Flange/Gasket Design Considerations

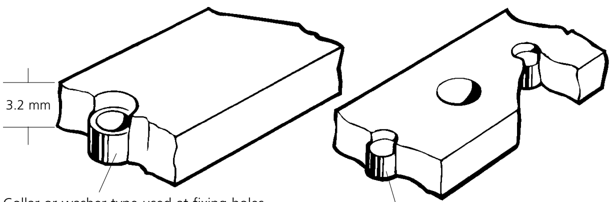
The design requirements for a gasket joint in a screened enclosure are primarily that there must be good conductivity between opposing flanges through the gasket. The first and most essential point is to ensure that the flange is in good contact with the screening gasket, with mating surfaces smooth, clean, flat and plated if necessary to provide a conductive surface. Poor conductivity between the flange and gasket will result in poor screening and, if there is no contact between the two the resulting gap, can act as a slot antenna transmitting energy at a wavelength that would be shorter than four times the gap length.

The compressibility of the gasket has to take into account any flange irregularities so that adequate compression is applied to the gasket along it's total length compensating for both high and low spots. The compression must not be so high that gasket damage occurs.

Surface Mounted Gaskets

With surface mounted knitted mesh and elastomeric gaskets,the aim should be to limit the compression of the gasket to between 10% and 50%, 10% being the minimum with a solid silicone style of gasket and up to 50% with a hollow tubular style. (Some form of compression stop or limit is essential with surface mounted gaskets to prevent over compression). Compression stops can be built into many styles of gasket, or made as an integral part of the flange. Their height should equal that of the maximum compressed height of the gasket. Compression stops fitted into gaskets can be in the form of collars or washers so that fixing bolts can pass through them (FIG. 1) or as solid studs located either side of a fixing bolt (FIG 1a).

FIG.1 FIG.1a

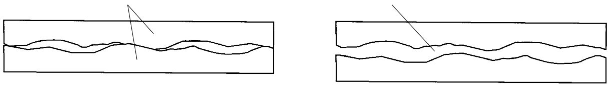


Collar or washer type used at fixing holes

Stud type used beside fixing holes

The thickness of the gasket for a known application can be calculated as follows e.g. Consider a gasket which can be compressed between 10% and 25% to be used on flanges which are not perfectly flat, i.e.the flanges without gaskets touch at some points and leave gaps in others. Since the gasket will compress between 10% and 25% we will require 25% compression at the high points and 10% at the low points (the 'gaps'). The greatest gap is therefore 15% of the gasket thickness. If that gap is 0.45mm, then a gasket of 3.0mm thickness is required (FIG. 2)

FIG.2 Surface Mounted Gaskets



25% Compression required where gaskets touch
10% Compression required at greatest gap
Gap = 15% of gasket thickness

This is fine in theory provided that the flanges do not 'bow' when placed under load. To overcome flange distortion, fixings may need to be added, the number of which will be determined by the flange stiffness. For example, a thin sheet metal flange may require many fixings per metre compared to over a metre spacing on a very stiff door return, such as that found on a screened cabinet.

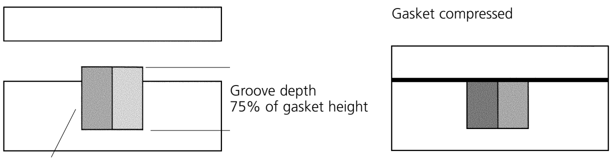
Gaskets in Grooves

For the typical electronic box, groove mounted gaskets are better than surface mounted gaskets because when the gasket is compressed in the groove the two mating flanges can come into contact with each other thereby enhancing the EMC performance with the advantage of the groove acting as a compression stop and therefore protecting the gasket from damage at the same time. Most types of gasket can be fitted into grooves, however it should be remembered that a sponge type of gasket will compress and change volume. Therefore the groove can be of a similar width to the gasket width. A solid silicone gasket, however, cannot change volume and requires room to deflect therefore requiring a larger groove to allow the compressed gasket room to deflect and fill the space provided for it.

Sponge Gaskets in Grooves

This theory is very similar to the calculation made for surface mounted gaskets. Considering a gasket of solid mesh 4.8mm high by 2.4mm wide attached to an environmental seal of silicone sponge with the same dimensions as the mesh giving a gasket 4.8mm square. The gasket will be compressed by 25% at the maximum point. The groove must therefore be 75% of the gasket height, or 3.6mm, with a width of 4.8 mm. There may be a slight interference fit of the gasket in the groove, however, as the gasket material is spongy and including the wire mesh, there is a lot of open volume. When the mating flange is fitted however, the gasket will compress into itself without damage into the groove and give a good environmental and EMC seal. (FIG.3)

FIG.3 Sponge Gaskets in Grooves



Solid and Hollow Gaskets in Grooves

Because solid and tubular style gaskets, when compressed, cannot change their volume the groove has to be larger in width to accommodate the change in shape, otherwise severe gasket damage can be caused when the flanges are fixed together. This can result in loss of compression on the gasket and 'compression set' occurring. This will give a reduction of shielding effectiveness, coupled with the possibility of environmental leakage (FIG. 4). The groove width should be from 5% to 35% larger than the gasket width, but this is dependent upon the gasket profile being used. For example, a round gasket has less volume than a square gasket of the same width/diameter.

The important factor is that in the worst case of high tolerances on the gasket size verses low tolerances on the groove size is that

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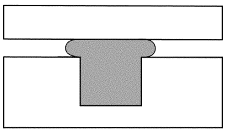
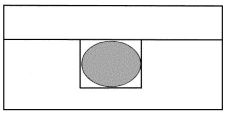
FIG.4 Solid and Hollow Gaskets in Grooves



Incorrect ratio of groove and gasket result :- Gasket damage

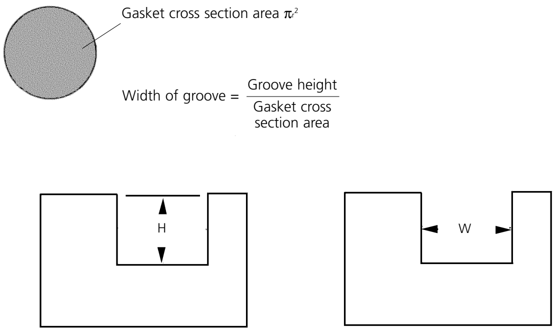


Correct ratio:- Groove width greater than the gasket diameter

when the gasket is compressed by both flanges it fills the available space by no more than 100%, ie: the volume of the accommodating groove with both flanges touching should be equal to, but be no less than the volume of the gasket cross section.

This can be calculated by dividing the height of the groove which, for example, would be 75% of the gasket height into the volume/area of the gasket cross section FIG 5.

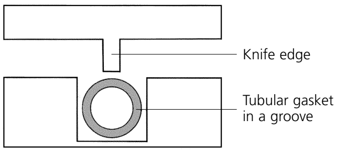
FIG.5 Calculating Minimum Groove Size

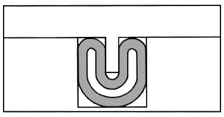


Knife Edge into Grooves with Tubular or Sponge Gaskets

Large applications, such as cabinets, may use an elastomer tube or sponge with knitted mesh fitted into a groove and the mating flange known as a knife edge. The knife edge plunges into the gasket causing the seal. With tubular gaskets the knife edge collapses the gasket rather than compressing it. The knife edge should not penetrate the gasket by more than 50% of it's diameter or there may be a danger of the gasket being unable to recover due to the excess pressure applied by the knife edge (FIG.5). This would not occur with sponge gasket types, but closure forces would be greater.

FIG.6 Knife Edge into Grooves with Tubular or Sponge Gaskets





Tube collapsed by a maximum of 50% of gasket height

The same policy applies to tube or hollow gaskets, however the forces used to compress the gasket are less thus enabling fewer fixings to be used.