Sealed Unit Manufacture and ‘Continuous Spacer bar’

Background

A typical double glazed unit is made from two leaves of glass separated by an aluminium spacer bar and a perimeter seal. The purpose of the unit is to provide structural protection from the elements combined with a higher level of thermal and acoustic insulation.

A double glazed unit will outperform single glazing by a around 400% in terms of heat loss, however with this extra performance comes an additional challenge in ensuring the unit is safeguarded from the phenomenon of ‘failure’, ie when the hermetic seal of the unit is broken, causing moisture to enter the cavity and the unit to ‘mist up’.

Constituent parts

It is often assumed that the cavity of a sealed unit is a vacuum. This is actually not the case but there are other elements which go towards ensuring the performance and longevity of the unit itself.

**Primary Seal**
The primary seal is made from a butyl polymer extruded onto the face of the spacer bar. This allows for adhesion of the two leaves to the bar during manufacture, and once the unit has been 'pressed' this butyl line flattens out and forms a continuous perimeter seal between the glass and the spacer. Not all manufacturers use a primary seal, favouring double sided tape or none at all.

**Secondary Seal**
The spacer bar is generally cut 25mm smaller than the glass size leaving a space behind the bar. The secondary seal runs between the two pieced of glass in this void and can be made from ‘hot melt’ or a two-part polyurethane. It is crucial that this seal must have an even depth, contains no voids and has the correct mix ratios to ensure a good cure and therefore mechanical strength.
Desiccant
The aluminium spacer is hollow and contains a molecular sieve known as desiccant. As the unit is sealed in an open air environment, the cavity will naturally contain moisture from the air. This must be removed, otherwise despite having a perfect hermetic seal, condensation will still occur due to this inherent moisture. The desiccant acts through small perforations in the spacer bar, drying the air and permanently locking moisture within the spacer bar.

Spacer Bar – Hand cut
Historically, the spacer within a unit has been made of 4 individual cut lengths of measured and cut bar - for a 500mm x 500mm unit this would be for example 4 x 488mm lengths. These are hand filled with desiccant and connected by L shaped corner keys. The finished bar will therefore have 9 constituent parts requiring assembly by an operator. There will be small gaps where the spacer bar is jointed at the corners, and being hand measured and assembled there is a risk of the bar being out of square risking an uneven seal depth. For large scale manufacture of 10,000+ sealed units this would mean the cutting, tracking and assembly of 40,000 hand cut lengths of aluminium and 40,000 plastic corner keys.

Spacer bar - Continuous
All large scale modern manufacturers have now moved to this method. With continuous bar, rather than individual lengths of bar joined together at the corners, one length is used. Here a specialist machine first saws the correct length, which for the same 500mm x 500mm would be just under 2m of bar. This spacer is then shaped by the machine into the required square, with a special tool bending and crimping the corners such as there is no break in the spacer itself at the corner points. Where the two ends pieces are connected, this will always be on one of the sides of the square typically around 80mm from the corner.

Around 200 units will be made in a batch by this machine, using stock lengths of spacer bar fed into the machine. These stock lengths are 5m long and are automatically jointed together by the machine as they are used as if to form one ‘continuous‘ flow (hence the name) with which to maximise usage and prevent off cuts. As spacer bar comes in 5M lengths, a typical continuous unit will therefore have one join of the stock bar and one join from the bending process. In certain units however, or at material changeover points there may be up to 4 joins. These joins are normal to modern manufacturing and do not affect the performance or longevity of the unit in any way.
Effect of manufacture method on failure rates

Cut bar hand made unit

Primary Seal - Being an inherent gap in the spacer at each corner, it is likely that the smooth and even application of the primary seal will be impaired. It will adhere less where the key breaks the surface of the spacer and thus is likely to be interrupted.

Secondary Seal - A hand cut bar will more than likely be hand gunned on a turntable and overfill at the corners will be ‘hand palleted’ in. Where this happens, it is likely voids can occur. Depth and consistency of seal can vary according to the positioning of the spacer bar and the skill of the operator.

Crucially, both of these potential faults occur at the corner of the units. As a cut bar has a physical break in the aluminium at this point, once either seal is breached the unit is virtually guaranteed to fail.

Desiccant - A cut bar will be ‘gravity filled’ with large desiccant granules, without accurate measurement.

Continuous unit

Primary Seal. It is far easier for the operator to achieve a consistent and even primary seal. As there are no joins in the corner the butyl will adhere and join on to itself in a continuous manner, and where there are joins in the spacer in the sides of the unit, these are easily covered in the smooth extrusion run along the edge.

Secondary Seal. A robot sealing head is used which permanently scans the seal depth and applies the correct volume at every point round the perimeter. At the corners, a slight overfill is purposely applied which is then rolled in to give a perfect seal. Any joins in the spacer along the sides will be covered in a good smooth ‘run’ of sealant rather than the turning action at the corner.

The use of continuous bar means that should either of these seals weaken at the corners, there is still an impregnable and solid aluminium barrier to further protect the unit.

Desiccant – This is injected directly into the bar through a small hole drilled by the machine. Not only is this accurately measured, but a special ‘mini – bead’ is used which will closer pack than standard desiccant. This means more fill and more moisture protection than in a cut bar.
Testing and Certification

It is not a legal requirement to use a certificated unit in any building works, and indeed a sealed unit can be made in a garage with some of the above materials. Clayton Glass however operates a full system of quality assurance, in house testing and external certification.

Working for blue chip customers, the military and many local authorities Clayton Glass has long held British Standard kitemarks for all of its products. The company is a market leader in the research and development of Argon gas filled units to further improve thermal efficiency, and has a approach pioneering in its testing methods looking at all types of seal and spacer construction. At the accession of the new European standards, Clayton Glass was at the forefront of conversion from BS to BS EN external accreditation. Copies of all of these certificates can be freely downloaded from our website for presentation to potential commercial clients.

Other Information.

Clayton Glass has been trading for over 50 years in the North East. It employs over 130 staff from its Stanley site, has a management team with over 100 years collective glass experience and makes around half a million sealed unit each year. Earlier this year the company was delighted to attend as finalists in the Company of the Year sector of the North East Business Awards. Further information can be found on the website, www.claytonglass.co.uk