Technical Application Report

Formed In Place Gasket (FIPG)

Gaskets can easily be overlooked when it comes to design and manufacture of many mechanical components. They may simply form a convenient seal to keep out contaminants, but more often they are critical to the function and long term reliability of the end product. In some cases they may consist of a simple 'O' ring or in other cases, form extremely complicated three dimensional shapes. They may have to withstand very high or low temperatures, large thermal cycles and be resistant to chemicals and other harsh environmental conditions. For maintenance purposes they are often required to allow for removal and reuse many times while retaining their flexibility and the ability to form an effective seal.

Major delays can be caused in the production process while the gasket is placed and held in position prior to applying any mechanical fixings. If not correctly positioned the gasket will often fail to provide a seal and result in costly product failure and reworking. To overcome these production problems many process engineers are turning to FIPG gaskets for a fast, cost effective alternative to the traditional pre-cut gasket.

FIPG: What is It?

FIPG is a relatively simple method using a liquid silicone adhesive sealant to form a gasket between two components. There are two processes: 1) The wet joint process, when the sealant is applied to one surface and immediately both components are then fixed together. This is a very fast process which has the added advantage of the sealant bonding to both components. However, it also has the disadvantage that should the components need to be taken apart again in the future, the gasket would be destroyed. 2) Post cure process, the adhesive sealant is used to form a gasket on one surface of the component which is allowed to cure prior to the final assembly process. The adhesive is therefore, bonded to one half of the assembly thus allowing for fast easy fixing during production. There is no need to position or hold the gasket in place and a perfect fit is guaranteed every time. If required the two components can be taken apart and the gasket will remain in its original position allowing for reuse.

These methods of producing gaskets have several advantages over using a pre-cut gasket:

- Fast accurate production
- Better resistance to heat differential expansion in bi-metal joints
- Reduces risk of shimmering (unwanted vibration between components)
- Better access for service or rework

Production Methods

Method 1

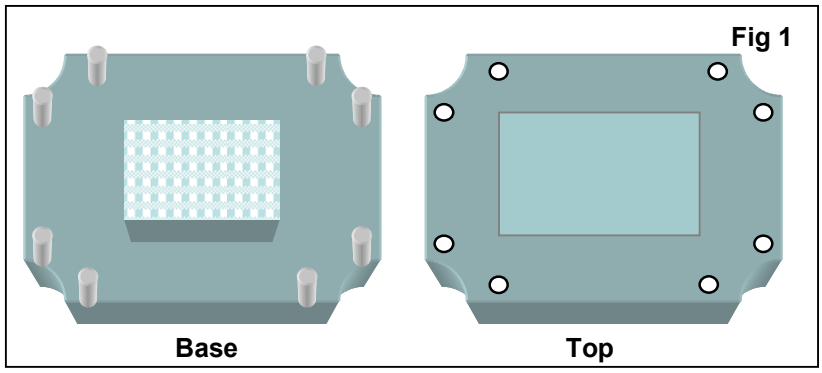
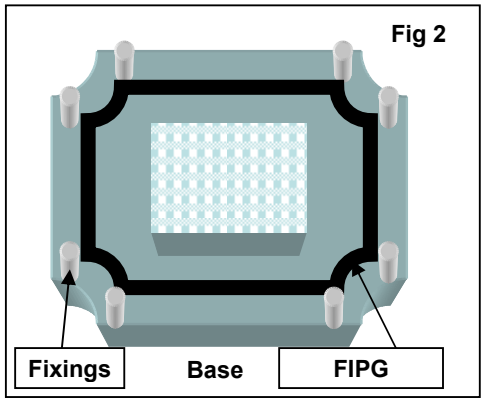
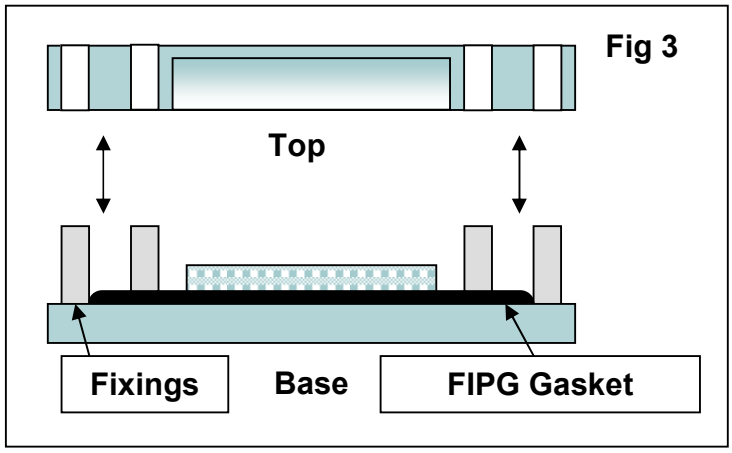


Fig1 shows a typical two component housing with a top and a bottom. A gasket seal needs to be provided between the two surfaces.



In **Fig2** a paste adhesive sealant is applied to one surface using a simple automatic dispensing system (shown below). The rheology of the sealant ensures that a raised profile is formed and this profile is maintained while curing takes place.



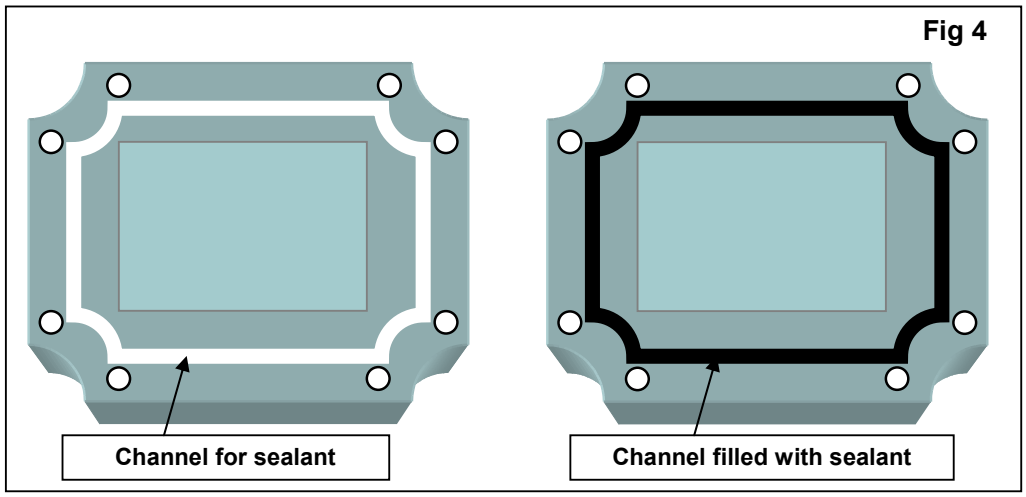
After sufficient time has been allowed for the sealant to cure the two components can then be placed together; see **Fig 3**. Mechanical fixings are used to hold the two components in place. The cured sealant is now compressed between the two surfaces to form a seal.

This method is particularly useful when the component surfaces are three dimensional. Using a three axis dispensing machine or an automated robot the sealant can be applied evenly to a three dimensional shape to provide an even and accurate gasket. Multiple gaskets can also be produced on one component where the sealing of several separate compartments or areas is required.

If the unit requires maintenance the gasket will remain in pace on one surface, allowing for easy reassembly.

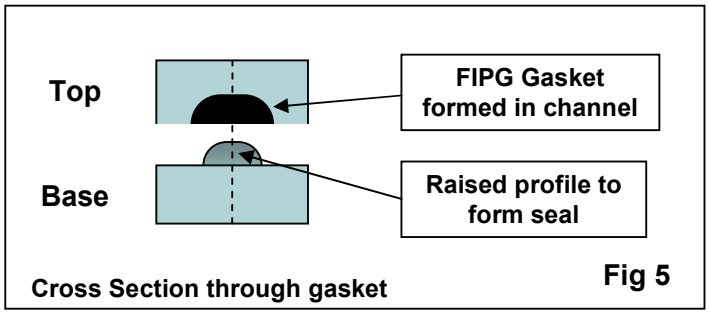
Method 2

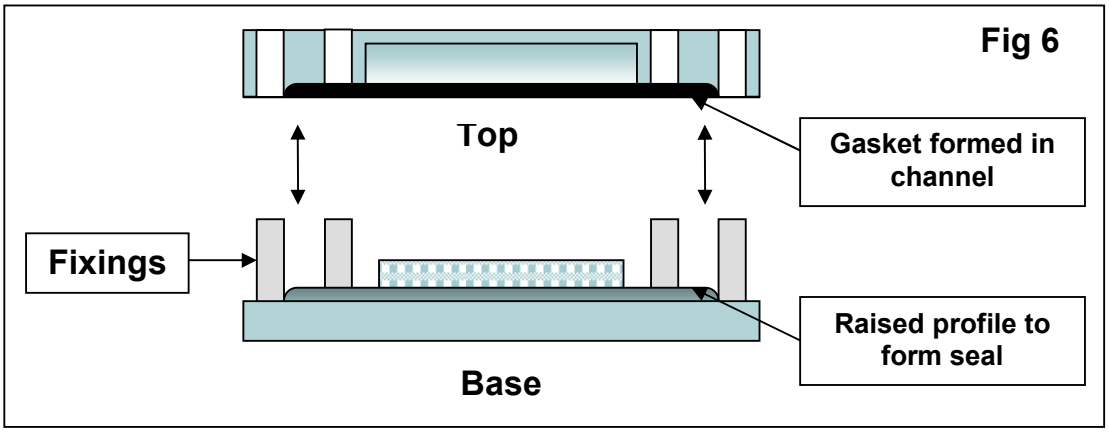
An alternative method can be employed on components that are only two dimensional; this is shown in **Fig4** below.



In the surface of one component a channel or groove is produced where the gasket is to be formed. This channel is then filled using a flowable or self levelling silicone adhesive sealant. The quantity of sealant is metered to fill the channel without overflowing onto surrounding surfaces.

On the other component a small raised profile is produced which follows the same outline as the filled channel in the first component. The centre line of the channel and raised profile would be the same. The width of the channel would be greater than that of the raised profile. See **Fig 5.** This will allow the raised profile to compress the seal evenly when the two components are assembled, using the mechanical fixings to apply pressure. See **Fig 6.**





This second method of forming the gasket has the added advantage of producing a seal which has greater mechanical strength and will therefore, be more suitable for high pressure applications.

Typical Example of FIPG

Using a recessed channel and raised profile

Top and bottom

Top section showing raised profile

Assembled unit

Bottom section with channel filled with sealant

Product Selection

Selection of the correct silicone adhesive sealant for use when making an FIPG is determined by both the method of production and the end application. The production methods will often dictate the rheology of the sealant, either a paste or flowable product. Other physical features of the sealant, such as flow rate, viscosity and extrusion rate, can affect both production speeds and the choice or design of the automated dispensing system. It is therefore, important to involve ACC Silicones and the equipment suppliers early in the design process.

Cure speeds and methods are crucial in order to maximise production efficiency. The chemical cure systems within silicone sealants produce by-products, some of which can be corrosive and harmful. These by-products can also affect the finished product and create H&S issues if they are not taken into account at an early stage.

Environmental operating conditions also affect the choice of sealant. What is the gasket providing a seal against, chemicals, oil, fuels, moisture, water etc? Silicones have proven excellent in resisting harsh operating conditions and maintaining their physical properties, but some silicone sealants are better suited to certain conditions than others. Extreme operating temperatures can degrade many gasket materials; this will result in a loss of elasticity which in turn will lead to product failures. ACC Silicones have products that will maintain their performance when exposed to very wide temperature ranges of -60^{o}C to +300^{o}C.

Other physical and electrical properties may be important and also add functionality to the gasket. Silicone is naturally electrically insulating but can be formulated to be electrically conductive. Thermal conductivity may be required to dissipate heat through the gasket into a heat sink or some other device.

ACC Silicones have a wide range of standard formulations and many more available to order. We also offer to work with our customer to create bespoke product to meet very specific design requirements. As the correct selection of product is crucial to product performance and efficient manufacturing, we encourage all our partners to involve our technicians in the design process and gain the benefit of our experience.

For the ACC Silicone range of sealants visit
http://www.acc-silicones.com/products/adhesives/adhesiveproductlist.ashx