation

Sealant ISO 11600 - F - 25LM

Tested on mortar (primed), anodised aluminium, glass

How to use ISO 11600

The specifier considers the parameters given in the sealant designation:

F Class or G class

If the end use is to seal a joint in construction, for example between panels in a facade, in a brickwork wall, etc., the selection of the sealant will be from the F Classes. If the sealant is for glazing, the selection will be from the G Classes.

Movement capability

For joints in building construction (F) the specifier calculates the maximum amount of movement the designed joint will experience in its application, as a percentage of the minimum width the joint will obtain. A knowledge of the materials forming the joint, the maximum and minimum temperatures expected and other prevailing environmental conditions at the construction site is required. Standard calculations are used, for example as illustrated in BS 6093 and BS 6213.

For moving joints the elastic sealant classes will be selected (25, 20 or 12,5E). For low movement or non-movement joints the plastic sealants could be selected (12,5P or 7,5P). Cost consideration might exclude truly elastic sealants from being specified for low movement joints, although there may be other factors which offset cost.

For glazing (G) the specifier can choose a Class 25 or a Class 20 sealant, i.e. elastic sealants are always specified. The final choice will depend on the substrates other than glass (for example metal, plastic, wood etc.), the geometry and the dimensions of the sealant section. Narrow joints will probably require the higher of the two classes.

What happens if the joint design indicates movement will exceed 25%? In principle there is no ISO 11600 class of sealant available (see Part Two - Movement Capability). A sealant producer may offer a sealant with a movement capability exceeding 25%, measured using the test method prescribed by ISO 11600. However, the ISO designation cannot be used to describe this sealant and the specifier should seek further assurance from the supplier with regard to its long term performance if selected for the joint.

Elasticity

In the case of cyclic movement, lightweight materials (metals and plastics) will move rapidly. Here the elasticity of the sealant is an important property and a Class 25 sealant may be selected. Although the Class 25 and Class 20 sealants are elastic by definition, sealants within these classes have different levels of elasticity. For fast moving joints, a highly elastic sealant is preferred and advice should be sought from the supplier.

Heavier components, such as concrete cladding panels, will probably move more slowly due to inertial factors. Thus, a sealant with a lower level of elasticity might be selected, for example a Class 12,5E . ISO 11600 does not consider stress relaxation in sealants, an advantageous property in certain situations. The designer should ask the sealant producer for guidance.

Modulus

The specifier must next make a decision about the modulus of the sealant. Modulus is related to hardness, the higher the modulus, the harder the sealant. In general *low modulus sealants are preferred*, especially in moving joints. When a low modulus sealant is extended it puts less stress on the substrate and on the adhesion bond line than a high modulus sealant. This may be important if the substrate materials are weak and/or friable and for the long term durability of the adhesion. At low temperatures the modulus of a sealant can increase dramatically. ISO 11600 defines a low modulus sealant as one which remains low modulus at temperatures down to -20°C. This is a good reason to specify low modulus sealants in colder climates.

In some circumstances a harder, high modulus sealant can offer protection against outside factors such as abrasion, foot traffic or vandalism and may, therefore, be the preferred choice. If a high modulus sealant is selected for a moving joint it is important to ensure the sealant has adequate movement capability and that the substrate materials are strong enough to accept it.

Specifier's Sealant Designation

Having determined the requirements for movement capability, elasticity and modulus, the specifier can now write down most of the ISO 11600 designation for the sealant for example:

Sealant ISO 11600 - F - 25LM
or Sealant ISO 11600 - G - 25HM
or Sealant ISO 11600 - F - 7,5P

Other Sealant Requirements

The specifier must now prepare a checklist of the other requirements of the application. Typical items might be:

- life expectancy
- colour
- adhesion (list all substrates)
- non-staining
- non-slump
- fire resistance
- stress relaxation
- potential site problems with regard to access, etc.
- resistance to - list specific potential stress factors associated with the joint: fast movement, movement during cure, water, chemicals, abrasion, traffic etc.

Using your Sealant Supplier

THE FINAL SELECTION PROCESS CAN NOW BEGIN AS A CO-OPERATIVE EFFORT BETWEEN THE SPECIFIER AND THE SEALANT SUPPLIER. The specifier should approach their sealant suppliers as soon as the ISO 11600 designation and specific requirements have been defined. A list of sealant manufacturers who are members of BASA is available from the BASA secretary.