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Performance standards for butyl strip sealants in metal clad buildings

Introduction

Building Regulations Approved Document L2 has highlighted the critical role that sealants play in achieving buildings that are both airtight and weatherproof. However whilst the performance of most gun-applied sealants is specified in ISO 11600, that standard does not cover "butyl strip sealants" which are the major class of sealants used in metal clad buildings.

The aim of this document is to introduce a new performance standard for butyl strip sealants which will reassure specifiers and users that sealants, conforming to this standard, will be fit for the intended purpose and can be used with confidence.

Moreover there is an increasing requirement for higher performing sealants where such properties as extended life, higher movement accommodation or higher temperature performance are required. This new classification therefore covers both "minimum performance" (Class B) and "higher performance" (Class A).

This bulletin is designed to supplement the information contained in the NFRC "Blue Book" - Profiled sheet roofing and cladding - a guide to good practice, third edition.

Scope

This bulletin covers butyl strip sealants used in conjunction with profiled steel and aluminium sheeting including overlapping composite panels (flat interlocking composite panels are outside the scope) in typical weather conditions found in the UK.

The use of butyl strip sealant with fibre cement sheets is excluded as sealants are often not used with this type of sheeting because of the high pitch of the roof. Where they are used the required sealant properties are different due to 1. The low level of thermal expansion 2. Large gaps to be filled and 3. The heavier weight and absorbency of the material.

The generic term "butyl" in this document includes all types of synthetic rubbers (e.g. Butyl, PIB, Cross-linked butyl etc) used in the manufacture of strip sealants. This is because most modern strip sealants are made of a blend of rubber types depending on the properties required.

In order to help specifiers and users select a suitable choice of butyl strip sealant for any particular use, this type of sealant has now been classified into two groups "Class B" — minimum performance, and "Class A" — higher performance. Suitable test methods have been devised in order to address the major properties required.

Properties required of sealants

General:

The required properties of sealants are clearly laid out in the NFRC Blue Book section 8.2 which covers the properties of sealants both as a weather sealant and as a vapour sealant. However, with the introduction of Building Regulations Approved Document L2, the requirement for airtightness has been highlighted. Sealants play a vital role in achieving airtight buildings and special care needs to be taken when designing joints to ensure that a permanent airtight seal can be achieved.

Correct sealant should be specified and fitted at all laps (endlaps and sidelaps) of roof weather sheets, in order to achieve a fully watertight lap and to prevent leaks.

Note that vapour control and airtightness should always be achieved at the liner panel level of any site assembled system, on both roof and wall. It is therefore vital that correct sealant should always be specified and fitted at all laps (endlaps and sidelaps) of all roof and wall liner panels to achieve vapour control, prevent risk of condensation and to achieve airtightness.

Special care is needed at the ridges, eaves and hip joints, as well as any penetrations e.g. vents. In addition the sealant must be able to perform these duties for the design life of the building, which nowadays is often being extended.

Butyl strip sealants:

Butyl strip sealants are particularly good for use in these applications because of their ease of application, long life and performance characteristics. Increasingly, higher performance variants are being used where extended life is required or in particularly demanding joints e.g. rooflights.

Butyl strip sealants are composed of a blend of synthetic rubber, plasticisers, fillers and resins, the types of which and the ratios between them giving rise to the final properties of the sealant. This combination of butyl rubbers gives a final product which has a very low moisture vapour transmission rate. When used in a joint these sealants effectively prevent the passage of moisture vapour and therefore reduce condensation build up.

These compounds are extruded into a variety of different sizes, usually specified by the end-user to suit their application. They are usually intended to be fitted within a lap, and rely on compression of the strip to achieve a good seal. Products are usually extruded either as a rectangular or a round strip. For many years the typical dimension used has been 9mm wide by 3mm thick when sealing side and end laps on external sheeting. However, there are many other sizes available, and increasingly there is a tendency to specify other sections, for example round beads, square sections or U sections, as recent testing has shown that these shapes can fill bigger gaps and compress more easily. Applications for these shapes include end laps, gutters or rooflights.

Applications

The correct positioning of the fixings in relationship to the sealant is vital to ensure correct compression of the sealant and achieve a long life weatherproof joint. At end laps, two beads of sealant should be used, equally spaced from, and close to, the line of the fixings. On weather sheet side laps the sealant should always be on the weather side of the fixing. For specific dimensional/positional requirements it is best to seek the advice of the particular system manufacturer concerned.

In recent years film backed butyl tapes have been introduced to the market. These combine butyl strip sealants laminated to a non adhesive film, typically about 50mm wide and 1mm thick.

These products combine the low moisture vapour transmission rate of butyl with a strong tear resistant film and are extremely easy to use. They are simply applied over the lap joint rather than being compressed within the lap. They provide the only practical way to seal side laps of 0.4mm metal liners where the flexibility of the liner makes it extremely difficult to compress any sealant inside the lap.

End laps can either be sealed using standard butyl strip within the lap or these film backed butyl tapes applied over the lap. Care needs to be taken however when using these products on end laps as the tape must be applied very carefully onto the joint following the ridges and troughs. See manufacturers recommendations for further information. Recent testing at BRE has shown that taping the liner in the manner described significantly reduces condensation build up (BRE Report No. 16573) whilst substantially increasing airtightness.

Performance Classification

In order to assess the performance of strip sealants, and to enable them to be classified as category A or B, a series of test methods have been devised.

The full details of these tests and the pass fail criteria are given in Appendix 1 of the bulletin which is available separately on request. However a summary of the tests is as follows:

1. Adhesion before and after accelerated ageing

An important requirement of these sealants is to adhere to the various substrates used in the construction of a roof. This method quantifies the minimum adhesion levels. Heat ageing is an artificial way to simulate a long period of time in real life. Therefore, testing the materials after this ageing period gives an indication of how well the product will be performing after a lengthy period of real time.

Pass criteria
Class A & B - no loss of adhesion when the joint is extended by 30% of its compressed thickness before and after ageing

2. Resistance to slump and creep

The sealant must be able to stay within the lap joint, i.e. not slump or creep. This is a simple test to assess how well a sealant is able to withstand movement when subjected to a small continuous load.

Pass criteria
Class A - 50g weight – movement less than 5mm after a 7 day period
Class B – 12.5g weight – movement less than 5mm after a 7 day period

3. Water resistance

One of the most important properties of these sealants is the ability to form a waterseal. It is a property that is usually taken for granted. However, there is a very simple test that can be done to demonstrate that a sealant really is capable of forming a waterseal.

Pass criteria
Class A&B – no leaks during test period against the textured plastisol coated surface and the smooth alkyd paint surface

4. Force to compress by 20%

The ease of compression of a sealant is an important factor when joining sheeting. If a product is too hard to compress, then it can lead to distortion of the roof between fixings. This in turn could cause inadequate contact between the sealant and the top sheet, and hence an area where water could penetrate into the building. As many roofs are installed in cold weather, this test has criteria for maximum force to compress at two temperatures (23°C and 5°C).

Pass Criteria
Class A&B — for samples tested at 23°C, maximum compression 1.5kg/cm^2. For samples tested at 5°C, maximum compression 2.5kg/cm^2.

5. Shear strength before and after accelerated ageing

Being able to accommodate some movement in shear without breaking down is another important property required of a sealant. This test has been devised to try to simulate this movement under harsh conditions in order to ascertain how well a sealant will perform in this situation over a long period of time.

Pass criteria
Class A – minimum 60N shear strength before ageing. Minimum 70% retention of shear strength
Class B – minimum 45N shear strength before ageing. Minimum 45% retention of shear strength.

As shown above these tests include clear pass and fail criteria for conformance with each class. To be classed as either Class A or Class B a sealant must meet the requirements for that class in all the tests. If a sealant does not reach the minimum standard (Class B) then it is not recommended for use in industrial metal clad buildings.

Summary

The use of butyl strip sealants is vital to the performance of any metal clad building, especially now that the requirements of Approved Document L2 have come into force with the consequent need for high levels of airtightness.

This bulletin introduces a new classification for these sealants that will help in the selection of the most suitable sealant for the job. Sealants can now be classified as Class A or B depending on their performance in the detailed set of tests given in Appendix 1.

System manufacturers now have a generic standard to use in order to advise on the use of sealants in their particular systems. Sealants that do not perform to the minimum standard (Class B) are not recommended for use in industrial metal clad buildings.

Sealant manufacturers should be able to undertake the necessary testing in order to advise how their particular products are classed.

Sealant strip, either rectangular or round section, should be used to seal all roof weather sheet end and side laps. Correct positioning of the sealant close to the fixings is vital to achieve good compression of the sealant.

On all site assembled systems, sealant should also be used to seal all liner panel end and side laps, on both roof and wall, in order to achieve air tightness and good vapour control. On lightweight metal liner side laps this is best achieved using film backed butyl tapes which can be applied over the lap joint.

"Every care and attention was taken to ensure the accuracy of the information set out above. The information is intended for general guidance only and readers must take specific advice in relation to particular materials, techniques and/or applications".