HF Technology - Technical Newsletter

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EMC Gaskets

The need for EMC gaskets

EMC gaskets are used in places where parts need to be disassembled when needed or to avoid RF energy to leak. EMC Gaskets are widely available in different shapes and sizes. The material that is used also varies leaving the main question which gasket to use for which purpose. EMC gaskets are very useful to close gaps that leak RF energy. There are some factors that you have to consider when choosing the right gasket. The most important ones will be discussed in this article.

Ways to solve the leaks

The following types of gasket can be distinguished, depending on how electric contact is established

- Clamping
- Filling
- Covering

Clamping gaskets are for example fingerstock. These gaskets firmly press to the mating surface. Fabric over foam or knitted wire gaskets are examples of filling gaskets, compressed by two metallic parts. Shielding tape can be used as a gasket that covers seams. It is attached when the mechanical assembly is finished.

Gasket types

Each gasket behaves differently under varying conditions. The following table summarizes the advantages and disadvantages.

Mating surfaces and corrosion

Any gasket should remain its full shielding capabilities throughout its lifetime.

The galvanic series that are shown in table 1, provide information about the likelihood of corrosion between metals. If two metals are to be connected, it is best to select the materials of the same group. If two metals from differing groups are joined, the metal that forms the anode will corrode heavily.

Material	Advantage	Limitation
Conductive fabric over foam	Has the advantage of the resiliency of the foam material	Possible foam cracks or shifts position. Generally low shielding effectiveness.
Carbon-filled conductive rubber	Fluid and conductive seal.	Moderate shielding effectiveness
Silver-filled conductive rubber	Fluid and conductive seal. Good resilience, reusable and available in a wide variety of size and shape	Contact area might need special treatment due to silver content (corrosion).
Oriented wires in silicone rubber	Fluid and conductive seal. Might punch through corrosion films if ends are sharp.	More points of contact provide better shielding but require more material hence wider gaskets.
Fingerstock	Best suited for sliding contacts (clamping).	Environmental issues (Be-Cu), few points of contact if only one strip used, break easily.
Knitted wire	Most resilient gasket with most points of contact. Available in a wide variety of materials (corrosion). Available as all-metal gasket and knitted wire over foam.	Generally not available as sheet material. Damaged if over-compressed. Shielding effectiveness generally depends on wire density and compression force. Risk of metal debris falling into circuitry after cutting (dipping recommended).
Teethed or punctured Brass or Beryllium-Copper sheet	Best penetration of corrosion layers.	Generally not reusable. Low resilience.
Adhesive tape	Good shielding performance provided it's carefully applied.	Conductivity of glue doubtful. Not reusable: leaves residue. Long term stability questionable especially in differing environments.

HF Technology - EMC Gasket supplier
Please contact our sales departement for (stock) EMC Gaskets on phonenumber +31 (0)75 - 628 37 17

About the author
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Table 1: Galvanic series

Group	Material
Anodic end (corrodes easily)	
1	Magnesium and magnesium alloys.
2	Aluminium, aluminum alloys, galvanised steel.
3	Carbon steel, duralumin alloys, tin, tin-lead solder, iron.
4	Monel, silver solder, nickel, stainless steel, chromium.
5	Gold, platinum, graphite, titanium.
Cathodic end (corrodes difficultly)	

Table 2 shows how to proceed if two dissimilar metals are connected. Exposed implies that the joint not protected from possible climatologic environments. Sheltered implies that there is limited protection. Housed implies that the joint is fully protected.

Table 2: Materials mating restrictions

Condition of exposure	Anode, group I	II	III	IV	Cathode
Exposed	A	A			II
Sheltered	A	A			
Housed	A	A			
Exposed	C	A	B		III
Sheltered	A	B	B		
Housed	A	B	B		
Exposed	C	A	B	B	IV
Sheltered	A	A	B	B	
Housed	A	B	B	B	
Exposed	C	C	C	A	V
Sheltered	A	A	A	B	
Housed	A	A	B	B	

A. The joint must be covered by a protective finish to avoid liquid film (electrolyte) can be formed between the joined metals.

B. The joined metals may be exposed at the junction surface. The remainder of the metal must be covered with a protective layer.

C. Do not use unless a short lifetime can be tolerated. Protective coatings must be applied.

If, for example, aluminum (group 2, anodic) is bolted to stainless steel (group 4, cathodic) it is recommended to use a metal of group 3 as intermediate metal. The joint shall be covered by a protective coating in an exposed environment.

Shielding and contact pressure

Any gasket requires a minimum force to reach its optimum shielding performance. This means that the construction must be rigid enough not to cause slits that affect the shielding performance. However, contact pressure is limited: too much pressure will over-compress a gasket that causes damage to the material. Manufacturers specify the pressure range. In some cases, compression stops are available to avoid damage.

Slits, gaps and attenuation

If the required attenuation is high, it will become very difficult to obtain using one gasket if a big gap is to be filled. It is recommended to use two or more gaskets, one after the other. Note that the attenuation is frequency-dependent as well as material dependent. Low frequency attenuation often requires a thorough metal-to-metal contact with a high density material like wire mesh gaskets.

Figure 1 shows the case when two bolted sheets are deformed. The effective radiating area in [A] can be halved by inserting intermediate fasteners as shown in [B]. The general rule-of-thumb is that screws, bolts or the likes are spaced at a distance of in which is defined by the highest anticipated frequency.

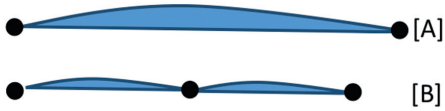

Figure 1

Gasket mounting

Gasket attenuation can easily be overruled by false mounting. For example if holes are drilled within the protected area.

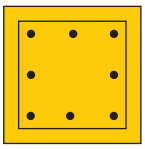

Figure 2

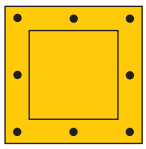

Figure 3

Figure 2 shows that the screw holes are placed at the inner side of the gasket. There is an increased risk of leakage due to the holes. This is not recommended. Figure 3 shows the gasket moved inside the screw holes. This practice is recommended as it deals with possible RF leaks.

Combined environmental and EMC gasket

Gaskets that combine the environmental as well as the EMC function do exist. When using these gaskets, one has to make sure that the EMC part is perfectly aligned with the mating surface for contact as figure 4 shows.

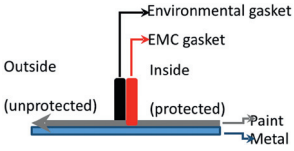

Figure 4
Precise painting required with combined gaskets.

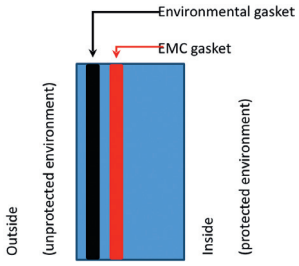

Figure 5
Two separate gaskets can be used instead as figure 5 shows.
Make sure that the environmental gasket also serves to protect the EMC gasket.