Mesh EMI Gasketing Selection Guide

EMI Shielding Plus
Environmental/ Pressure Sealing

Some gasket applications require only restoration of the shielding integrity of an enclosure, and can be satisfied with Chomerics’ simple MESH STRIP gasketing. In these cases, the use of MESH STRIP with Elastomer Core provides additional resiliency. Elastomer cored strips offer limited environmental sealing by positive blocking of dust and rain. Additional environmental sealing or exclusion of ventilating air or vapor requires a gasket such as COMBO STRIP, which incorporates a smooth, easily compressed, elastomer sealing strip in parallel with the EMI shielding strip. When an appreciable pressure differential must be maintained between the interior and exterior of an enclosure, in addition to EMI protection, materials such as CHO-SEAL conductive elastomers or POLA gaskets should be used.

Gasket Attachment and Positioning

Substantial cost savings can result from the careful choice of gasket attachment or positioning method, which often determines the final choice of material.

A. Groove Capture

This method is strongly recommended if a groove can be provided at relatively low cost, such as die-casting. (Caution: POLA-STRIP gaskets are essentially incompressible, although they seem to compress because the material flows while maintaining the same volume. Extra space must be allowed to permit the solid elastomer material to flow [see Figure 30].

B. Pressure-Sensitive Adhesive

This is often the least expensive attachment method for mesh EMI gasket materials. Installation costs are dramatically reduced with only a slight increase in cost over gasketing without adhesive backing.

3. MESH STRIP – The all metal and elastomer core versions of these with attachment fins can be held in position with non-conductive adhesive or epoxy if it is restricted to the mounting fins [see Figure 31c].

4. Frame Gasketing can be attached with a non-conductive adhesive or epoxy restricted to the aluminum extrusion [see Figure 31d]. However, most Frame Gaskets are attached mechanically with fasteners.

5. Dry Back Adhesive for Neoprene Sponge COMBO Gaskets – Factory-applied solvent-activated adhesive is recommended for several reasons: a) controlled application guarantees restriction of the adhesive to the nonconductive portion; b) controlled adhesive thickness assures reliable bonding without reducing compressibility; and c) the adhesive provides a permanent bond.

D. Bolt-Through Holes

This is a common, inexpensive means to hold gaskets in position [see Figure 32]. For most Chomerics metal shielding products, providing bolt holes involves only a small tooling charge, with no additional cost for the holes in the unit price of the gasket.
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Boltholes can be provided in the fin portion of MESH STRIP, or in rectangular cross section MESH STRIP if these are wide enough, (minimum width 3/8 in. (9.52 mm).

**Figure 3 Bolt-Through Gasket Mounting**

**E. Special Attachment Means**

Knitted mesh fins provided on some versions of MESH STRIP, and extruded aluminum strips on Frame Gasketing are designed for attachment (see Figure 33). Attachment fins can be clamped under a metal strip held down by riveting or spot welding, or can be bonded with a structural adhesive or epoxy. The aluminum extrusions in Frame Gaskets can also be fastened by riveting or bolting.

**Figure 4 Rivet or Spot Welding**

**Friction, Abrasion and Impact Considerations**

EMI gaskets should be positioned so that little or no sliding or shear occurs when compressed. In Figure 34a, the EMI gasket is subject to sliding as the door is closed, which may lead to tearing, wearing out, or detachment. Figure 34b illustrates the preferred position, in which the EMI gasket is subjected almost entirely to compression forces.

**Figure 5 a-b Sliding Motion vs. Straight Compression**

**Mesh Gasketing Materials**

**A. Knitted Wire Mesh**

Knitted wire mesh can be produced from any metal which can be drawn into wire form. However, the great majority of shielding requirements are readily satisfied with a choice of two materials – monel or Ferrex – both of which are standard production materials for Chomerics’ mesh gaskets.

Two design considerations should influence the choice of EMI gaskets:

- required shielding performance in E-, H- and Plane Wave fields,
- required corrosion resistance of the gasket.

Additional considerations include the mechanical strength, durability, resiliency and compression set of the gasket.

**Monel**

This good all-purpose nickelcopper alloy resists oxidation (thereby maintaining its conductivity), has good EMI qualities, and very good mechanical strength and resiliency. In controlled or protected atmospheres, it may be used in contact with aluminum; but where salt spray environments are encountered, galvanic corrosion is a problem.

**Note:** In salt spray environments, monel is corrosion-resistant, but when in contact with aluminum flanges, electrolytic currents will cause corrosion of the aluminum flange.

**Ferrex®**

Chomerics’ Ferrex tin-plated copper-clad steel wire offers the best EMI/EMP performance of the standard mesh materials, especially for H-field shielding. Its mechanical properties are very close to monel, and it is more compatible with aluminum, but it has poorer intrinsic corrosion resistance than monel.

With this understanding of material characteristics, gasket metal is usually chosen using the following guidelines:

- For low frequency magnetic field shielding: recommended gaskets are Ferrex versions of knitted mesh gasketing (provided corrosion resistance requirements are not severe).
- For high frequency electric field shielding: recommended gaskets are monel or Ferrex.
- For best corrosion resistance (except in contact with aluminum in salt spray environments where corrosion will occur): monel is recommended, preferably embedded in elastomer (e.g., POLA).
Chomerics Knitted Wire Mesh Products

MESH STRIP is available as resilient, single and dual all-metal strips or compressed shapes, with optional mounting fins. Both rectangular and round profiles are offered in a large range of standard dimensions for use as EMI gaskets where no environmental sealing is required (see Figure 6). Note: See also SPRINGMESH highly resilient wire mesh gaskets made from tin-plated steel wire.

![Figure 6](image)

Wire Mesh Frame Gaskets offer combinations of one or two round profile mesh strips, or one mesh/one pressure-seal strip (round or rectangular) with a metal mounting frame (see Figure 7). METALKLIP clip-on strips consist of wire mesh over elastomer core gaskets attached to metal mounting clips.

![Figure 7](image)

COMBO and COMBO STRIP Gaskets combine a low-profile, solid or sponge elastomer strip in parallel with one or two rectangular mesh strips (see Figure 8). With solid elastomers, the mesh strip has a higher profile than the elastomer, to allow for compression of the mesh.

![Figure 8](image)

MESH STRIP with Elastomer Core Profiles

Compressed Mesh Gaskets are jointless units made by diecompressing knitted metal mesh, usually in round or rectangular forms, with a constant rectangular cross section. Standard waveguide types are available, and Chomerics maintains a large selection of existing tooling for other annular types.

![Figure 9](image)

Wire Mesh Frame Gaskets offer combinations of one or two round profile mesh strips, or one mesh/one pressure-seal strip (round or rectangular) with a metal mounting frame (see Figure 7). METALKLIP clip-on strips consist of wire mesh over elastomer core gaskets attached to metal mounting clips.

![Figure 10](image)

B. Oriented Wire in Silicone POLASTRIP/POLASHEET are composite mesh and elastomer materials in which wire is embedded in part or all of the silicone elastomer. The mesh is in the form of individual wires oriented perpendicular to the joint mating surfaces, for maximum EMI shielding (see Figure 10).

![Figure 11](image)

Metalastic Gasketing is formed of woven aluminum mesh, filled with silicone or neoprene for pressure sealing. It is produced in 8 in. (20.3 cm) wide sheets in random lengths, in thicknesses of 0.016 in. (0.40 mm) and 0.020 in. (0.51 mm). The 0.016 in. (0.40 mm) material is the thinnest available for EMI plus pressure seal gasketing. It can be obtained in sheets, standard connector gaskets or custom die-cut configurations. It should only be used where joint unevenness is less than 0.002 in. (0.05 mm).

D. Expanded Metal Mesh PORCUPINE METALASTIC gasketing is a material composed of expanded Monel metal mesh, and is available with optional silicone filling. It is produced in sheets of continuous length, 12 in. (30.4 cm) by 0.020 in. or 0.030 in. (0.51 mm or 0.76 mm) thick. PORCUPINE METALASTIC gasketing is easily cut into intricate shapes with inexpensive rule dies, has high uniformity in thickness, ±0.004 in. (0.010 mm), and withstands high compression forces without damage. Available as sheets and standard connector gaskets, it can also be supplied in custom die-cut configurations. It should only be used where joint unevenness is less than 0.003 in. (0.08 mm) (see Figure 11).
EMI Shielding Theory

Magnetic Field Secondary Reflection Losses | k | I Figures 8 and 9:
To determine the magnetic field secondary reflection loss factor | k | I to solve for B:

Given: r = 2 inches for 0.0162 in.
thick copper and A = 1.3 dB.
Find B at 1 kHz.

a. Draw a line between copper
on the G/µ scale and r = 2
inches on the “source to shield
distance scale.” Locate a point
on the X scale.
b. Draw a line from the point on
the X scale to 1 kHz on the
f scale.
c. At its intersection with the | k | I
scale, read | k | I = 2.2 x 10⁻².
d. Proceed to Figure 9.
e. On Figure 9, locate | k | I = 2.2 x
10⁻² on the horizontal scale.
f. Move vertically to intersect the
A = 1.3 curve (interpolate),
and then horizontally to find
B = –8.5 dB.