

# 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.

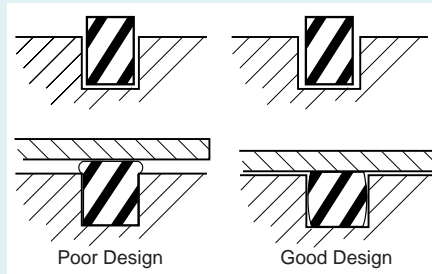
Additional environmental sealing or exclusion of ventilating air or vapor requires a gasket such as COMBO STRIP, which incorporates a smooth, easily compressed, elastomer sealing strip in parallel with the EMI shielding strip. When an appreciable pressure differential must be maintained between the interior 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



**Figure 30** Allowing for Solid Elastomer Flow in Groove Capture Attachment Method

without adhesive backing. In many cases customers purchase COMBO STRIP or COMBO Gasket materials for applications which don't require environmental sealing, but utilize the adhesive-backed rubber portion as an inexpensive, temporary attachment method ("third hand") during installation.

### C. Bond Non-EMI Portion of Gasket

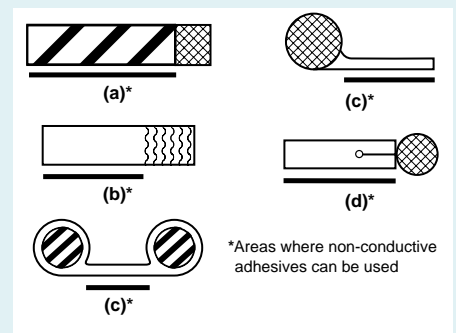
Non-conductive adhesives may be employed to bond an EMI gasket in position by applying adhesive to the portion that is *not the EMI gasket* (and which can be insulated from the mating surfaces by a non-conductive material).

**Note:** When specifying non-conductive adhesive attachment, applicable drawings and standard procedures for production personnel should emphasize that the adhesive is to be applied only to the portion of the gasket which is not involved with the EMI shielding function. The assumption that the gasket "will hold better if all of it is bonded rather than half of it" will result in serious degradation of EMI shielding effectiveness.

1. Figure 31a illustrates this method used for *COMBO STRIP* and *COMBO Gaskets*, in which only the elastomer portion is bonded to one of the mating surfaces.
2. "Combo" forms of *POLA-STRIP* may be bonded if, as in Figure 31b, the adhesive is restricted to

the non-conductive portion. Spot applications to the conductive area are permissible.

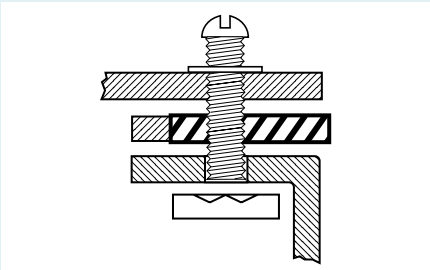
3. *MESH STRIP* – The all metal and elastomer core versions of these with attachment fins can be held in position with non-conductive adhesive or epoxy if it is restricted to the mounting fins (see Figure 31c).
4. *Frame Gasketing* can be attached with a non-conductive adhesive or epoxy restricted to 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 non-conductive portion; b) controlled adhesive thickness assures reliable bonding without reducing compressibility; and c) the adhesive provides a permanent bond.



**Figure 31 a-d** Application of Non-Conductive Adhesive

**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

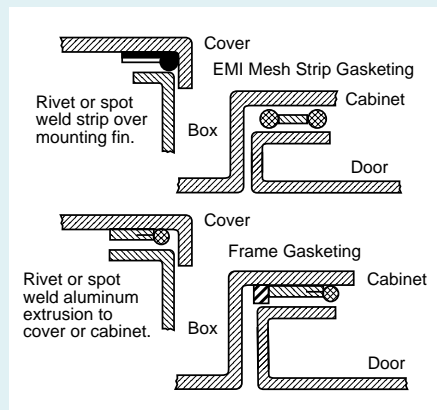
in the unit price of the gasket. Bolt-holes can be provided in the fin portion of MESH STRIP, or in rectangular cross section MESH STRIP if these are wide enough, (minimum width  $\frac{3}{8}$  in. (9.52 mm).



**Figure 32** Bolt-Through Gasket Mounting

### E. Special Attachment Means

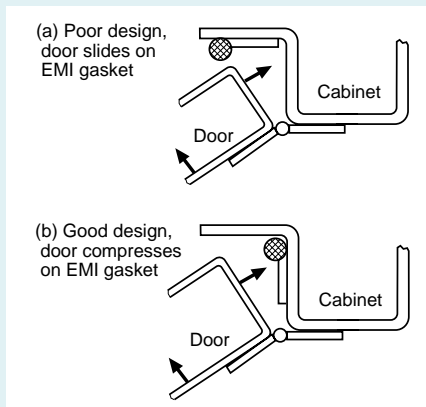
Knitted mesh fins provided on some versions of MESH STRIP, and extruded aluminum strips on Frame Gasketing are designed for attachment (see Figure 33). Attachment fins can be clamped under a metal strip held down by riveting or spot welding, or can be bonded with a structural adhesive or epoxy. The aluminum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



**Figure 33** 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 34 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 material.

### Monel

This good all-purpose nickel-copper 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.

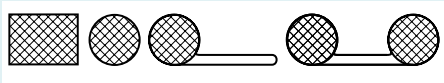
*For best corrosion resistance (except in contact with aluminum in salt spray environments where corrosion will occur):* monel is recommended, preferably embedded

in elastomer (e.g., POLA). Aluminum mesh is sometimes selected when equipment specifications permit no other metal to be used against aluminum mating surfaces, for galvanic corrosion compatibility. However, it must be understood that aluminum mesh oxidizes readily, and shielding effectiveness therefore degrades.

## Chomerics Knitted Wire

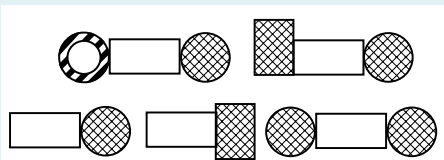
### Mesh Products

*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 35). *Note:* See also *SPRINGMESH* highly resilient wire mesh gaskets made from tin-plated steel wire, page 111.



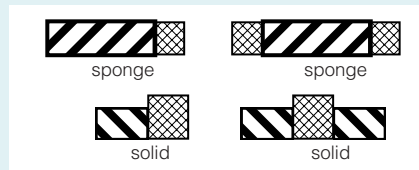
**Figure 35** MESH STRIP Gasketing Profiles

*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 36). *METALKLIP* clip-on strips consist of wire mesh over elastomer core gaskets attached to metal mounting clips.



**Figure 36** Frame Gasketing Profiles

*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 37). With solid elastomers, the mesh strip has a higher profile than the elastomer, to allow for compression of the mesh.



**Figure 37** Normal and High Pressure COMBO STRIP Gaskets

*MESH STRIP with Elastomer Core* is available in round or rectangular profiles, with solid or hollow elastomer, with an optional mesh mounting fin (see Figure 38).

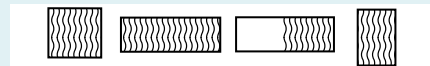


**Figure 38** MESH STRIP with Elastomer Core Profiles

*Compressed Mesh Gaskets* are jointless units made by die-compressing 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.

## 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 39).



**Figure 39** POLA Materials Profiles

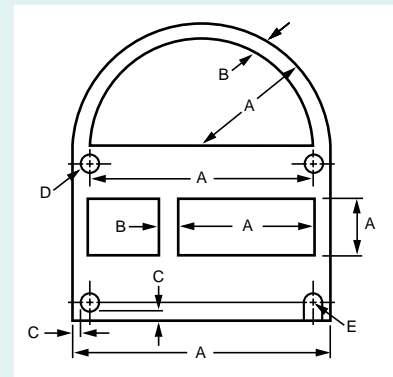
## C. Woven Metal Mesh

*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,  $\pm 0.004$  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 40).



**Figure 40** PORCUPINE METALASTIC Die-Cut Gaskets (fully dimensioned drawings required)

# Wire Mesh EMI Gasket Selection Guide

PRODUCT TRADE NAME	MESH STRIP™ (ALL-METAL)	SHIELDMESH™ COMPRESSED MESH GASKETS	MESH STRIP™ (ELASTOMER CORE) AND METALLOID® GASKETING	COMBO® AND COMBO® STRIP GASKETING	COMBO® GASKETS	FRAME GASKETING	POPCUPINE® METALASTIC® GASKETING	METALASTIC® GASKETING	POLASTRIP® GASKETING	POLASHEET®
Schematic Cross Section										
Construction	Formed or Compressed Knitted Wire Mesh	Formed or Compressed Knitted Wire Mesh	Knitted Wire Mesh Over Elastomer Strips	Formed Knitted Wire Strips in Parallel with Elastomer Strips; or Die-Cut Gaskets	Formed Knitted Wire Strips in Parallel with Elastomer Strips; or Die-Cut Gaskets	Formed Knitted Wire Strips Clamped in Aluminum Extrusions	Expanded Metal in Elastomer	Woven Wire in Elastomer	Oriented Wire in Matrix of Silicone Elastomer (available with pressure sensitive adhesive)	
Available Forms	Strips, Gaskets Made by Joining Strips	Jointless Rings or Rectangular Gaskets	Strips, Gaskets Made by Joining Strips, Clip-On Strips	Strips, Gaskets Made by Joining Strips	Die-Cut Elastomer with Joined EMI Strips	Strips, Fab. Lengths, Frames with Joined EMI Strips	Sheets, Die-Cut Gaskets	Sheets, Die-Cut Gaskets	Strips, Gaskets Made by Joining Strips	Sheets, Die-Cut Gaskets
EMI Rating <sup>(6)</sup>	>20- >30 dB >102 dB	>25- >30 dB >102 dB	>25- >35 dB >102 dB	>20- >30 dB >102 dB	>20- >30 dB >102 dB	>20- >30 dB >102 dB	>35 dB >102 dB	>35 dB >102 dB	>46 dB >102 dB	>35 dB >102 dB
Maximum Joint Unevenness, % of Gasket Height	30-40% 25-30% 20-25%	30% 25% 20%	30-50% 25-40% 20-30%	30% 30% 25%	30% 30% 25%	30% 25% 25%	15% 10% 10%	10% 7% 7%	20% 17% 17%	20% 17% 17%
Minimum/Maximum Height (mm)	0.062/0.500 (1.57/12.70)	0.040/0.375 (1.02/9.53)	0.125/0.750 (3.18/19.05)	0.062/0.375 (1.57/9.53)	0.062/0.375 (1.57/9.53)	0.062/0.250 (2.36/6.35)	0.020/0.030 (0.51/0.76)	0.016/0.020 (0.41/0.51)	0.062/0.312 (1.57/7.92)	0.030/0.250 (0.76/6.35)
Mfn. Width (Greater of Actual Dm. or Portion of Height)	0.062"/2H (1.57"/2H)	0.062"/2H (1.57"/2H)	0.62"/2H (1.57"/2H)	0.125"/2H (3.18"/2H)	0.125"/2H (3.18"/2H)	0.437 (11.0)	0.140 (3.56)	0.125 (3.18)	0.093"/2H (2.36"/2H)	0.125 (3.18)
Recommended Compression Pressure	5-100 (0.35-7.03)	5-100 (0.35-7.03)	5-100 (0.35-7.03)	20-100 (1.41-7.03)	20-100 (1.41-7.03)	5-100 (0.35-7.03)	20-100 (1.41-7.03)	20-100 (1.41-7.03)	20-100 (1.41-7.03)	20-100 (1.41-7.03)
Attachment or Positioning	Excellent	Excellent	Excellent	Good-Excellent	Excellent	No	No	No	Good	Possible
	Strips, N/A	N/A	N/A	Excellent	Excellent	N/A	N/A	N/A	Special	Excellent
	Versions with Fins Only <sup>(2)</sup>	*	Versions with Fins Only <sup>(2)</sup>	Good-Excellent	Good-Excellent	Poor <sup>(3)</sup>	Special	Special	Combo Version Only	N/A
	Poor to Good	Poor to Good	Poor to Good	N/A	N/A	N/A	No	No	Use Silicone Base Adhesive See Note 7.	Excellent
	Possible with Fin Versions <sup>(2)</sup>	N/A	Possible with Fin Versions <sup>(2)</sup>	Excellent	Excellent	Excellent <sup>(3)</sup>	Excellent	Excellent	Excellent	Excellent
Elastomer Temperature Range	N/A	N/A	-30°F to 150°F -34°C to 66°C	-30°F to 150°F -34°C to 66°C	-30°F to 150°F -34°C to 66°C	-30°F to 150°F -34°C to 66°C	N/A	-40°F to 225°F -40°C to 107°C	Special	Special
	N/A	N/A	-80°F to 400°F -62°C to 204°C	-80°F to 400°F -62°C to 204°C	-80°F to 400°F -62°C to 204°C	-80°F to 400°F -62°C to 204°C	-80°F to 400°F -62°C to 204°C	-70°F to 500°F -53°C to 260°C	Special	Special
Standard Metals Available in EMI Portion (others also available)	Monel Ferrex <sup>(1)</sup> , Aluminum	Monel Ferrex <sup>(1)</sup> , Aluminum	Monel Ferrex <sup>(1)</sup> , Aluminum	Monel Ferrex <sup>(1)</sup> , Aluminum	Monel Ferrex <sup>(1)</sup> , Aluminum	Monel, Ferrex <sup>(1)</sup>	Monel, Aluminum	Aluminum Only	Monel, Aluminum	Monel, Aluminum

(1) Ferrex® is Chomerics' trademark for tin-plated, copper-clad steel EMI gasketing.  
 (2) Two versions,  and  have fins especially designed for easy attachment.  
 (3) The aluminum extrusion is intended as a convenient means of attachment.  
 (4) Most products for which this method is suitable are available with "dry back" (solvent-activated) adhesives already applied.  
 (5) Available without elastomer in metal form only.  
 (6) These EMI ratings are based on MIL-STD-285 test methods and are useful for making meaningful qualitative comparisons between products in this table since all tests were conducted under similar conditions. They cannot be used to compare to other EMI gasket data unless those data were obtained by the same methods.  
 (7) Non-conductive RTV yields excellent results, but use sparingly. If more adhesive surface is needed, use conductive adhesive.  
 \* Pressure sensitive adhesive is available for certain mesh over core gaskets. Contact Chomerics for details.