TECKNIT®

EMI SHIELDING PRODUCTS

EMI Shielding Design Guide and Product Selection Catalog

TECKNIT EM! SHIELDING PRODUCTS

After World War II, the increased use of high frequencies in communications and electronic equipment created the crippling problem of Electromagnetic Interference (EMI). Tecknit was one of the pioneering leaders in the search for EMI shielding methods.

Founded in 1958, Tecknit at first specialized in the manufacture of wire based shielding products designed for military use. Since then, Tecknit has matched continuing advances in electronic technology by expanding its line of shielding products to include metal impregnated silicone elastomers, air vent panels, shielding windows, beryllium copper finger stock, coatings and a host of hybrid shielding products.

Today, Tecknit supplies shielding solutions to an ever widening range of technology companies, including telecommunications, aerospace, data communications, medical diagnostic equipment, test instrumentation, automotive, military, and information technology.

MANUFACTURING / ENGINEERING

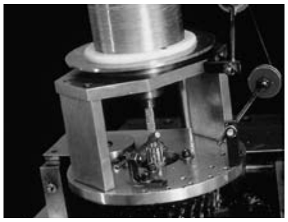
Tecknit EMI Shielding Products maintains a staff of experienced engineers—expert in every phase of shielding technology. The Tecknit Global Manufacturing Facilities have an ever widening range of precision disciplines including: injection molding, precision computer controlled milling, silicone extrusion and stamping, wire spinning, precision wire forming and clean room assembly. In addition, Tecknit maintains EMI shielding test laboratories in order to help insure quality standards and a reliable flow of world class products.

RECOGNIZED FOR QUALITY

Tecknit EMI Shielding Products has been awarded ISO 9001:2000 certification and distributes products into every important technology center around the world, where Tecknit shielding products enjoy a reputation for technical excellence and high reliability.

QUALITY POLICY

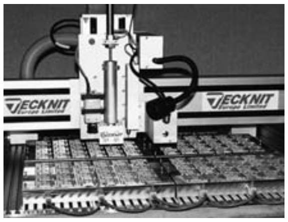
Tecknit strives to expand its market share and to maintain its presence as a world class manufacturer through it s ongoing commitment to continuous quality improvement and customer satisfaction. Tecknit is dedicated to exceeding customer expectations and needs by delivering high quality products and maintaining an exceptional on time delivery performance.



Wire knitting

Computer controlled milling

Precision metal stamping



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Tecknit World-Wide

Cranford, NJ

Grantham, England

Madrid, Spain

Apodaca, Mexico

Beijing, China

TECKNIT INC.

Founded in 1958, Tecknit has grown into a multimillion dollar international group of companies offering a broad range of EMI shielding products and services. In order to better serve customers, Tecknit maintains manufacturing facilities in the United States, England, Spain, Mexico and China. Each facility is equipped to efficiently and economically supply EMI shielding products to regional customers as well as making available cost savings to customers world-wide. Our Tecknit-USA facility, located in Cranford, New Jersey, is an ISO 9001:2000 certified company.

TECKNIT EUROPE

Tecknit Europe is headquartered in Grantham, England, it supplies the European automotive, telecommunication, aircraft and commercial electronics manufacturers. Tecknit Europe consists of manufacturing facilities in Grantham, England and Madrid, Spain. These facilities enable Tecknit Europe to pursue specialized engineering projects tailored to fit your requirements in the European market. Tecknit Europe is a BS-EN-ISO 9002 certified company.

TECKNIT DE MEXICO

Tecknit de Mexico offers both Latin American and North American customers design and engineering support from its large facility conveniently located near the U.S. border in Apodaca, Mexico. Here, Central, South and North American customers benefit from the unique manufacturing advantages found in Mexico, plus the pooled world-wide engineering resources of Tecknit EMI Shielding Products. Tecknit de Mexico is an ISO 9001:2000 certified company.

TECKNIT CHINA

China is a major participant in the world economy. In order to serve China and the growing Asian market Tecknit has established manufacturing facilities in the heart of Beijing's Economic And Industrial Development Area as well as in Shenzhen and Shanghai, China. Here large varieties of shielding materials are fabricated to suit customer's needs. Tecknit China manufactures beryllium-copper fingerstock, ventilation panels, knitted mesh products, Form-In-Place gaskets and other EMI shielding products. Tecknit (Beijing) Electronics Technologies Co. is an ISO 9001:2000 certified company.

Introduction

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STANDARD PRODUCTS AND SPECIALS

This catalog presents a technical review of the TECKNIT EMI Shielding Product Line. It is intended to serve as a guide to the selection, engineering, and specification of materials and components for EMI or EMP shielding, grounding, and static discharge. While the standard products illustrated in this catalog cover a broad range of materials and applications, TECKNIT has consistently provided successful solutions to an even broader range of special problems. We invite inquiries about our capabilities and recommendations for any shielding, grounding, or static discharge application.

BASIC DESIGN CONSIDERATIONS

The following will serve to introduce basic mechanical and electrical packaging design considerations for effectively achieving Electromagnetic Compatibility through the use of TECKNIT EMI Shielding products described in this catalog. Terminology used, in some cases, is somewhat unique to the subject, and is described in the Glossary of Terms included in a separate section of this catalog.

Electronic equipment/systems, which operate effectively within design parameters without causing or suffering unacceptable performance degradation due to electromagnetic radiation or response, are described as having Electromagnetic Compatibility (EMC). A review of the following electromagnetic spectrum describes the area in which TECKNIT products can provide the designer with the required shielding levels of Electromagnetic Interference (EMI) protection for electronic equipment and systems.

Both mechanical and electrical design aspects should be carefully considered in the selection of EMI Shielding products. Mechanical considerations are significant because of physical dimensions and tolerances involved in construction of electronic equipment and systems. These factors may seriously impact on the electrical performance characteristics of EMI shielding products. It is thus essential that the designer adequately consider the origin and methods of suppression of EMI.

The EMI Shielding Design Guide section of this catalog contains valuable theoretical and practical information on "how to select" TECKNIT EMI/FFI shielding materials. In addition, the EMI Shielding Design Guide provides specific information on EMI shielding requirements for electronic circuits which either radiate electromagnetic energy or are susceptible to electromagnetic interference.

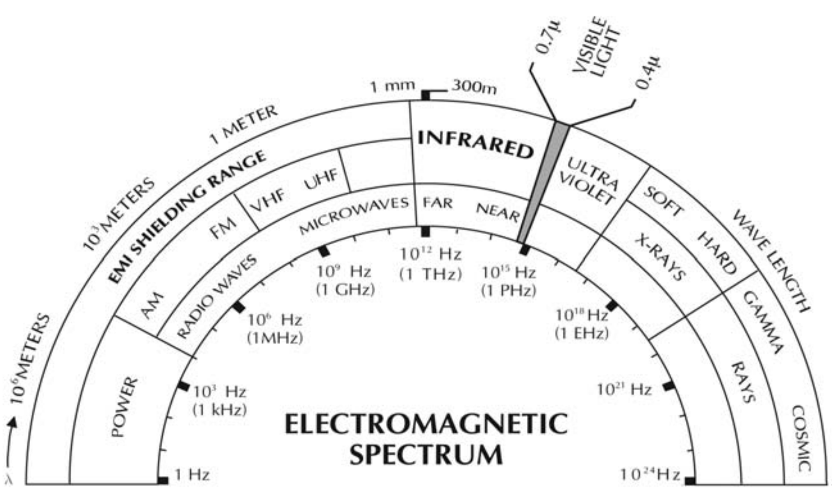
TYPES OF INTERFERENCE

RFI - Radio Frequency Interference: unwanted radiated electronic noise (broadcast) 10 kHz to 1000 MHz

EMP - ElectroMagnetic Pulse: broadband, high intensity transient phenomena, such as lightning or nuclear explosion

EMI - ElectroMagnetic Interference: dc to 300 GHz

ESD - ElectroStatic Discharge: A Transient Phenomena Involving Static Electricity-Friction



Introduction, Continued

By using the information provided, the design or packaging engineermay develop an EMI shielding profile by comparing the required shielding levels of specific TECKNIT EMI shielding materials.

Total shielding is accomplished through the use of line filters, and EMI shielding materials. These EMI shielding materials consist of gasket and barrier materials which provide custom designed products for specific applications.

EMI shielding materials may be generally classified into three categories:

- Gasketing Materials
- Barrier Materials
- Shielding Components

As shown in the Table of Contents, the products in these categories may then be arranged to form eight subsections (A through H) based upon shielding materials (e.g., knitted wire mesh) or product type (e.g., windows, vent panels, etc.)

GASKETING MATERIALS:

- Knitted Wire Mesh (Section A)
- Metal Fibers & Screen Gaskets (Section B)
- Oriented Wire Gaskets (Section C)
- Conductive Elastomers (Section D)
- Beryllium Copper Gaskets (Section I)
- Fabric-over-Foam (Section J)

BARRIER MATERIALS:

- Viewing Windows (Section E)
- Air Vent Panels (Section F)
- Conductive Coatings (Section G)

SHIELDING COMPONENTS:

- Toggle boots and shaft seals, foil tape, FUZZ BUTTON contact elements, connector gaskets, O-Seals (Section H).

There are seven basic steps involved in the selection and specification of EMI shielding materials.

1. **IDENTIFY -** susceptible devices and major emissions sources. Example: Home computer power supply, aircraft navigation equipment, etc. (generally specified).
2. **EMI SHIELDING DESIGN SPECIFICATIONS -** Example: Military, FCC, VDE, Tempest, etc. (Specified)
3. **PERFORM SHIELDING ANALYSIS -** Reference TECKNIT Design Guide to determine shielding profile by comparing "required shielding" with shielding obtained for various gaskets and materials.
4. **IDENTIFY MECHANICAL RESTRAINTS -** Example: Openings and discontinuities for viewing, servicing, air flow, moisture seals, temperature extremes, etc.
5. **TEST-VERIFICATION -** To FCC, VDE, MIL-STD specification. Examine new methods employing Transfer Impedance or TEM cell.
6. **GENERATE SHIELDING SPECIFICATION** - For gasket, barrier, gasket and/or shielding components. Reference TECKNIT EMI Shielding Products Catalog data sheets for specific material specifications. Contact TECKNIT Representative or TECKNIT Factory locations for design assistance if required and for assigning of TECKNIT part numbers.

MECHANICAL ASPECTS OF THE SELECTION OF GASKETING MATERIALS

In developing EMI Shielding, many mechanical and electrical design considerations are interdependent. One of the more important is joint unevenness. Joint unevenness refers to the degree of mismatch between mating seam surfaces. It results when the mating surfaces make contact at irregular intervals due to surface roughness or to bowing of cover plates which may be the result of: Improper Material Selection, Thickness of Cover Plate, Too Few Fasteners, Excessive and/or Uneven Bolt Alignment, Improper Gasket Size Selection. Ideally, gaskets should make even, continuous and uniform contact with seam surfaces. Seam surfaces should be free of contaminates and insulating materials such as paints or other decorative finishes. Joint uneveness and surface conditions are excellent examples of mechanical restraints which can have adverse effects on the electrical performance of a gasket. The ideal gasket material will bridge irregularities without losing its properties of resiliency, stability or conductivity. The primary function of an EMI seam gasket is to minimize the coupling efficiency of a seam. To provide effective EMI Shielding, the seam design should incorporate the following features:

- Mating surface should be as flat as economically possible.
- Flange width should be at least (5) times the maximum expected joint unevenness.
- Mating surfaces requiring dissimilar materials should be selected from the groupings of metals shown in the electrochemical compatibility chart in the TECKNIT Shielding Design Guide. Materials at opposite ends of the table should be avoided.
- Mating surfaces should be cleaned to re-move all dirt and oxide films just prior to assembly of the enclosure parts.
- Dielectric protective/decorative coatings should be removed in the mating surface area. These faces should be treated with chromate conversion coating for aluminum, and plated with tin, nickel, or zinc for steel.
- Fasteners should be tightened from the middle of the longest seam toward the ends to minimize buckling and warping. In most cases, there will be several gasket and barrier shielding materials which can be utilized. A final selection is made through the consideration of application requirements, as well as, mechanical design restraints, economics and other factors which might be imposed.

ADMINISTRATION AND MANUFACTURING

From its origin in 1958 as Technical Wire Products, Inc., TECKNIT has become a world leader in the design and production of EMI/EMP shielding, grounding, and static discharge products. Today TECKNIT occupies administrative and manufacturing facilities in the United States, Mexico, China, Spain and the UK.

SALES AND APPLICATIONS ASSISTANCE

TECKNIT sales representatives and distributors located throughout the World are available to provide sales and product application assistance.

PRICE AND AVAILABILITY

Price and delivery quotations on catalog items are available from your nearest TECKNIT representative or directly from TECKNIT Sales Administration Offices Worldwide.

STATEMENT IN LIEU OF WARRANTY

All technical information and data in this document is based on tests and is believed accurate and reliable. Nevertheless, since the products described herein are not provided to conform with mutually accepted specifications and the use thereof is unknown, the manufacturer and seller of the products do not guarantee results, freedom from patent infringement or suitability of the products for any application thereof. The manufacturer and seller of the products described in this document will provide all possible technical assistance and will replace any products proven defective. No statement or recommendation made by the manufacturer or seller not contained herein shall have any force or effect unless in conformity with an agreement signed by an officer of the seller or manufacturer.

Section 1: Electromagnetic Compatibility Overview

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Electromagnetic compatibility (EMC) is the ability of an electronic system or subsystem to reliably operate in its intended electromagnetic environment without either responding to electrical noise or generating unwanted electrical noise. **Electromagnetic interference (EMI)** is the impairment of the performance of an electronic system or subsystem by an unwanted electromagnetic disturbance.

Electromagnetic compatibility is achieved by reducing the interference below the level that disrupts the proper operation of the electronic system or subsystem. This compatibility is generally accomplished by means of electronic filters, and component or equipment shielding. An example of an EMI emitter/ susceptor system is shown in Figure 1.

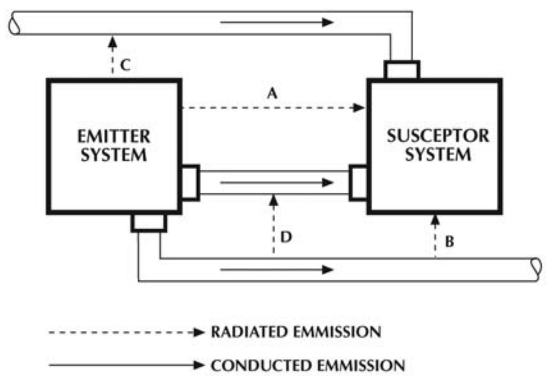

FIGURE 1
INTERFERENCE COUPLING PATHS

The emitter represents a system or subsystem that generates noise and the susceptor represents a system or subsystem that is susceptible to noise. In the real world, a system or subsystem can be simultaneously an emitter and a susceptor. The dotted lines show examples of radiated interference phenomena and the solid lines show examples of conducted interference phenomena. The arrows indicate the direction of noise transmission and coupling. Line A depicts interference coupled directly from the emitter to the susceptor through radiation paths. Line B shows that interconnect cables can also act as emitters of radiated noise. Line C shows that interconnect cables can act as susceptors and respond to noise that originated as radiated emissions. Thus, noise that originally began as radiated emission can show up in the susceptor system as conducted susceptibility. Line D represents the crosstalk problem found in interconnect cables where noise in one cable can be capacitively and inductively coupled to another cable.

Section 1: Electromagnetic Shielding Overview

Electromagnetic waves consist of two oscillating fields at right angles (Figure 2). One of these fields is the **electric field (E-Field)** while the other is the **magnetic field (H-Field). The electromagnetic wave impedance (Z_W)** in ohms is defined as the ratio of E-Field intensity expressed in **volts per meter (V/m)** to the H-Field intensity expressed in **amperes per meter (A/m).** E-Fields are generated by and most easily interact with high impedance voltage driven circuitry, such as a straight wire or dipole. H-Fields are generated by and most readily interact with low impedance current driven circuitry such as wire loops.

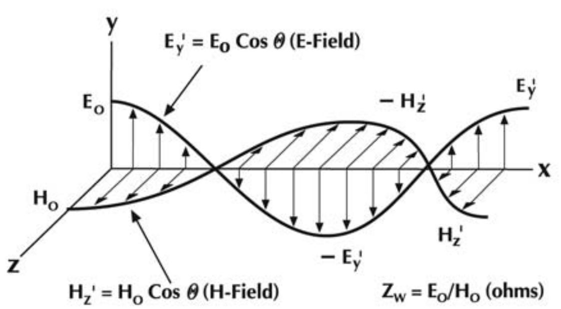

FIGURE 2
ELECTROMAGNETIC PLANE POLARIZED WAVEFORM

Any barrier placed between an emitter and a susceptor that diminishes the strength of the interference can be thought of as an EMI shield. How well the shield attenuates an electromagnetic field is referred to as its **shielding effectiveness (SE).** Therefore, shielding effectiveness is a measure of the ability of that material to control radiated electromagnetic energy. The standard unit of measurement for shielding effectiveness is the **decibel (dB).** The decibel is expressed as the ratio of two values of electromagnetic field strength where the field strengths are compared before and after the shield is in place. It is defined as:

$$\text{E-Field, } SE_{dB} = 20 \log_{10} (E_1 \backslash E_2)$$

$$\text{H-Field, } SE_{dB} = 20 \log_{10} (H_1 \backslash H_2)$$

The losses in field strength from a shielding barrier are a function of the barrier material (permeability, conductivity and thickness), frequency and distance from the EMI source to the shield.

The basic differential equations that express classical electromagnetic field phenomena and its interaction with conductive materials were developed well over a hundred years ago by J.C. Maxwell. The solutions of these differential equations are generally complex, even for simple models. This has discouraged their use in shielding analysis.

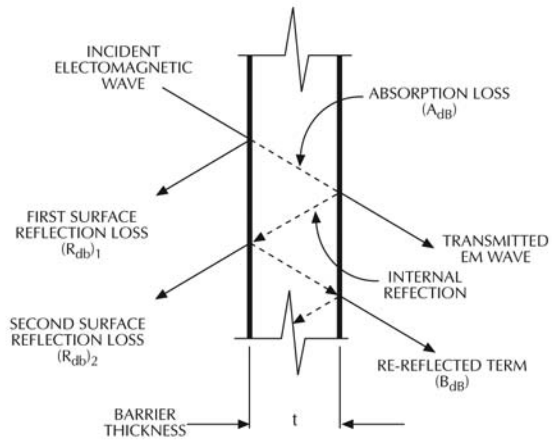

FIGURE 3
LOSSES DUE TO A SOLID CONDUCTIVE BARRIER

A simpler method for studying the effects of electromagnetic wave interaction with conductive barriers was developed by S.A. Schelkunoff in the 1930's. Using this technique, total **shielding effectiveness (SE_{dB})** of a solid conductive barrier can be expressed as the sum of the **reflection, (R_{dB}), absorption, (A_{dB})** and **re-reflection (B_{dB})** losses (refer to Figure 3). The reflection loss is proportional to the electromagnetic **wave impedance (Z_W)** and inversely proportional to the **barrier intrinsic impedance (Z_B).** The absorption loss is proportional to the **barrier thickness (t)** and **absorption coefficient of the barrier** (α). The inverse of the absorption coefficient is called the **'skin depth'** (δ). Skin depth is a magnetic property that tends to confine the current flow to the surface of a conductor. The skin depth becomes shallower as frequency, conductivity or permeability increases. Electromagnetic fields become attenuated by 1/e (natural logarithm) for every skin depth of penetration into the barrier as shown in Figure 4. The greater the number of skin depths that exist within a given thickness of metal, the greater the absorption loss. Since the skin depth becomes shallower as frequency increases, absorption loss becomes the dominant term at high frequencies. The re-reflection loss is

Section 1: Electromagnetic Shielding Overview, cont

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strongly dependent upon the absorption loss. Just as a reflection occurs at the air to metal entrance boundary of the barrier, a similar reflection occurs at the metal to air exit boundary . For an absorption loss of greater than 10 dB, the reflection term can be ignored.

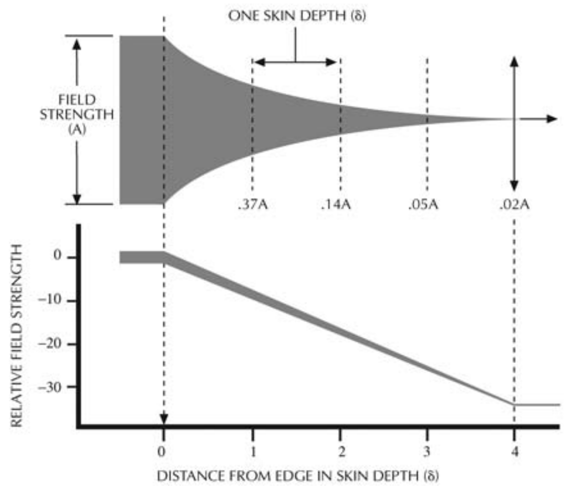

FIGURE 4
ABSORPTIVE LOSSES AS A FUNCTION OF SKIN DEPTH (δ)

The barrier intrinsic impedance is a function of the barrier relative permeability (μ_r), relative conductivity (σ_r), and frequency (f). The wave impedance is a function of the absolute permeability (μ_o) and absolute permittivity (ε_o). Two other important factors in the shielding equation are the distance (r) from the source of electromagnetic energy to the barrier, and wavelength (λ). Wavelength is related to the propagation velocity ($C = 3 \times 10^8$ m/sec) and the frequency (f) as follows: $\lambda = c/f$. When the source to barrier distance is less than about one sixth of the wavelength of the frequency of the electromagnetic energy ($\lambda/2\pi$), the field is called the 'near field'. When the source to barrier distance is greater than $\lambda/2\pi$, the field is called the 'far field'.

The distance between the source and barrier is important in determining the reflectivity factors in the near field for E-Fields and H-Fields. For E-Fields the reflection loss in the near field increases as the separation between the source and shielding barrier decreases and as frequency decreases. For H-Fields, on the other hand, the reflection loss in the near field increases as the separation between the source and shielding barrier increases and as the frequency increases. For absorption, the losses are independent of the near field/far field condition and are the same whether the wave is predominantly an E-Field, HField or a plane wave, which is an electromagnetic wave in which all points normal to the direction of propagation are in phase or parallel to one another or going in the same direction.

Summarizing:

- **Absorption:** Absorption increases with increase in frequency of the electromagnetic wave, barrier thickness, barrier permeability, and conductivity.
- **Reflection:** As a general rule, above 10 kHz, reflection increases with an increase in conductivity and a decrease in permeability.
- **Reflection - E-Field:** Increases with a decrease in frequency and a decrease in distance between the source and shielding barrier.
- **Reflection - H-Field:** Increases with an increase in frequency and an increase in distance between the source and shielding barrier.
- **Reflection - Plane Wave:** Increases with a decrease in frequency.

The solution of shielding effectiveness equations for solid conductive barriers, which considers the barrier as an infinite plane of finite thickness, usually results in shielding levels much greater than practically achieved with an actual shielded enclosure. This is due to barrier finite dimensions and discontinuities, which are a necessary part of a conductive cabinet design (e.g., seams, cable penetrations and air vents). Barrier thickness required to meet mechanical strength requirements generally provides adequate shielding effectiveness. The barrier material and shielding treatments of seams, penetrations and apertures are the more important design considerations. In Appendix A is a ranking of materials with respect to relative conductivity, relative permeability, absorption loss, and, reflection loss. Shielding treatments, including those manufactured by Tecknit, are discussed in the following sections of this Design Guide.

Section 1: Electromagnetic Compatibility Design

EMC design should be an integral part of any electronic device or system. This is far more cost effective than the alternative, that is, attempting to achieve EMC on a finished product. The primary EMC design techniques include electromagnetic shielding, circuit filtering, and good ground design including special attenuation to the bonding of grounding elements.

Figure 5 presents a recommended methodology to good EMC design of a device or system. A hierarchy is presented in the form of a pyramid. First, the foundation of a good EMC design is simply the application of ***good electrical and mechanical design*** principles. This includes reliability considerations like meeting design specifications within acceptable tolerances, good packaging and comprehensive development testing.

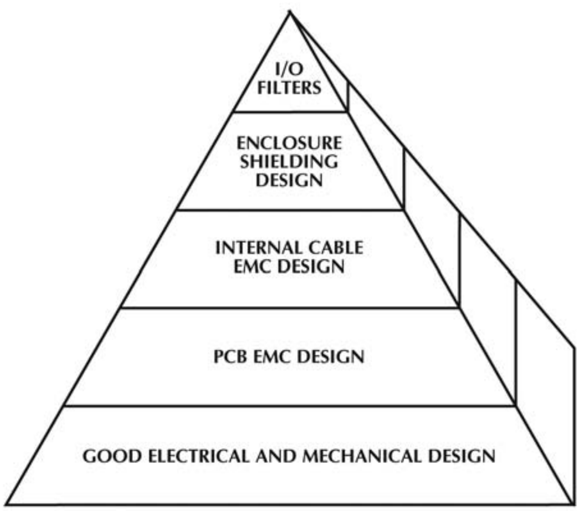

FIGURE 5
EMC DESIGN PYRAMID

Generally, the engine that drives today's electronic equipment is located on a printed circuit board (PCB). This engine is comprised of potential interference sources, as well as components and circuits sensitive to electromagnetic energy. Therefore, the ***PCB EMC design*** is the next most important consideration in EMC design. The location of active components, the routing of traces, impedance matching, grounding design, and circuit filtering are driven, in part, by EMC considerations. Certain PCB components may also require shielding.

Next, internal cables are generally used to connect PCBs or other internal subassemblies. The ***internal cable EMC design***, including routing and shielding, is very important to the overall EMC of any given device.

After the EMC design of the PCB and internal cables are complete, special attention must be given to the ***enclosure shielding design*** and the treatment of all apertures, penetrations and cable interfaces. Finally, consideration must be given to ***filtering of input and output power and other cables.***

The following sections look at each of these important areas and provide practical EMC design guidelines.

PCB DESIGN

When designing a PCB, the design goal is to control the following:

1. emissions from the PCB circuitry,
2. susceptibility of the PCB circuits to external interference,
3. coupling between PCB circuits and other nearby circuits in the device, and
4. coupling between circuits on the PCB.

This is accomplished primarily by paying special attention to the board layout and design, minimizing impedance discontinuities, and, when possible, by using low amplitude signals.

If clock frequencies above 10 MHz are used, in most cases it will be necessary to use multilayer design with an embedded ground layer. If this is cost prohibitive for your product, use guardbanding, that is, grounds on each side of signal traces.

Components should be located such that noisy and sensitive circuits can be isolated. Keep clock traces, buses and chip enables separate from I/O lines and connectors. Clock runs should be minimized and oriented perpendicular to signal traces. If the clocks go off the board, then they should be located close to the connector. Otherwise, clocks should be centrally located to help minimize onboard distribution traces. Input/output chips should be located near the associated connectors. Output circuits should be damped with a resistor, inductor or ferrite bead

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mounted close to the driver. Circuit types (i.e., digital, analog, power) should be separated, as well as their grounds. Tecknit offers a variety of shielding components especially suited for PCB shielding applications including a comprehensive line of conductive elastomers. See Section D of the Tecknit Shielding Products Catalog.

For high frequency design, the layout should be treated as a signal transmission environment, necessitating that impedance discontinuities be minimized.

Good decoupling practices should be used throughout the PCB; use bypasses liberally. Typically, this will be a 0.1 to 1.0 microfarad ceramic capacitor. Bypass capacitors should be mounted close to the IC.

Minimize power bus loop areas by routing the power bus as close as possible to its return. Power lines should be filtered at the PCB interface.

INTERNAL CABLE DESIGN

Internal cabling should be minimized as much as possible. When cables are required to connect assemblies and PCBs, the lengths should be minimized. Long service loops can be disastrous. If PCBs are properly designed, the requirement for shielding of internal cabling will be minimized. However, if it is found that cable shielding is required, the technique used to ground the shield is critical to the attenuation afforded by the shield. Cable shields should not be used as signal returns. For certain unbalanced circuits, coaxial cables are often used. In this case the ‘shield’ of the coaxial cable is intentionally used for signal return. In this application, the shield is not intended for attenuation of electromagnetic energy emanating from the center conductor. If the circuits at each end of a coaxial cable are designed properly, the coaxial cable should not radiate. However, if circuit impedances are not properly matched and the coaxial cable does radiate, another shield must be added to the cable (triaxial). This outer ground would be then bonded to the chassis ground.

In the Tecknit EMI Shielding Products Catalog, knitted wire mesh and metal foil tapes can be found which are specifically designed for harness and cable shielding, as well as grounding applications.

ENCLOSURE SHIELDING DESIGN

The enclosure must be designed with shielding in mind. If PCBs and internal cabling are properly designed, the need for enclosure shielding will be minimized. However, if it is found that enclosure shielding is required, designing the enclosure to permit the application of shielding treatments will minimize the level of the shielding design and associated cost.

A shielded enclosure should be fabricated from materials that possess the desired physical and electrical characteristics, including resistance to adverse environmental conditions. Discontinuities degrade the shielding and their design is critical in maintaining the desired levels of shielding effectiveness, providing the possibility of electromagnetic coupling through the openings and seams. The efficiency of the coupling depends upon the size of the hole or seam in relation to the wavelength of the interference. Any openings in an enclosure can provide a highly efficient coupling path at some frequency. As the aperture increases in size, its coupling efficiency increases.

A good rule of thumb to follow in general design practice is to avoid openings larger than l/20 for standard commercial products and l/50 for products operating in the microwave range. Since most EMI coupling problems are broadband in nature, the frequency of concern would be the highest threat frequency within the bandwidth envelope. Figure 6 shows l/20 and l/50 aperture sizes over the frequency range 100 kilohertz (kHz) to 10 gigahertz (GHz).

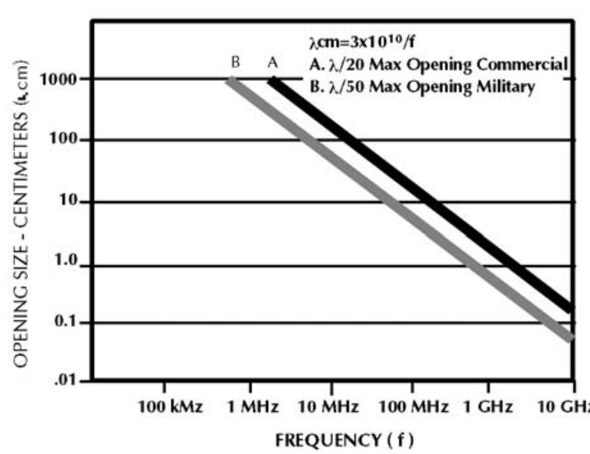

FIGURE 6
MAXIMUM SIZE OPENING AGAINST THREAT FREQUENCY

When it is necessary to specify an opening larger than λ/20 or λ/50, protective measures, such as the products manufactured by Tecknit, may be required to reduce the coupling which the aperture introduces. See Section 4 for application solutions.

Electromagnetic energy leakage through an aperture is dependent upon two factors:

1. the longest dimension, (d), of the aperture
2. the wavelength of the radiating field.

For wavelengths less than two times the longest aperture dimension, the electromagnetic energy will pass freely through the opening without being attenuated. For wavelengths equal to twice the opening, the shielding is zero. The frequency at which this occurs is called the cutoff frequency (f_c).

f_c = C/2d, where C is the propagation velocity of electromagnetic waves

For wavelengths greater than two times the maximum dimension, the attenuation is expressed as :

R_{dB} = 20 log λ/2d, where 2 > d > t (t = material thickness)

Apertures affect both the reflection and absorption terms. The reflection term is lowered as a result of an increase in the barrier impedance relative to the wave impedance. This increase in barrier impedance is caused by leakage inductance, which is related to the dimensions of the aperture and the spacing of the radiating circuits from the aperture. A good approximation of the net shielding is to assume 0 dB shielding at the cutoff frequency and a linear increase of 20 dB per decade in shielding as the frequency decreases. The maximum possible shielding effectiveness, of course, is equal to that calculated for a solid barrier without an aperture. However, this does not consider the effects of the noise source in close proximity to the aperture. As long as the potential EMI source is spaced at least as far away as the largest dimension of the aperture, this approximation will hold true.

When a noise source is closer than the largest dimension of the aperture, a reduction in shielding can be expected. Deriving the shielding requirement in this situation can be very complicated. As an approximation, the effective cutoff frequency is reduced proportionally to the ratio of the distance from the aperture:

f_c = (C/2d) (r/d) and
R_{dB} = (20 log l/2d) (r/d), where λ/2 > d

The presence of more than one aperture of the same size in a solid metal barrier has the effect of reducing the total effective shielding. The amount of shielding reduction is dependent on the spacing between any two adjacent apertures, the wavelength of the interference and the total number of apertures. If the adjacent apertures have the same maximum dimension and are spaced at least a half wavelength apart, the shielding reduction is minimal and can be considered zero for practical purposes.

As the apertures are brought closer together (s<2 λ), they no longer behave independently as single apertures. The reduction in shielding due to multiple apertures is approximately proportional to the square root of the total number (n) of equal sized apertures.

R_{dB} = 20 log λ/2d - 20 log $n^{1/2}$,

where n = number of apertures

s < λ/2 > d > t

s = edge to edge hole spacing

These relationships apply to knitted or woven wire screen material if the wires make good contact at each crossover or intersection.

Nonmetallic Enclosures

Many commercial electronic devices are packaged in enclosures of plastic or other nonconductive materials. If the devices must rely on enclosure shielding for EMC compliance, these enclosures must be treated with a conductive material to provide shielding. Metallizing techniques for this application include vacuum deposition, electroless plating, arc spray, and conductive spray 'paint'. The latter is the most frequently used technique which is really a paint-like slurry of metal particles in a carrier. These conformal coatings are loaded with very fine particles of a conductive material such as silver, nickel, copper and carbon. For example, Tecknit manufactures a highly conductive acrylic and polyurethane paints filled with silver particles. Surface resistivities as low as 50 milliohms per square are attainable for a one mil coating thickness. The lower the sur-

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face resistivity of the conductive coating, the greater the shielding effectiveness. Shielding effectiveness levels of 60 dB to 100 dB can be achieved.

Windows

Often, large-area openings are required for viewing displays, status lamps and device operating status. When shielding of these large areas is required for EMC purposes, several options are available: (a) laminating a conductive screen between optically clear plastic or glass sheets; (b) casting a mesh within a plastic sheet; and (c) applying an optically clear conductive layer to a transparent substrate.

Refer to Section E of the Tecknit EMI Shielding Products Catalog for application and performance data on EMI shielding windows.

Seams

In the design of seams, the goal should be to achieve complete conductive contact along the entire length of the seam. In cases where this is not practical, special attention must be given to:

1. Seam Overlap: The two surfaces of the seam form a capacitor. Since capacitance is a function of area, seam overlap should be made as large as practical to provide sufficient capacitive coupling for the seam to function as an electrical short at high frequencies. As a good rule to follow, the minimum seam overlap to spacing-between-surfaces ratio should be 5 to 1.

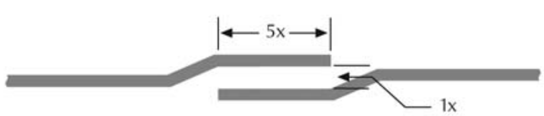


FIGURE 7
SEAM OVERLAP AND SPACING

2. Seam Contact Points: Along the entire length of every seam there should be firm electrical contact at intervals no greater than $\lambda/20$ for most commercial devices and $\lambda/50$ for microwave devices. This contact can be obtained by using pressure devices such as screws or fasteners, grounding pads, contact straps across the seam, or conductive gaskets. Tecknit manufactures foil tapes, thin elastomer gaskets, conductive caulks and various other products which can be used in this application.

If the seam surfaces are conductive and mate tightly, an electrical short is provided. To ensure a tight seam design, conductive gasketing along the entire length of the seam may be used. Conductive gasketing should be considered in the following cases:

1. Total enclosure shielding requirements exceed 40dB.
2. Enclosures with seam openings greater than $\lambda/20$.
3. Threat/emission frequencies exceed 100 MHz.
4. Machined mating surfaces are impractical.
5. Dissimilar materials are used on the mating surfaces of the seam and the device is designed to operate in severe environments.
6. Environmental (e.g., dust, vapor) seals are necessary.

Tecknit manufactures a wide variety of conductive gaskets for a broad range of applications, see the Tecknit Catalog.

When using gasketing materials to attain a satisfactory EMI shield, as well as proper environmental seal, be aware that gaskets are subject to both minimum and maximum pressure limits to achieve a proper electromagnetic seal. The greater the pressure applied to the gasketed joint, the better the apparent environmental and EMI seal. However, should the pressure exceed the maximum pressure limit of the gasket, permanent damage to the gasket can occur. This damage may decrease pressure across the seam and degrade both the environmental and EMI shielding characteristics. Wherever possible, use gasket compression stops or grooves to limit compression to the maximum recommended values.

Penetrations

Enclosure penetrations may be categorized as (a) those through which a conductor is passed, and (b) those through which a conductor does not pass. An example of the former is a cable interface port, and examples of the latter are air vents and holes for dielectric shafts.

Generally, to maintain the shielding integrity of the enclosure at cable penetrations, electronic filters or shielded cables must be used. Tecknit manufactures wire mesh and foil tapes which can be used for cable shielding purposes. See Section A in the Tecknit Catalog.

To maintain the shielding integrity of an enclosure with feedthroughs for non-conductive shafts or air vents, waveguide theory may be applied. A metal tube may be used for non-conductive shafts as shown in Figure 8. This tube may be treated as a waveguide to determine its 'shielding' characteristics. The attenuation (A) characteristics of an individual waveguide below the cutoff frequency (fc) is a function of the depth to width ratio (d/w). As the depth to width ratio increases, so does the shielding.

For circular waveguides, the following relationships apply:

$$f_c = 1.76 \times 1010/w_{cm} = 6.92 \times 109/w_{in}$$
$$A_{dB} = 32\ d/w$$

For rectangular waveguides, the following relationships apply:

$$f_c = 1.5 \times 1010/w_{cm} = 5.9 \times 109/w_{in}$$
$$A_{dB} = 27.3\ d/w$$

As discussed above, air vents that attenuate electromagnetic energy can generally be designed using multiple small holes in a metallic enclosure. However, in some cases where adequate attenuation can not be achieved in this manner, for example, when the noise source is close to the air vent, a honeycomb waveguide design may be used as shown in Figure 8. These waveguide air vent panels are available from Tecknit. See Section F in the Tecknit Catalog.

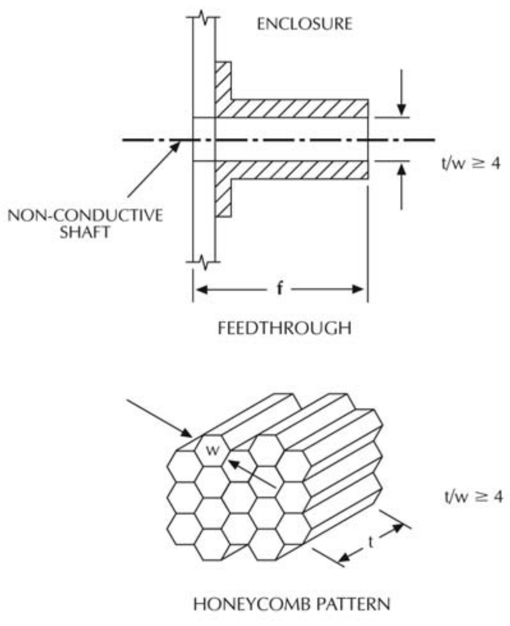


FIGURE 8
WAVEGUIDES BEYOND CUTPFF

FILTERS

Generally, to suppress power line and signal line emission, some form of filtering is required. Filter attenuation is highly dependent upon source and load impedances. Manufacturers' data is generally published for 50 ohm source and load impedances while actual impedances are generally reactive and vary considerably over the frequency range of interest. While there are methods for determining the actual impedances, these values are usually unknown. Hence, the selection of filters through mathematical computation is usually impractical.

An alternative approach is that of impedance mismatch. That is, if a filter mismatches its source and load impedances, minimum transfer of signal (EMI) power will occur. If the source impedance is high, the filter input impedance should be low, or shunt capacitive. If the source impedance is low, the filter input impedance should be high, or series reactive. The same mismatch should exist between the load impedance and the filter's output impedance.

Another consideration is whether the EMI is common mode or differential mode, where common mode refers to noise voltages on two conductors referenced to ground, and differential mode refers to a voltage present on one conductor referenced to the other. In many cases both types of EMI must be attenuated.

Virtually all off-the-shelf power line filters are designed to handle common mode noise, and many provide both common and differential mode filtering. Without conducted emission test data, it is generally difficult to determine the interference mode of the equipment and thus the type of filter required.

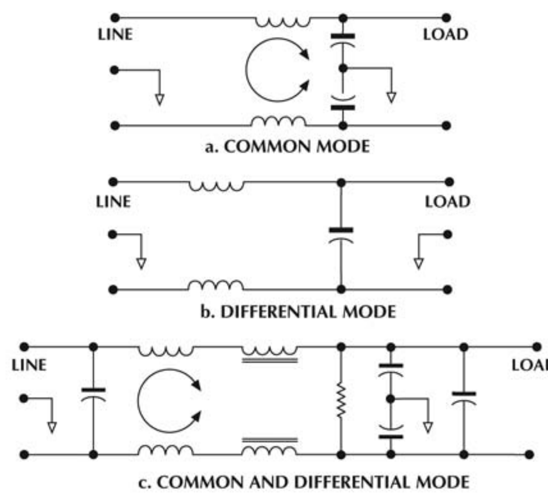


FIGURE 9
EXAMPLE OF FILTER TYPES

Section 1: Electromagnetic Compatibility Design, cont

U.S. Customary
[SI Metric]

Some knowledge of basic filter design is helpful in selecting which filter type to try first. Where common mode filtering is required, line-to-ground capacitors and common core inductors should be used.

Where differential mode filtering is required, line-to- line capacitors and discrete series inductors should be used. Figure 9 illustrates examples of both filter types. Most filter manufacturers, given some knowledge of a particular device and the EMI problem, can assist in selecting a suitable filter. The only way to be sure that a filter will reduce EMI to compliant levels is to test the equipment for conducted emissions, and be prepared to try several different filters. This trial-and-error approach may be unscientific, but in most cases proves to be the fastest, most cost effective, and minimum risk approach.

The installation of a filter is extremely critical. Filter case-to-frame ground connections must have low impedance over the frequency range of the filter, input- to-output leads must have maximum physical isolation, and, in the case of power line and I/O line filters, the filtered lines must be as close as possible to the enclosure entry point (see Figure 10).

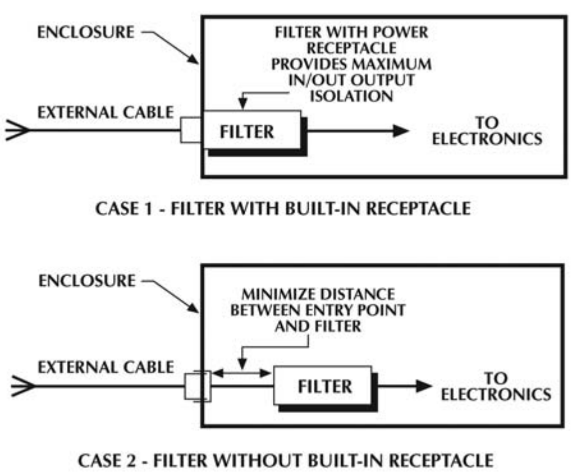


FIGURE 10
FILTER INSTALLATION

Connector pin filters and ferrite beads are also very effective, especially on I/O line and for high frequency (>100 MHz) attenuation. One must be cautious that the capacitor and ferrite impedances do not affect intended signal characteristics.

BONDING AND GROUNDING

In the preceding sections, references were made to the importance of good low impedance ground connections for shielding and filtering. Grounding is probably the most important, yet least understood, aspect of EMI control. Often, 'ground' connections are made without appropriate attention to the ground conductor impedance at the frequencies of interest. As a result, the performance of enclosure shielding, cable shielding or filtering may be degraded, and the erroneous conclusion made that the 'shield' or 'filter' design is incorrect.

When we use the word "ground", we are generally speaking about a reference point. In most cases, the best place to begin is with the green safety wire of the AC power cable, assuming the device is not battery powered of course. Since safety organizations require that the safety ground be connected to the chassis, the green wire is generally attached to the chassis immediately upon entering the enclosure. This is good practice for EMI control as well since this 'safety ground point' will also serve as the primary point of reference for all other ground connections. The goal is to maintain a very low impedance path between this point and any other ground connection point in the device.

Thus, 'bonding', or maintaining a low impedance connection between mating conductive parts, is an important part of a good ground scheme. This requires that mating parts of enclosures not be painted, the ground straps not be attached to painted surfaces, and, perhaps, in corrosive environments, special attention be given to the use of dissimilar metals to preclude the effects of galvanic action. The goal is to maintain, as close as practical, a single potential 'safety ground' system.

Signal returns should generally be attached to safety ground at one point (single-point ground concept) to avoid ground loops. The term generally is important to note here since, in some cases, it might be found that a multi-point ground approach yields better results. Trial-and-error may be required. Printed circuit board design should also employ a singlepoint ground approach to maintain isolation of different circuit types as previously discussed. The best approach is to develop a ground diagram showing all ground connections, using different symbols for 'safety', 'analog', 'digital', and 'rf' grounds. This will help to highlight potential problems such as ground loops and common ground paths for different circuit types.

Figure 11 illustrates the concept described above. This is an ideal condition. However, in many cases it is necessary to connect returns from one PCB to another or one circuit type to another. This results in ground loops. To minimize the potential EMI threat, the following approaches can be taken:

1. use balanced differential circuits when possible,

2. minimized loop areas, and

3. run hot and return leads next to each other.

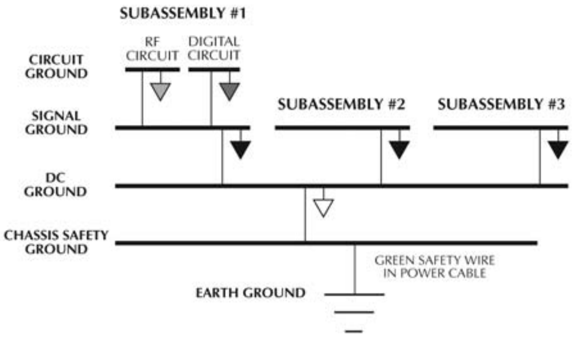


FIGURE 11
EXAMPLE OF DEVICE GROUND DIAGRAM

Section 2: Special Applications

U.S. Customary
[SI Metric]

MILITARY EQUIPMENT EMC DESIGN

Since about 1990, there has been a trend in the military to accept commercial-off-the-shelf (COTS) equipment, especially in 'noncritical' equipment. In many military contracts, EMC requirements referencing FCC and IEC standards can be found. There are several reasons for this including cost reduction.

However, where more stringent requirements are deemed necessary the most commonly used military standards for both emissions and immunity (more commonly referred to as susceptibility in the military) are MIL-STD-461D, Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility and MIL-STD-462D, Measurement of Electromagnetic Interference Characteristics. As the titles indicate, one document sets forth emission limits and susceptibility criteria while the other defines the test methodology.

As one might expect, the military emission limits are much lower and the susceptibility criteria more severe than those found in most commercial standards. Also, the frequency ranges are broader as referenced in the MIL-STD- 461D requirements.

The basic EMC design principles set forth in this Design Guide for commercial products applies as well to military products. The primary areas that differ are generally in the design of the enclosures and line filters. Also, especially in large complex systems, EMC design analyses are required in the schematic design phase to guide the electrical and mechanical engineers.

MODELING AND ANALYSIS

In many cases a circuit or module will emit or be susceptible to EMI only on certain frequencies. For example: a radio transmitter operating at 10 MHz might interfere with the normal operation of a digital electronic circuit located nearby, whereas, with a difference of as little as one percent in the transmission frequency, the problem might not exist. On the other hand, a particularly 'noisy' signal source might have several discrete emission frequencies, all within the response bandwidth of the susceptible circuit.

To comprehend the multifrequency problem associated with electromagnetic emissions, it is helpful to understand frequency relationships associated with fundamental waveforms, such as the square wave. An ideal square wave consists of a signal switching two distinct voltage levels with

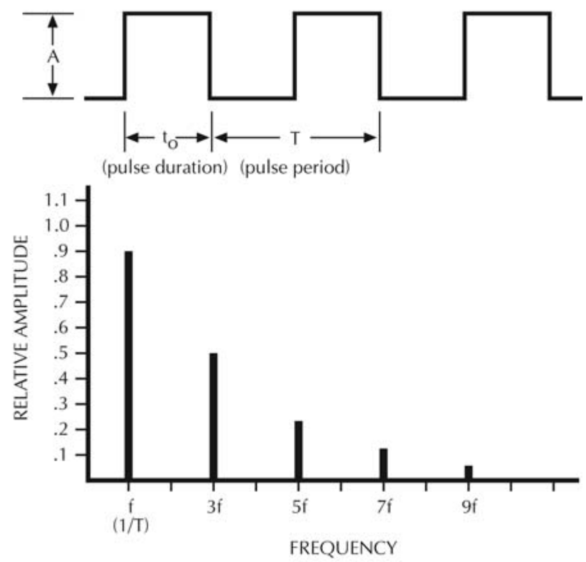


FIGURE 12
IDEALIZED SQUARE WAVE WITH ITS FOURIER COMPONENTS

instantaneous transitions between levels. Figure 12 illustrates an ideal square wave along with its frequency spectrum. Fourier theory states that a square wave spectrum can be expressed as an infinite sum of simple sine waves of decreasing amplitude whose frequency decreases as the odd multiple of the basic frequency of the square wave itself. This figure illustrates that there is a significant amount of energy still contained in the higher order harmonics when compared to the energy contained in the fundamental frequency.

Figure 13 shows the same ideal square wave spectrum with amplitude converted to decibels and frequency on a logarithmic scale. This is commonly done to permit comparison with applicable limits which are formatted in this manner. The vertical lines represent the signal amplitude as a function of frequency and the curve drawn through the points of maximum amplitude represents the worst case limits. It is standard practice to ignore the discrete nature of emissions and deal exclusively with the curve shown connecting the points of maximum amplitude since it is difficult and time consuming to predict emissions one frequency at a time. Figure 13 shows that the emissions profile of an ideal square wave decreases at the rate of 20 dB per frequency decade. Actual square waves do not have instantaneous transitions to perfectly flat voltage levels as shown in the idealized case. They are more accurately modeled by a trapezoidal waveform.

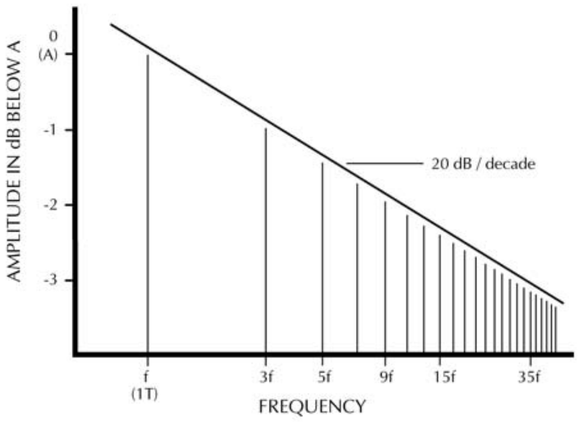


FIGURE 13
AMPLITUDE OF IDEALIZED SQUARE WAVE IN dB REFERENCE TO A

Figure 14 shows a trapezoidal wave with a finite rise time together with a frequency versus amplitude plot. The slope of the emissions shifts from 20 dB per decade to 40 dB per decade as a function of the rise time/fall time of the waveform (1/+tr). As the rise time (tr) increases, the frequency at which the slope changes from 20 dB to 40 dB per decade decreases. In addition, the emissions profiles are functions of the duty cycle of the signal. If the signal is symmetrical (50% duty cycle) the worst case emissions profile results. As the duty cycle decreases, the amplitude of the low frequency emissions also decreases. the amplitude of the low frequency emissions also decreases. Figure 14 shows the amplitude verses frequency plot for 50% and 20% duty cycle trapezoidal waveforms.

After the major emission sources and the most susceptible devices in system have been identified and characterized, the entire EMC problem must be integrated into the total system EMC design plan. The noise acceptable from individual units or subsystems must be allocated on the basis of the total acceptable system noise. Each emitter circuit adds its noise to the system in a root mean square (rms) fashion. If all the noise emitters are of approximately equal strength, the total noise is equal to the average noise of the emitters times the square root of the number of emitters. If one emitter dominates the others, total noise would be approximately equal to the noise of the dominant emitter. Usually there are two or three dominant emitters of comparable magnitude.

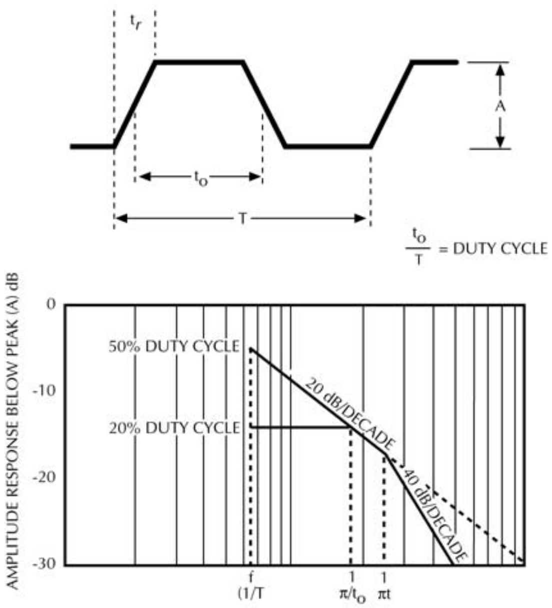


FIGURE 14
TRAPEZOIDAL WAVEFORM AMPLITUDE VERSUS FREQUENCY

Both the emitter noise level as well as the susceptor's noise threshold must be considered. If the susceptor's lowest signal threshold level can be made greater by at least two times the highest emitter (noise) level (for a 6dB safety margin), then the emitter and susceptor are considered to be compatible with each other.

In addition to the interaction of the system with the external environment, interaction inside the system must also be considered, i.e., crosstalk must be controlled. In other cases, it may be necessary to characterize electromagnetic fields from high power antennas on ships and aircraft platforms, and how these fields affect on-board equipment. The more complex analytic problems require computer aided techniques. Many EMC analysis software packages are available for modeling these complex scenarios. Whether simple manual models or the more complex computer aided models are used, the characteristics of any EMI control devices or techniques must be included in the final analysis. For example, shielding attenuation levels and filter insertion loss levels.

Section 2: Special Applications, cont

U.S. Customary [SI Metric]

SPECIAL DESIGN CONSIDERATIONS

When military equipment must operate in severe electromagnetic environments or mission critical scenarios, the EMC design moves to a much higher level. As mentioned above, the basic EMC design principles and approach for non-military equipment and illustrated in Figure 5 still apply, however, the level of design changes significantly. Let's look at each design phase shown on Figure 5 and the briefly review the ways the design might change for a severe military environment or mission critical application.

Good Electrical and Mechanical Design

The major impact on the basic design of the equipment is generally due to reliability, maintainability, and atmospheric and mechanical environmental constraints. Thus, 'MIL' parts, those meeting military standards are used PCB Design.

Again PCB material, design and layout will be affected primarily by reliability, maintainability, and atmospheric and mechanical environmental constraints. However, when devices must operate in extremely high frequency regions, impedance discontinuities become particularly critical. For mission critical equipment, all aspects of good PCB EMC design become critical including the control of circuit emission, circuit susceptibility to external interference, coupling between circuits on the board, as well as circuits on the board and other nearby circuits.

Tecknit offers a variety of shielding components especially suited for PCB shielding applications. These are very effective in minimizing chip and circuit radiation. For example, Tecknit Shielding Laminates are available in a variety of foil and substrate combinations, from simple die cut shapes to formed complex assemblies with folds, scores, and cooling holes.

Internal Cable EMC Design

Internal cable design and layout is a real challenge in military equipment. For equipment designed to operate at millimeter wave and microwave frequencies, extremely high quality, rigid coaxial transmission lines must be used. In complex equipment in mission critical systems, containing large multi-wire cable harnesses, different circuit types (i.e., rf, data, DC power, AC power) must be separated and the cable routing controlled to prevent interference coupling. To prevent or minimize radiation from harnesses, shielding is often required, or as a minimum, the cables must be routed close to the metal enclosure surface. The latter enhances harness emission decoupling to ground. Tecknit EMC Shielding Tape is specially designed for harness shielding providing 60 dB of shielding at 10 MHz and 30 dB of shielding at 10 GHz.

Enclosure Shielding Design

The area where EMC design criteria varies most between non-military and military equipment is in the enclosure shielding design. Therefore, this topic requires special attention. The reason for this is simply that the enclosure is the last line of defense for controlling radiated EMI, often the difference between meeting specification requirements and not meeting the requirements. Minor miscalculations in gasket pressure, aperture dimensions, and seam design, for example, may result in major EMC problems. Also, atmospheric and mechanical environmental factors must be integrated into the shielding design as discussed below.

a. Environmental Seals The EMI gasket is often called upon to function as an environmental seal to provide protection from dust, moisture and vapors. Therefore, selection of the sealing elastomer is as important as the EMI gasket. To seal against dust and moisture, flat or strip EMI gaskets joined to a sponge or solid elastomer are adequate. Sponge elastomers, characterized by compressibility, are ideally suited for use in sheet metal enclosures having uneven joints. Required closure pressures are generally low, between 5 and 15 psi. To avoid overcompressing sponge elastomers, compression stops are recommended. These stops can be designed into the enclosure or embedded in the elastomer. Both techniques are illustrated in Figure 15. Tecknit offers a wide variety of sponge elastomer gaskets, as well as other types of low closure force gaskets.

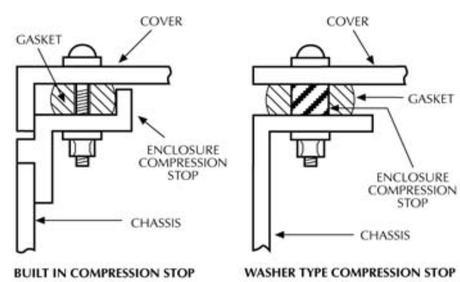


FIGURE 15
GASKET COMPRESSION STOPS

The listing below presents the most important characteristics of the more common elastomers.

Neoprene This elastomer is used commonly in EMI gaskets and will withstand temperatures ranging from -54°C to +100°C for sponge (closed cell) elastomers. Neoprene is lightly resistant to normal environmental conditions, moisture and to some hydrocarbons. It is the least expensive of the synthetic rubber materials and is best suited from a cost standpoint for commercial applications.

Silicone This material has outstanding physical characteristics and will operate continuously at temperatures ranging from -62°C to +260°C for solid and - 75°C to +205°C for closed cell sponge elastomers. Even under the severest temperature extremes these materials remain flexible and are highly resistant to water and to swelling in the presence of hydrocarbons.

Buna-n Butadiene-Acrylonitrile resists swelling in the presence of most oils, has moderate strength and heat resistance although it is not generally suited for low temperature applications.

Natural Rubber This material has good resistance to acids and alkalies (when specially treated) and can be used to 160°C, is resilient and impervious to water. Rubber will crack in a highly oxidizing (ozone) atmosphere and tends to swell in the presence of oils.

Fluorosilicone Has the same characteristics of silicone with improved resistance to petroleum oils, fuels and silicone oils. Since most seals used with EMI gaskets have elastomeric properties of stretch and compressibility, some guidelines are needed when specifying the dimensional tolerance of these materials. Figure 16 shows some of the common errors encountered in gasket design.

DETAIL	WHY FAULTY	SUGGESTED REMEDY
Bolt holes close to edge	Causes breakage in stripping and assembling	Projection or "ear" Notch instead of hole.
Metalworking tolerances applied to gasket thickness, diameters, length, width, etc.	Results in perfectly usable parts being rejected at incoming inspection. Requires time and correspondence to reach agreement on practical limits. Increases cost of parts and tooling. Delays deliveries.	Most gasket materials are compressible. Many are affected by humidity changes. Try standard or commercial tolerances before concluding that special accuracy is required.
Transference of fillets, radii, etc., from mating metal parts to gasket.	Unless part is molded,such features mean extra operations and higher cost.	Most gasket stocks will conform to mating parts without preshaping. Be sure radii, chamfers, etc., are funtional, not merely copied from metal members.
Thin walls, delicate cross section in relation to overall size.	High scrap loss; stretching or distortion in shipment or use. Restricts choice to high tensile strength materials.	Have the gasket in mind during early design stages.
Large gaskets made in sections with beveled joints.	Extra operations to skive. Extra operations glue. Difficult to obtain smooth, even joints without steps or traverse grooves.	Die-cut dovetail joint.

FIGURE 16
GASKET DESIGN ERRORS

a.) Minimum gasket width should not be less than one half of the thickness (height).
b.) Minimum distance from bolt hole (or compression stop) to nearest edge of sealing gasket should not be less than the thickness of the gasket material. When bolt holes must be closer, use U-shaped slots.
c.) Minimum hole diameter not less than gasket thickness.
d.) Tolerances should be conservative whenever possible. Refer to Tecknit Shielding Products Catalog for tolerances on rule die-cut gaskets and elastomer strips.

Section 2: Special Applications, cont

U.S. Customary
[SI Metric]

Sealing against differential pressure between the enclosure interior and exterior is best accomplished using a gasket which is contained within a groove in the enclosure. This is also true for shielding extremely high frequencies. For these applications, the best known seal is the "O" ring. Tecknit offers seals of this type in either solid or hollow cross sections, and in various shapes.

Unlike sponge elastomers, solid elastomers do not compress, they deflect. Since solid elastomers do not change volume under pressure, groove design must take into consideration seal deflection. As a rule of thumb, the groove should have a minimum cross sectional area at least equal to 125% of that of the seal to accommodate deflection under worst case tolerance conditions of elastomer and groove.

Normal deflection for solid rectangular seals ranges from 5 to 15%. The pressure required to deflect solid elastomer seals is a function of the elastomer hardness and the cross section shape. Typical pressures are as low as 20 psi for low compression, low durometer material to 150 psi for high compression, high durometer material.

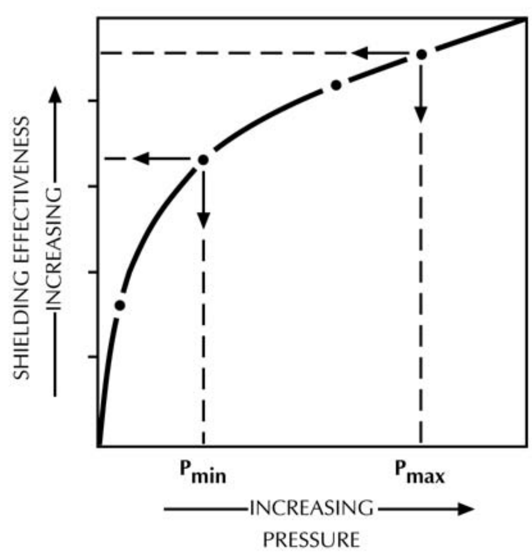


FIGURE 17
SHIELDING EFFECTIVENESS VERSES CLOSURE FORCE
(TYPICAL CHARACTERISTICS AT A GIVEN FREQUENCY)

b. Closure Pressure Shielding effectiveness and closure pressure have a general relationship as shown in Figure 17. The minimum closure force (P_{min}) is the recommended applied force to establish good shielding effectiveness and to minimize the effects of minor pressure difference. The maximum recommended closure force (P_{max}) is based on two criteria:

1. maximum compression set of 10% and/or
2. avoidance of possible irreversible damage to the gasket material when pressure exceeds the recommended maximum.

Higher closure pressures may be applied to most knitted wire mesh gaskets when used in Type 1 joints, but the gaskets should be replaced when cover plates are removed, i.e., whenever the seam is opened.

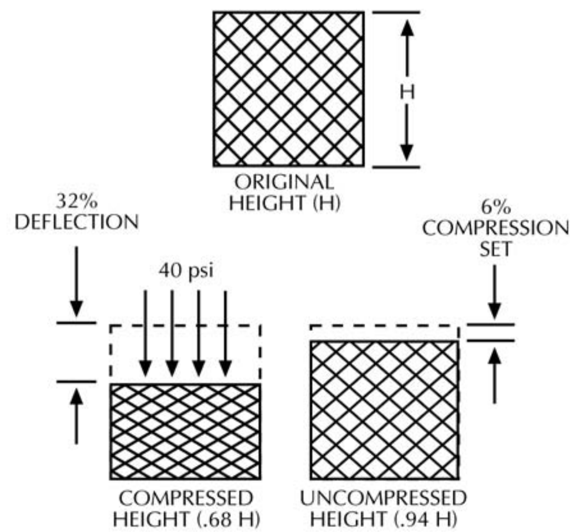


FIGURE 18
COMPRESSION SET

c. Compression Set Selection of a gasketing material for a seam which must be opened and closed is to a large extent determined by the compression set characteristics of the gasket material. Most resilient gasket materials will recover most of their original height after a sufficient length of time when subjected to moderate closing forces. The difference between the original height and the height after the compression force is removed is compression set. As the deflection pressure is increased, the compression set increases. See Figure 18.

Another consideration for pressure seals is the chemical permeability of the elastomer compound. This is defined as the volume (cm3) of gas that will permeate in one second through a specimen of one cubic centimeter.

Finally, leakage can be reduced by using conductive grease. Compatibility of the grease with the seal elastomer and the application should be checked. Tecknit manufactures a wide variety of "O" ring gaskets and conductive grease for a broad range of applications.

d. Corrosion It is necessary to select shielding materials and finishes which inhibit corrosion, are compatible with the enclosure materials and are highly conductive. Corrosion occurs between dissimilar metals in the presence of an electrolyte. The rate of corrosion depends on the electrochemical potential between two metals and the conditions under which contact is made. Materials must be used which provide the least corrosion due to galvanic action when materials are in contact for an extended period of time with appropriate protective finish. Maximum galvanic activity occurs when dissimilar metals are exposed to salt atmosphere, fuels, chemicals and other liquids which may act as electrolytes. To minimize corrosion, all surfaces should be free of moisture.

Therefore, EMI gasket material making contact with the enclosure material in a corrosive atmosphere must be selected or treated to ensure that materials in contact are compatible. Table 1 separates metals by electrochemical compatibility. The design goal should be to use metals in the same group. When this is not feasible, a protective finish must be used to retard corrosion.

Table 1
GROUPING OF METALS BY ELECTROCHEMICAL COMPATIBILITY

GROUP I	GROUP II	GROUP III	GROUP IV
Magnesium	Aluminum	Cadmium Plating	Brass
Magnesium Alloys	Aluminum Alloys	Carbon Steel	Stainless Steel
Aluminum	Beryllium	Iron	Copper & Copper Alloys
Aluminum Alloys	Zinc & Zinc Plating	Nickel & Nickel Plating	Nickel/Copper Alloys
Beryllium	Chromium Plating	Tin & Tin Plating	Monel
Zinc & Zinc Plating	Cadmium Plating	Tin/Lead Solder	Silver
Chromium Plating	Carbon Steel	Lead	Graphite
Iron Brass Rhodium			
	Nickel & Nickel Plating	Stainless Steel	Palladium
	Tin & Tin Plating	Copper & Copper Alloys	Titanium
	Tin/Lead Solder	Nickel/Copper Alloys	Platinum
	Lead	Monel	Gold

When it is necessary for dissimilar metals to be used, the following practices should be applied to insure compatibility:

1. Use a tin or cadmium plated washer between a steel screw in contact with aluminum.
2. Use selective plating where it is essential to have reliable electrical contact.
3. Design to ensure that the area of the cathodic metal (lower position in a group) is smaller than the area of the anodic metal (higher position in a group).

e. Seam Design Generally, higher enclosure shielding effectiveness levels will be required for military equipment operating in severe electromagnetic environments or mission critical scenarios. Therefore, special attention must be given to seam design. A few special seam shielding features for achieving higher levels of shielding effectiveness are as follows:

Section 2: Special Applications, cont

U.S. Customary [SI Metric]

Grooves For Retaining Gaskets: A groove for retaining a gasket assembly provides several advantages:

1. Can act as a compression stop.
2. Prevents overcompression.
3. Provides a fairly constant closure force under repeated opening and closing of the seam.
4. Provides a moisture and pressure seal when properly designed.
5. Cost effective in lowering assembly time and cost of gasketing material.
6. Best overall sealing performance.

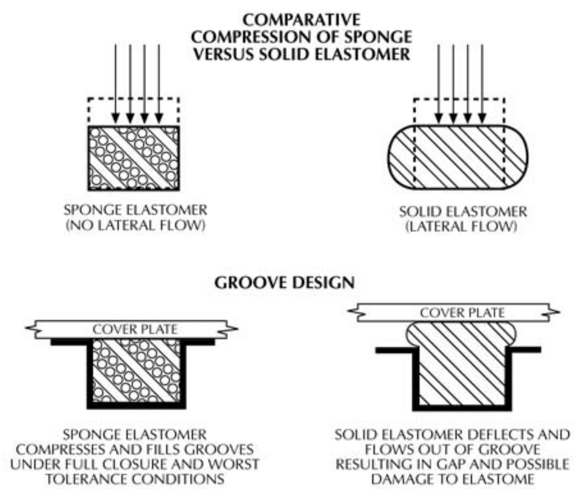


FIGURE 19
GROOVE DESIGN CONSIDERATIONS

Solid elastomers are not compressible. They are easily deformed but do not change in volume as do sponge elastomers. Therefore, allowance for material flow must be considered in the groove design. If the groove cross section (volume), when the cover flange is fully closed, is insufficient to contain the fully deflected material, proper closure of the flange may be difficult. In addition, overstressing of the material may degrade electrical and physical properties of the shielding material. Figure 19 depicts the various conditions of groove design.

Closely Spaced Fasteners: Fastener spacing design is a function of cover plate thickness, minimum- maximum pressures, gasket compressibility and material characteristics, and flange dimensions. This is reflected in the following equation for calculating fastener spacing (Refer to Figure 20):

$C = [480 (a/b) E t^3 DH / 13 P_{min} + 2P_{max}]1/4$
where

a = width of cover plate flange at seam

b = width of gasket

C = fastener spacing

E = modulus of elasticity of cover plate

$\Delta H = H1 - H2$

H1 = minimum gasket deflection

H2 = maximum gasket deflection

H = gasket height

P_{min} / P_{max} = minimum/maximum gasket pressure

t = thickness of cover plate

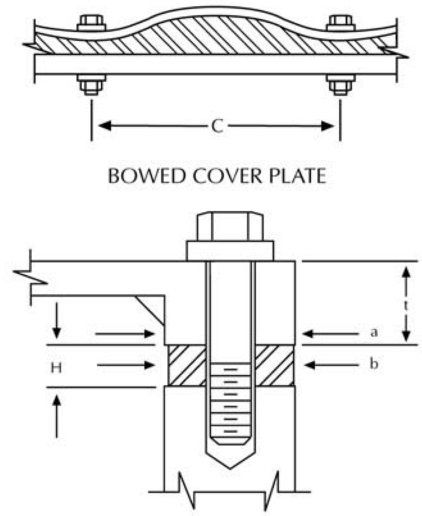


FIGURE 20
COVER PLATE AND GASKET DIMENSION

Input/Output Filters

Just as the enclosure shielding design is the last line of defense for radiated EMI control, I/O filtering is the last line of defense for controlling conducted EMI. Generally, higher filter insertion loss levels will be required for military equipment operating in severe electromagnetic environments or mission critical scenarios. This generally results in physically larger filters, which could conflict with size and weight constraints. To accommodate large filters it is often necessary to design the filter enclosure around other subassemblies within the equipment, resulting in filters with complex shapes. Interface connectors are often unique. Therefore, all things considered, filters for military equipment will most likely be a custom design.

To minimize cost and schedule impacts, the filter should be designed early in the equipment development cycle, as part of the EMC analysis and modeling effort.

ARCHITECTURAL SHIELDING DESIGN

Certain buildings, and large areas within buildings, must be designed to provide electromagnetic wave shielding. The purpose of this requirement is either:

1. to protect sensitive electronic equipment operating inside the building (generally computer based equipment) from high level rf or radar signals outside the building, or
2. to protect confidential or proprietary information being processed on computer equipment inside the building from interception by unauthorized persons outside the building through the detection and analysis of the electromagnetic waves emanating from the computer equipment.

A few examples of the first condition are as follows:

1. airline reservation centers located near airports,
2. computer facilities located near military installations, and
3. Magnetic Resonance Imaging (MRI) facilities located near a commercial radio broadcast station. The second scenario is generally associated with the following:

1. government embassies,
2. secure government computer facilities,
3. stock and other financial organizations, and
4. industrial computer facilities involved in classified government contracts.

In both cases some level of electromagnetic shielding is required over a specified frequency spectrum. The owner, or user, of the building determines this shielding requirement based on an analysis of the potential problem. This analysis might include a site or computer equipment survey. When associated with a government installation, certain regulations and guidelines must also be followed to determine the shielding requirements.

Once these requirements have been established, they are passed on to the architects and engineers who generally work with an engineering firm that specializes in shielding design, so that the proper shielding design approach is employed in the building plans and specifications. Tecknit can direct you to the appropriate design firms.

Where unfinished material is appropriate, tin coated steel, galvanized steel, aluminum and copper are most frequently used. Basically, the entire building, or area in the building to be shielded, is “covered” with this metallic material; that is, the roof (or ceiling), walls and floor. In some cases, it is possible to make use of earth for completing a building shielding system. When shielding an entire building the shielding may be installed: a) outside the structural steel, b) as an integral part of the structure, or, c) inside, depending on the building design, materials selected, shielding requirements and cost. When shielding is required as part of the renovation of an existing building, shielding options are more limited. In the latter case, it is generally easier to apply to shielding on the exterior of the building.

In general, the shielding material is covered with standard exterior or interior building finishes such as architectural panels, sheet rock, brick, and so forth. Finished exterior metal architectural panels may be used to achieve shielding where low leve requirements exit (< 30 dB). The obvious advantage is economic where the finish and shield material are the same. This applies as well to metal roofing.

The shielding envelope must be continuous, free of openings which might allow a leak. This requirement poses some unique problems in the treatment of windows, doors, air vents, plumbing, electrical connections and other penetrations which are essential for the operation of the building.

An important consideration is the method used in joining the metallic shielding panels. The seams must be tight, metal-to-metal connections, free of paint, dirt, rust or any other insulating material. The various techniques used for joining shielding panels include welding, soldering, mechanical fasteners with pressure plates, and conductive tape. Tecknit has many products in its Shielding Products Catalog that can be used in these, architectural shielding applications, including gaskets, windows, vents, conductive coatings and tapes, etc..

Section A: Knitted Wire Mesh

U.S. Customary
[SI Metric]

Tecknit Strips

WIRE MESH GASKET MATERIAL

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT STRIPS are resilient, conductive, knitted wire mesh strips used as gasket material to provide effective EMI shielding at the joints and seams of electronic enclosures. Any metal that can be produced in the form of wire can be fabricated by TECKNIT into one of the EMI shielding strips. TECKNIT STRIPS are produced in one of four basic cross sections: rectangular, round, round with fin and double core. The standard materials used are: Tin-Plated Phosphor Bronze (Sn/Ph/Bz), Tin-Coated Copper-Clad Steel (Sn/Cu/Fe), Silver-Plated Brass (Ag/Brass), Monel (a Nickel-Copper alloy) and Aluminum (Al).

APPLICATION INFORMATION

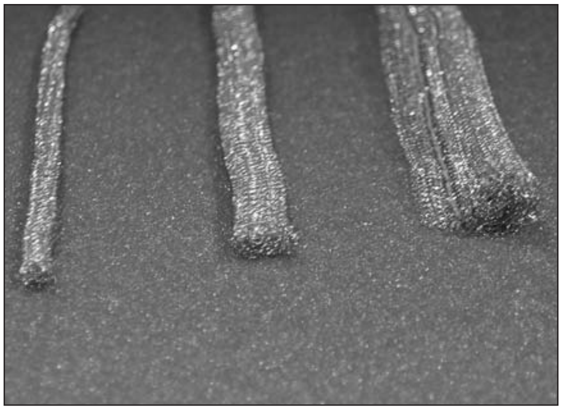
TECKNIT STRIPS are used to provide EMI shielding for electronic enclosures. Generally the rectangular strips are used on cast or machined enclosures while the round and fin types are used on sheet metal enclosures. TECKNIT STRIPS can be attached using TECKNIT conductive adhesives. (Refer to Conductive Adhesives) They can also be riveted or spot-welded. Mesh strip does not provide a pressure or weather seal and should not be used in salt spray environments. To shield effectively, the mesh should be deflected 15% (min.) to 30% of its height.

EMI SHIELDING PERFORMANCE*

TECKNIT STRIPS Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are:

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Ag/Br	80+	135+	105	95
Sn/Cu/Fe	80+	130+	105	95
Sn/Ph/Bz	80+	130+	110	100
Aluminum	60	130	90	80
Monel	60+	130	90	80

*Based on 127 mm x 127 mm Aperture



SPECIFICATIONS

Wire Mesh Material Description

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33. (Code: 20-6XXXX).
- **Sn/Cu/Fe:** .0045 in. [0.114 mm] diameter, per ASTM B-520. (Code: 20-4XXXX).
- **Ag/Brass:** .005 in. [0.114 mm] diameter, per QQ-W-321, (ASTM-B-134) silver-plated (3% silver by weight). (Code: 20-3XXXX).
- **Monel:** .0045 in. [0.114 mm] diameter, per QQ-N-281, or AMS-4730. (Code: 20-1XXXX).
- **Aluminum Alloy:** .005 in. [0.127 mm] diameter, per SAE-AMS-4182 (except max. tensile strength is 75,000 psi). (Code: 20-2XXXX).

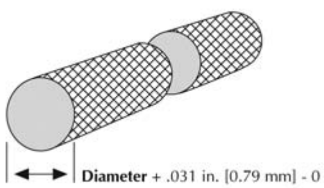
ORDERING INFORMATION

After selecting the TECKNIT standard material and the strip cross section desired, substitute the TECKNIT wire code number in place of the “X” to complete the Part Number as indicated on the following page.

Example: The part number signifying a round with fin strip made of Sn/Cu/Fe wire (.063 in. dia. x .750 in. overall width) would be 20 - 4 2114.

Wire Code
Dimensions Reference

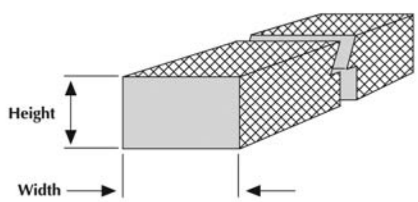
ROUND CROSS SECTION



DIAMETER in. [mm]	PART NUMBER	DIAMETER in. [mm]	PART NUMBER
.063 [1.60]	20-X1110t	.250 [6.35]	20-X1103
.094 [2.39]	20-X1111t	.313 [7.95]	20-X1113
.125 [3.18]	20-X1101	.375 [9.53]	20-X1114
.156 [3.96]	20-X1112	.438 [11.13]	20-X1115

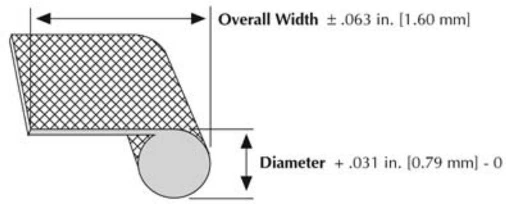
t Tolerance is +.015-0.

RECTANGULAR CROSS SECTION



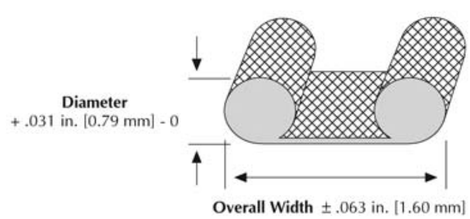
WIDTH in. [mm]	HEIGHT in. [mm]	PART NUMBER	WIDTH in. [mm]	HEIGHT in. [mm]	PART NUMBER
.063 [1.60]	.063 [1.60]	20-X0105	.250 [6.35]	.188 [4.78]	20-X0118
.094 [2.39]	.094 [2.39]	20-X0107	.250 [6.35]	.250 [6.35]	20-X0119
.125 [3.18]	.063 [1.60]	20-X0104	.313 [7.95]	.063 [1.60]	20-X0120
.125 [3.18]	.094 [2.39]	20-X0110	.313 [7.95]	.094 [2.39]	20-X0121
.125 [3.18]	.125 [3.18]	20-X0101	.313 [7.95]	.125 [3.18]	20-X0122
.125 [3.18]	.156 [3.96]	20-X0102	.313 [7.95]	.188 [4.78]	20-X0123
.188 [4.78]	.063 [1.60]	20-X0111	.313 [7.95]	.250 [6.35]	20-X0124
.188 [4.78]	.094 [2.39]	20-X0112	.313 [7.95]	.313 [7.95]	20-X0125
.188 [4.78]	.125 [3.18]	20-X0113	.375 [9.53]	.063 [1.60]	20-X0126
.188 [4.78]	.188 [4.78]	20-X0114	.375 [9.53]	.094 [2.39]	20-X0127
.250 [6.35]	.094 [2.39]	20-X0116	.375 [9.53]	.188 [4.78]	20-X0129
.250 [6.35]	.125 [3.18]	20-X0117	.375 [9.53]	.250 [6.35]	20-X0130
			.375 [9.53]	.375 [9.53]	20-X0131

ROUND WITH FIN



DIA. in. [mm]	O/A in. [mm]	PART NUMBER	DIA. in. [mm]	O/A in. [mm]	PART NUMBER
.063 [1.60]	.375 [9.53]	20-X2111	.188 [4.78]	.875 [22.23]	20-X2128
.063 [1.60]	.500 [12.70]	20-X2112	.250 [6.35]	.500 [12.70]	20-X2129
.063 [1.60]	.625 [15.88]	20-X2113	.250 [6.35]	.625 [15.88]	20-X2104
.063 [1.60]	.750 [19.05]	20-X2114	.250 [6.35]	.750 [19.05]	20-X2105
.094 [2.39]	.375 [9.53]	20-X2115	.250 [6.35]	.875 [22.23]	20-X2130
.094 [2.39]	.500 [12.70]	20-X2116	.250 [6.35]	1.000 [25.40]	20-X2131
.094 [2.39]	.750 [19.05]	20-X2117	.313 [7.95]	.625 [15.88]	20-X2132
.125 [3.18]	.375 [9.53]	20-X2101	.313 [7.95]	.750 [19.05]	20-X2133
.125 [3.18]	.438 [11.13]	20-X2118	.313 [7.95]	.875 [22.23]	20-X2134
.125 [3.18]	.500 [12.70]	20-X2119	.375 [9.53]	.625 [15.88]	20-X2135
.125 {3.18]	.563 [14.30]	20-X2120	.375 [9.53]	.750 [19.05]	20-X2136
.125 [3.18]	.625 [15.88]	20-X2102	.375 [9.53]	.875 [22.23]	20-X2137
.125 [3.18]	.750 [19.05]	20-X2121	.375 [9.53]	1.000 [25.40]	20-X2138
.156 [3.96]	.500 [12.70]	20-X2122	.438 [11.13]	.750 [19.05]	20-X2139
.156 [3.96]	.625 [15.88]	20-X2123	.438 [11.13]	.875 [22.23]	20-X2140
.156 [3.96]	.750 [19.05]	20-X2124	.438 [11.13]	1.000 [25.40]	20-X2141
.188 [4.78]	.438 [11.13]	20-X2125	.500 [12.70]	.750 [19.05]	20-X2142
.188 [4.78]	.500 [12.70]	20-X2126	.500 [12.70]	.875 [22.23]	20-X2143
.188 [4.78]	.625 [15.88]	20-X2103	.500 [12.70]	1.000 [25.40]	20-X2144
.188 [4.78]	.750 [19.05]	20-X2127			

DOUBLE CORE



DIA. in. [mm]	O/A in. [mm]	PART NUMBER	DIA. in. [mm]	O/A in. [mm]	PART NUMBER
.063 [1.60]	.500 [12.70]	20-X5103	.188 [4.78]	.625 [15.88]	20-X5112
.063 [1.60]	.625 [15.88]	20-X5104	.188 [4.78]	.750 [19.05]	20-X5113
.063 [1.60]	.750 [19.05]	20-X5106	.188 [4.78]	.875 [22.23]	20-X5114
.063 [1.60]	.875 [22.23]	20-X5107	.188 [4.78]	1.000 [25.40]	20-X5115
.125 [3.18]	.500 [12.70]	20-X5108	.250 [6.35]	.750 [19.05]	20-X5116
.125 [3.18]	.625 [15.88]	20-X5101	.250 [6.35]	.875 [22.23]	20-X5117
.125 [3.18]	.750 [19.05]	20-X5109	.250 [6.35]	1.000 [25.40]	20-X5118
.125 [3.18]	.875 [22.02]	20-X5115	.375 [9.53]	1.000 [25.40]	20-X519
.125 [3.18]	1.000 [25.40]	20-X5111	.375 [9.53]	1.250 [31.75]	20-X5120

Custom Strips

WIRE MESH OVER ELASTOMER CORE

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT Custom Strip combines the resiliency and conductivity of knitted wire mesh with excellent compression and deflection characteristics of sponge elastomer. TECKNIT Custom Strip consists of two covers of knitted wire mesh over an elatomer (core). Core materials can be either neoprene, silicone closed cell sponge or TECKNIT low-closure force elastomer tubing. The knitted wire mesh can be either Tin Plate Phosphor Bronze, Tin Coated Copper Clad Steel (Sn/Cu/Fe), or Monel.

APPLICATION INFORMATION

TECKNIT Custom Strip is intended for use in electronic enclosures exhibiting a wide range of seam unevenness. It is especially useful as an EMI shieldseal for doors and other access openings where lowclosure force and compression set are primary considerations. TECKNIT Custom Strip is also ideal for EMI shielding applications that demand frequent assembly and disassembly and whose environmental requirements are not critical factors. For more critical environmental sealing, refer to TECKNIT DUOSTRIP™, DUOSIL®, ELASTOMET®, ELASTOFOAM™, or CONSIL® materials.

EMI SHIELDING PERFORMANCE*

Optimum EMI shielding is obtained with two (2) knitted covers deflected to 75% of original gasket height. The use of only one (1) knitted cover decreases shielding effectiveness 5-10 dB. More than two (2) covers do not improve shielding effectiveness significantly. See total shielding effectiveness data given below.

TECKNIT CUSTOM STRIPS Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Sn/Ph/Bz	80	130	110	95
Monel	60	125	90	80
Sn/Cu/Fe	80	130	105	95

*Based on 127 mm x 127 mm Aperture

SPECIFICATIONS

MATERIAL DESCRIPTION

Wire Mesh:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.
- **Sn/Cu/Fe:** .0045 in. [0.114 mm] diameter, per ASTM B-520.
- **Monel:** .0045 in. [0.114 mm] diameter per QQ-N-281 or AMS-4730.

Elastomer Core:

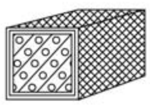
- **Neoprene sponge:** per MIL-R-6130, Type II, Grade A, Condition medium (ASTM-D-6576).
- **Silicone sponge:** per SAE-AMS-3195.
- **Silicone solid:** per ZZ-R-765, Class 2, Grade 40 (Standard), Grade 50 (Hollow Cores) (AA-59588).

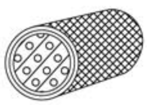
PERFORMANCE CHARACTERISTICS

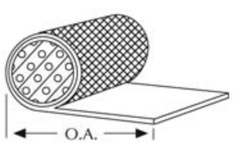
Temperature Range:

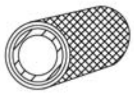
- 24°F to 212°F [-30°C to 100°C] for Neoprene sponge.
- 103°F to 401°F [-75°C to 205°C] for Silicone sponge.
- 75°F to 500°F [-60°C to 260°C] for Silicone solid.

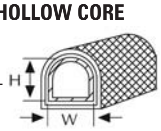
TABLE 1-STANDARD FORMS AVAILABLE

RECTANGULAR DOUBLE KNITTED COVER OVER SPONGE	ELASTOMER DIMENSIONS MIN. [MM] L X W	NEOPRENE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel	SILICONE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel
	.125 X 188 [3.18 X4.78]	21-63915	21-43915	21-13915	21-63948	21-43948	21-13948
	.125 X250 [3.18 X6.35]	21-63916	21-43916	21-13916	21-63949	21-43949	21-13949
	.125 X.375 [3.18 X 9.53]	21-63917	21-43917	21-13917	21-63950	21-43950	21-13950
	.188 X .188 [4.78 X 4.78]	21-63918	21-43918	21-13918	21-63951	21-43951	21-13951
	.188 X .375 [4.78 X 9.53]	21-63920	21-43920	21-13920	21-63953	21-43953	21-13953

ROUND DOUBLE KNITTED COVER OVER SPONGE	ELASTOMER DIMENSIONS	NEOPRENE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel	SILICONE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel
	.063 [1.60]	-	-	-	-	21-00076	-
	.125 [3.18]	21-63900	21-43900	21-13900	21-63933	21-43933	21-13933
	.188 [4.78]	21-63901	21-43901	21-13901	21-63934	21-43934	21-13934
	.250 [6.35]	21-63902	21-43902	21-13902	21-63935	21-43935	21-13935

SINGLE FIN DOUBLE KNITTED COVER OVER SPONGE	ELASTOMER DIA.	O.A.	NEOPRENE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel	SILICONE SPONGE CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel
	.125 [3.18]	.500 [12.70]	21-63907	21-43907	21-13907	21-63940	21-43940	21-13940
	.125 [3.18]	.625 [15.88]	21-63908	21-43908	21-13908	21-63941	21-43941	21-13941
	.125 [3.18]	.750 [19.05]	21-63909	21-43909	21-13909	21-63942	21-43942	21-13942
	.188 [4.78]	.500 [12.70]	21-63910	21-43910	21-13910	21-63943	21-43943	21-13943
	.188 [4.78]	.625 [15.88]	21-63911	21-43911	21-13911	21-63944	21-43944	21-13944
	.188 [4.78]	.750 [19.05]	21-63912	21-43912	21-13912	21-63945	21-43945	21-13945
	.250 [6.35]	.750 [19.05]	21-63913	21-43913	21-13913	21-63946	21-43946	21-13946
	.250 [6.35]	1.000 [25.40]	21-63914	21-43914	21-13914	21-63947	21-43947	21-13947

ROUND DOUBLE KNITTED COVER OVER HOLLOW CORE	ELASTOMER DIAMETER DIA.	O.A.		SILICONE HOLLOW CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel
.062 [1.58] CORE WALL THICKNESS 	.500 [12.70]	.375 [9.53]		-	21-00070	21-00072
	.375 [9.53]	.250 [6.35]		-	21-00071	21-00073

"D" DOUBLE KNITTED COVER OVER HOLLOW CORE	ELASTOMER DIAMETER W	H		SILICONE SOLID HOLLOW CORE Sn/Ph/Bz	Sn/Cu/Fe	Monel
.093 [2.36] CORE WALL THICKNESS 	.500 [12.70]	.500 [12.70]		-	21-00074	21-00075

ELASTOMER TOLERANCES: ±.031 in. [0.79 mm]

For TECKNIT OVERALL DIMENSIONS, add .031 in. [0.79 mm] to Elastomer Dimension. Resulting dimensions are applicable to parts under a 4 oz. [113 g.] load using .75 in. [19.05 mm] anvils.

ORDERING INFORMATION

To order available TECKNIT Custom Strip, specify TECKNIT Part Number and quantity required. For other types of custom strips or for those utilizing fiberglass, high-temperature ceramic fibers, elastomer tubing, or other specialized materials, contact your nearest TECKNIT area representative or factory.

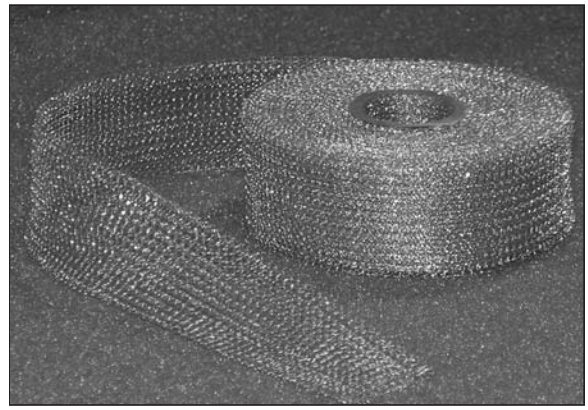
EMI Shielding Tape

THIN STRIP OF WIRE MESH

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

EMC SHIELDING TAPE is a double layered strip of knitted wire mesh providing effective EMI shielding for electrical and electronic cable assemblies. The knitted construction of EMI SHIELDING TAPE maximizes conformability and flexibility while minimizing bulk and weight. Standard EMC SHIELDING TAPE uses Sn/Cu/Fe knitted wire to provide greater physical strength and shielding effectiveness than may be achieved with other tape materials.



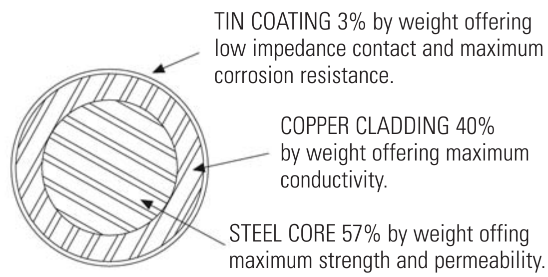


Figure 1. Cross section of Sn/Cu/Fe wire.

APPLICATION INFORMATION

TECKNIT EMC SHIELDING TAPE is recommended for EMI shielding, grounding, and static discharge applications. It is particularly effective as a primary or supplementary shield for electronic cables and cable assemblies. The flexibility of EMC SHIELDING TAPE permits it to conform to irregular surfaces. EMC SHIELDING TAPE is useful in a broad range of temperatures and environments.

EMI SHIELDING PERFORMANCE

TECKNIT EMC SHIELDING TAPE Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Sn/Cu/Fe	45	60	40	30

SPECIFICATIONS

MATERIAL DESCRIPTION

Wire Mesh*: Sn/Cu/Fe, (tin coated copper clad steel see Figure 1) .0045 ± .0005 in. [0.114 ± 0.012mm] diameter in accordance with ASTM B-520.

Width: 1.00 in. [25.4 mm] nominal.

Thickness: .02in. [0.45 mm] nominal.

Weight: 8.0 oz. per 100 feet [745 grams per 100 meters].

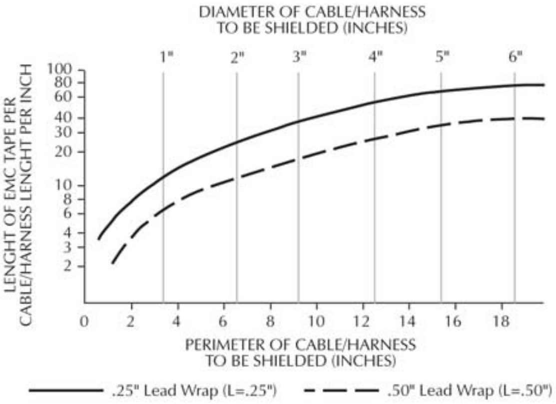
PERFORMANCE CHARACTERISTICS

Corrosion Resistance: Excellent.

Solderability: Excellent.

*Special orders available in different widths and in such materials as Monel, Aluminum, Silver Plated Brass, Tin-Plated Phosphor Bronze.

TAPE LENGTH VS. CABLE SIZE



Note: For each termination and/or branch connection add 30 in. [76 cm] of EMC tape to anticipated usage.

Figure 2

SHIELDING TAPE TERMINATION

TECKNIT Two Part, Silver-filled, Conductive Epoxy (Part No. 72-08116), is recommended for cable shielding tape termination. The epoxy is rigid with a volume resistivity of 0.001 ohm-cm. EMC SHIELDING TAPE may also be terminated by means of soldering or clamping.

METHODS OF APPLYING EMC SHIELDING TAPE TECKNIT EMC SHIELDING TAPE

should be wrapped around the cable assembly. Wrap the main cable and terminate the tape before beginning to wrap the cable branch. Start and end all helical wrapping with a minimum of two overlapping circumferential wraps. At branch connections, start at least 4 in. [100 mm] before and after branch to assure adequate EMC SHIELDING TAPE coverage at the "V" section. Branch connections should not be designed to occur within 4 in. [100 mm] or each other.

Recommended lead for most applications is 0.50 in. [13 mm], although some additional shielding will be achieved when utilizing a 0.25 in. [6 mm] lead. The length of EMC SHIELDING TAPE required for each cable using these two types of lead wraps can be obtained by referring to Figure 2.

TECKNIT PART NUMBERS	LENGTH OF EMC TAPE
23-50225	25 ft. [7.6 m] per roll
23-50200	100 ft. [30.5 m] per roll
23-50233	1000 ft. [305 m] per spool
23-50231	1500 ft. [457 m] per spool
23-50228	2000 ft. [610 m] per spool
23-50229	2500 ft. [762 m] per spool

WIRE TYPE / WIRE DIAMETER

TECKNIT mesh stockings are available in any of our standard wires:

WIRE TYPE	WIRE DIAMETER
Sn/Cu/Fe	.0045"
Monel	.0045"
Aluminum	.005"
Sn/Phosphor Bronze	.0045"
Ag/Brass	.005"

Stockings are available in widths from .250" to 10.0"

Contact TECKNIT for price and availability.

ORDERING INFORMATION

For 25 and 100 ft. [7.6 and 30.5 m] lengths, EMC SHIELDING TAPE is supplied in individual packages. Longer continuous lengths are supplied on spools. To order standard parts, specify the TECKNIT Part Number and the quantity or rolls or feet. For non-standard items contact your nearest TECKNIT area representative or factory location.

Teckmesh Tape

SHIELD & SEAL WIRE MESH

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKMESH is a flexible EMC tape for shielding and sealing cables and harnesses. Constructed of knitted wire mesh for shielding and silicone elastomer for sealing, it is self-sealing and inseparable after 24 hours at room temperature.

The shield is a double layer of knitted wire mesh. Standard wire material is tin coated copper clad steel (Sn/Cu/Fe) for optimum magnetic and electric field shielding. Minimum shielding in the 100 kHz to 1 GHz spectrum is 40 dB. Other materials are available such as tin plated phosphor bronze for increased shielding in the 10 MHz to 10 GHz region.

The seal is a silicone elastomer that fuses on contact with itself. No adhesives, clamps or special tools are required for cable or harness wrapping or curing.

The combination of shielding and sealing materials provides uniform tension on the shielding mesh to ensure tight EMI control even under adverse conditions of cable twisting and bending. The tape seals against moisture, corrosive electrolytes, and noxious gases permitting extended life. It readily conforms to cable or harness surface permitting branching, extensions, repairs and the mounting of grounding tabs. It is extremely easy to use.

APPLICATION INFORMATION

TECKMESH is recommended for shielding, grounding, and static discharge applications. It is effective for most commercial applications for supplemental shielding of electrical and electronic cables and harnesses against radiating emissions under FCC or VDE regulations. As a primary shield, it provides more than an adequate shield when properly assembled for personal computers, communication devices and equipment controllers.

SPECIFICATIONS

MATERIAL DESCRIPTION

Shield:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.
- **Knitted wire mesh:** 1.0 in. [25.4 mm] wide.
- **Standard (P/N 23-50300):** Sn/Cu/Fe (tin coated copper clad steel), .0045 in. [0.114 mm] dia. per ASTM B-520.
- **Option (P/N 23-50303):** Tin plated phosphor bronze, .0045 in. [0.114 mm] per ASTM B-105, alloy 30 (CDA C50700), plated per ASTM B-33.

Seal: Silicone, 1.0 in. [25.4 mm] wide.

- **Width (overall):** 1.50 in. [38.1 mm] nominal.
- **Length (of roll):** 36 ft. [10.97 meters] nominal.
- **Thickness:** Tape, .04 in. [1.0 mm] nominal. 50% overlap, .09 in. [2.2 mm] nominal.
- **Weight:** 24.6 oz. per 100 ft. [2.3 kg per 100 meters].

PERFORMANCE CHARACTERISTICS

Shield:

- **Pull Strength:** 50 lbs. [222 N].
- **Elongation (max.):** 100%.
- **Solderability:** Excellent.

Seal:

- **Hardness, Shore A Durometer:** 50 (ASTM D-2240).
- **Room Temp. Cure:** 24 hours.
- **Tensile Strength (min.) (ASTM D-412):** 700 psi [4.8 MPa].
- **Tear Strength (min.) (ASTM D-624):** 85 lbf/in. [148 N/m].
- **Bond Strength (min.) 24 hours at room temp.:** 2 lbs. [8.5 N].
- **Dielectric Strength (min.):** 400V/mil [15.7 kv/mm].
- **Volume Resistivity (min.):** 10^{14} ohms/cm.
- **Temperature Range:** -67°F to 390°F [-55°C to 200°C]

EMI SHIELDING PERFORMANCE

TECKMESH Shielding Tape has been tested for shielding effectiveness (SE) in accordance with TECKNIT Test Method TSET-01 based on a modified MIL-STD-285 test. The tests were performed using a 50% overlap which produces a 4 layer shield. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
	dB	dB	dB	dB
Sn/Cu/Fe	45	60	40	30
Sn/Ph/Bz	--	70	50	35

METHOD OF APPLICATION

The overall width of the shielding tape is 1.5 inches; one inch for the shield and one inch for the elastomer. The two sections of the tape are overlapped by .5 inch and bonded together:

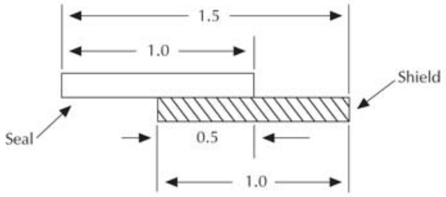


Figure 1. Cross Section

Wrap tape around the cable starting at one end. Wrap the main cable before wrapping the branches. Secure the beginning wrap by using the sealing tape. Remove about 4 inches of the shielding mesh by clipping the tie points holding the mesh to the elastomer seal. The 4 inch long tab of mesh can be used as a grounding point or removed if the opposite end is to be grounded. The mesh shield can be soldered to a convenient ground or a spade lug attached to the mesh for grounding to a mounting screw. The free end of the sealing tape should be used to seal off the end of the shield to exclude moisture.

ORDERING INFORMATION

To order, specify the TECKNIT part number and the quantity or rolls or feet. For assistance contact your nearest TECKNIT area representative or factory location.

TECKNIT PART NUMBERS	LENGTH
23-50300	36 ft. roll
23-50303	36 ft. roll

TECKNIT

Seamless Knitted Wire

DIE-COMPRESSED MESH GASKETS

U.S. Customary
[SI Metric]

TECKNIT

GENERAL DESCRIPTION

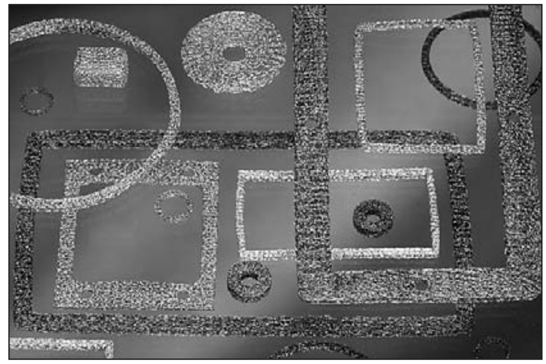
SEAMLESS KNITTED WIRE gaskets are utilized forhigh volume, custom engineered applications. Although most applications involve rings, gaskets can be produced in rectangular and special shapes, with holes or mounting recesses, corner radii and other special features. TECKNIT gaskets are formed by die-compressing a controlled amount of knitted wire mesh that contains no joints or splices. SEAMLESS KNITTED WIRE MESH gaskets offer excellent EMI shielding characteristics, controlled density, good resiliency, low cost, and easy installation. They can be manufactured as small as 0.125 in. [3.18 mm] I.D. and 0.250 in. [6.35 mm] O.D. Wall thickness and height are generally limited to 0.063 in. [1.59 mm] minimum and 0.250 in. [6.35 mm] maximum.

APPLICATION INFORMATION

Unique SEAMLESS KNITTED WIRE MESH gaskets are used in EMI shielding applications that include cable TV, microwave ovens, waveguide flanges, connector and filter mountings. They have also been used for shaft seals, heat sinks, shock absorbers, and filters, and can be manufactured by hand-forming and joining for prototype requirements. (For applications requiring both EMI shielding and moisture sealing, see TECKNIT DUOGASKET.)

MATERIAL RECOMMENDATIONS

The four standard wire materials used to manufacture SEAMLESS KNITTED WIRE gaskets are listed under TECKNIT specifications. For availability of SEAMLESS KNITTED WIRE MESH gaskets in other wire materials, contact TECKNIT.



SPECIFICATIONS

MATERIAL DESCRIPTION

Wire Mesh*:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.
- **Sn/Cu/Fe:** .0045 in. [0.114 mm] diameter, per ASTM B-520.
- **Ag/Brass:** .005 in. [0.127 mm] diameter, per QQW-321 (ASTM B-520), silver-plated (3% silver by weight).
- **Monel:** .0045 in. [0.114 mm] diameter, per QQN-281 or AMS-4730.

* NOTE: Recommended volume density of wire is 14 to 20 percent.

EMI SHIELDING PERFORMANCE

TECKNIT SEAMLESS KNITTED WIRE Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Ag/Br	80	135	105	95
Sn/Cu/Fe	80	130	105	95
Sn/Ph/Bz	80	130	110	100
Monel	60	130	90	80

SEAMLESS KNITTED WIRE MESH gaskets may also be made from wire of nonstandard materials and diameters. Maximum gasket size is limited to approximately 4 in. [102 mm] diameter. Contact your nearest TECKNIT representative or factory for design assistance.

STANDARD TOLERANCES		
	DIMENSIONS in. [mm]	TOLERANCES in. [mm]
I.D.	0.125-3.875 [3.175-98.4]	+0, -0.020 in. [+0, -0.50 mm]
O.D.	0.250-4.0 [6.35-101.6]	+0.020, -0 in. [+0.50, -0 mm]
HEIGHT*	.063-.250 [1.6-6.35]	+0.020, -0 in. [+0.50, -0 mm]

*Dimensions applicable to parts under a 4 oz. [113g] load using .75 in [19.1 mm] anvils.

ORDERING INFORMATION

When ordering round SEAMLESS KNITTED WIRE MESH gaskets, specify the I.D., O.D. and height. For gaskets of other shapes, provide a drawing specifying all critical dimensions (i.e., corner radii, hole dimensions, location of holes and density/weight requirement.) Before finalizing design, contact TECKNIT to determine whether existing tooling is available for your application.

Custom Knitted Wire

CUSTOM MESH GASKETS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT CUSTOM KNITTED WIRE MESH gaskets and assemblies are produced from many standard forms of knitted wire materials. These include TECKNIT STRIPS (rectangular, round, double core and round with fin) and TECKNIT CUSTOM STRIPS (double knit over sponge and hollow cross section elastomer core constructions). For standard materials and cross sections used in the manufacture of TECKNIT CUSTOM KNITTED WIRE gasket and assemblies, refer to pages listing TECKNIT STRIPS and TECKNIT CUSTOM STRIPS.

APPLICATION INFORMATION

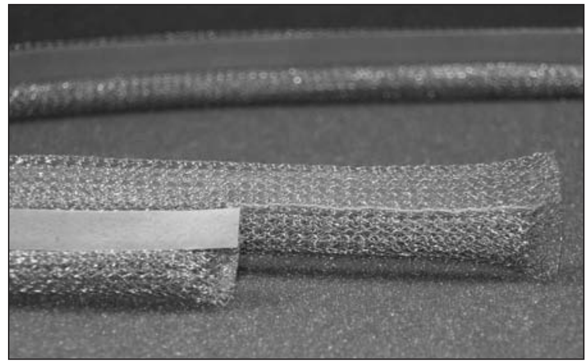
TECKNIT CUSTOM KNITTED WIRE MESH gaskets and assemblies are effective in a variety of EMI shielding applications. They install easily and offer the design engineer many methods of attachment, such as rivets, clips, retaining strips, spot welds, side wall friction, and adhesives (see TECKNIT CONDUCTIVE systems).

EMI SHIELDING PERFORMANCE*

TECKNIT CUSTOM KNITTED WIRE Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
	dB	dB	dB	dB
Ag/Br	80+	135+	105	95
Sn/Cu/Fe	80+	130+	105	95
Sn/Ph/Bz	80+	130+	110	100
Aluminum	60	130	90	80
Monel	60+	130	90	80

*Based on 127 mm x 127 mm Aperture



SPECIFICATIONS

MATERIAL DESCRIPTION

Wire Mesh*:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin plated per ASTM B-33.
- **Sn/Cu/Fe:** .0045 in. [0.114 mm] diameter, per ASTM B-520.
- **Ag/Brass:** .005 in. [0.127 mm] diameter, per QQW-321 (ASTM-B-134), silver plated (3% silver by weight).
- **Monel:** .0045 in. [0.114 mm] diameter, per QQN-281, or AMS-4730.
- **Aluminum Alloy 5056:** .005 in. [0.127 mm] diameter, per SAE AMS-4182 (except max. tensile strength is 75,000 psi).

Elastomer

- **Neoprene sponge (closed cell):** MIL-R-6130, Type II, Grade A, Condition medium.
- **Neoprene solid:** MIL-R-6855, Class 2, Grade 40.
- **Silicone sponge (closed cell):** AMS-3195.
- **Silicone solid:** ZZ-R-765, Class 2, Grade 40 (Standard), Grade 50 (For Hollow Cores).

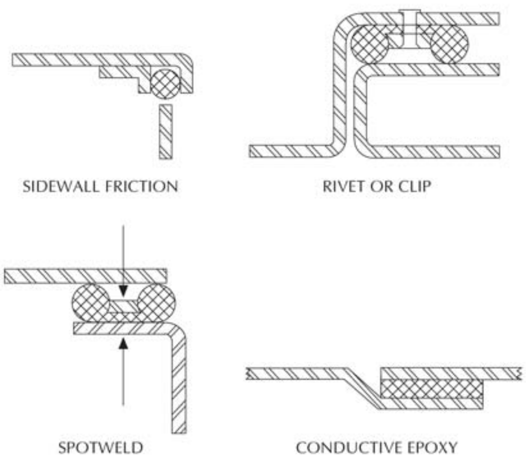
PERFORMANCE CHARACTERISTICS

Temperature Range

- **Neoprene sponge:** -24°F to 212°F [-30°C to 100°C]
- **Neoprene solid:** -65°F to 212°F [-54°C to 100°C]
- **Silicone sponge:** -103°F to 401°F [-75°C to 205°C]
- **Silicone solid:** -75°F to 500°F [-60°C to 260°C]

INSPECTION METHODS

TECKNIT CUSTOM KNITTED WIRE MESH gaskets and assemblies conform to flange or groove mountings. Dimensional tolerances for gaskets and assemblies are usually greater than the tolerances of flanges and grooves. The inherent resiliency and conformability of the gaskets allow them to easily adapt to enclosure dimensions. Recommended inspection methods for knitted wire mesh gaskets employ the use of templates or samples of the flange or groove into which the gasket will be installed.



TOLERANCES

CROSS SECTION DIMENSIONS

Width and Height*

.06 to .38 in. [1.6 to 9.5mm] .... ±.031 in. [0.79mm]
.38 in. [9.5mm] to .500 in. [12.7] ±.063 in. [1.60 mm]

OVERALL DIMENSIONS

Length and Width

Up to 12 in. [305mm]....................±.063 in. [1.60mm]
For additional
6 in. [152.4 mm] ....±.031 in. [0.79mm]
Holes and Slots ....±.031 in. [0.79mm]

*NOTE: Dimensions are measured with parts under 4 oz. [113g] load using .75 in. [19.1 mm] anvils.

ORDERING INFORMATION

It is recommended that TECKNIT CUSTOM KNITTED WIRE MESH gaskets and assemblies be designed using standard TECKNIT STRIP and CUSTOM STRIP cross sections listed on their respective pages in this catalog. Specify TECKNIT Part Number for cross section and material. Supply the remaining specifications for finished parts: overall dimensions, hole locations, mounting methods, and any other mechanical requirements. Holes and ends of knitted wire mesh may be finished to minimize fraying. This can be accomplished by utilizing finishing methods such as sewing, spot welding, grommetting, or similar methods. For assistance with your custom application, contact your nearest TECKNIT area representative or factory location.

Duostrips™ and Duogaskets™

WIRE MESH WITH ELASTOMER SEAL

U.S. Customary
[SI Metric]

TECKNIT

GENERAL DESCRIPTIONS

TECKNIT DUOSTRIPS and DUOGASKETS consist of knitted wire mesh strips combined with an elastomer. This combination provides electromagnetic shielding plus an environmental seal. The EMI shielding knitted wire mesh should be selected to provide optimum shielding effectiveness while assuring compatibility with the metals of the surface being gasketed. Most commonly employed metals are Tin-Plated Phosphor Bronze, Tin-Coated Copper-Clad Steel (Sn/ Cu/Fe) and Monel. Environmental sealing is achieved by using elastomers with solid or closed cell sponge neoprene or silicone. Optional elastomers include fluorosilicone, buna and butyl rubber.

APPLICATION INFORMATION

TECKNIT DUOSTRIPS and DUOGASKETS are used in applications requiring EMI shielding and environmental sealing. Optional pressure sensitive adhesive backing provides a convenient and effective means of mounting the gasket. DUOSTRIPS and DUOGASKETS are used to seal enclosure doors and lids, removable cover plates, and as interface gaskets for mounting shielding windows and air vent panels.

EMI SHIELDING PERFORMANCE*

TECKNIT TWIN DUOSTRIP Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
	dB	dB	dB	dB
Monel	65	135	100	90

*Based on 127 mm x 127 mm Aperture

CLOSURE PRESSURES RECOMMENDED

The many parameters in shielding/sealing gasket design, such as width, thickness and durometer, make it difficult to specify exact closing pressure criteria. A general rule, for both solid and sponge elastomers, closing pressures should be 69 kPa [10 psi] min.

SPECIFICATIONS

MATERIAL DESCRIPTION

Wire Mesh:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.
- **Sn/Cu/Fe:** .0045 in. [0.114 mm] diameter, per ASTM B-520.
- **Ag/Brass:** .005 in. [0.127 mm] diameter, per QQ-W-321, (ASTM-B-134) silver-plated (3% silver by weight).
- **Monel:** .0045 in. [0.114 mm] diameter, per QQ-N-281, or AMS-4730.
- **Aluminum Alloy 5056:** .005 in. [0.127 mm] diameter, per SAE AMS-4182 (except max. tensile strength is 75,000 psi).

Elastomer:

- **Neoprene sponge:** (closed cell), MIL-R-6130, Type II, Grade A, Condition medium. (ASTM-D-6576)
- **Neoprene solid:** MIL-R-6855, Class 2, Grade 40.
- **Silicone sponge** (closed cell): SAE AMS-3195.
- **Silicone solid:** ZZ-R-765, Class 2, Grade 40 (Standard), Grade 50 (Hollow Cores). (AA-59588)

PERFORMANCE CHARACTERISTICS

Temperature Range:

- **Neoprene sponge:** -24°F to 212°F [-31°C to 100°C]
- **Neoprene solid:** -65°F to 212°F [-54°C to 100°C]
- **Silicone sponge:** -103°F to 401°F [-75°C to 205°C]
- **Silicone solid:** -75°F to 500°F [-60°C to 260°C]

DUOSTRIPS

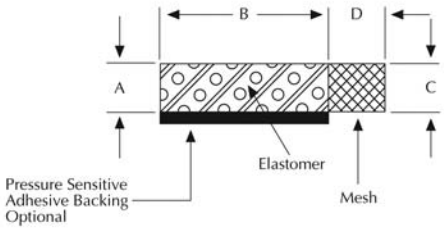


Figure 1.

CROSS SECTION				NEOPRENE SPONGE				SILICONE SPONGE			
DIMENSIONS in. [mm]				PLAIN		TECKSTIK ADH.		PLAIN		TECKSTIK-SIL. ADH.	
A	B	C	D	MONEL	SN/CU/FE	MONEL	SN/CU/FE	MONEL	SN/CU/FE	MONEL	SN/CU/FE
.062 [1.57]	.250 [6.35]	.062 [1.57]	.125 [3.18]	43-13511	43-00213	43-16792	43-00252	43-13802	43-00120	43-00144	43-00165
.062 [1.57]	.375 [9.53]	.062 [1.57]	.125 [3.18]	43-13446	43-00214	43-00003	43-00253	43-00063	43-00121	43-16796	43-00166
.062 [1.57]	.500 [12.70]	.062 [1.57]	.125 [3.18]	43-00030	43-00215	43-16795	43-00000	43-13546	43-00122	43-00145	43-00167
.062 [1.57]	.625 [15.88]	.062 [1.57]	.125 [3.18]	43-00200	43-00216	43-00237	43-00254	43-13841	43-00123	43-00041	43-46711
.093 [2.36]	.250 [6.35]	.093 [2.36]	.125 [3.18]	43-13634	43-00217	43-16764	43-00255	43-00100	43-00124	43-00146	43-00168
.093 [2.36]	.375 [9.53]	.093 [2.36]	.125 [3.18]	43-00201	43-00218	43-00238	43-46456	43-00101	43-00125	43-00147	43-00169
.093 [2.36]	.500 [12.70]	.093 [2.36]	.125 [3.18]	43-13613	43-00219	43-16797	43-46458	43-00102	43-00126	43-16799	43-00170
.093 [2.36]	.750 [19.05]	.093 [2.36]	.125 [3.18]	43-13245	43-00220	43-00239	43-00256	43-00103	43-00127	43-00148	43-00171
.125 [3.18]	.187 [4.75]	.125 [3.18]	.187 [4.75]	43-13268	43-00221	43-00240	43-00258	43-00104	43-00128	43-00150	43-00173
.125 [3.18]	.250 [6.35]	.125 [3.18]	.125 [3.18]	43-13334	43-00222	43-00241	43-46136	43-00105	43-00129	43-00021	43-00174
.125 [3.18]	.250 [6.35]	.125 [3.18]	.250 [6.35]	43-13261	43-00223	43-16136	43-00259	43-13635	43-00130	43-00151	43-00175
.125 [3.18]	.375 [9.53]	.125 [3.18]	.125 [3.18]	43-13971	43-43971	43-16106	43-46102	43-13980	43-43980	43-16404	43-46406
.125 [3.18]	.500 [12.70]	.125 [3.18]	.125 [3.18]	43-13746	43-00224	43-16108	43-46100	43-13842	43-00131	43-16408	43-46408
.125 [3.18]	.500 [12.70]	.125 [3.18]	.250 [6.35]	43-13262	43-00225	43-00242	43-00260	43-13794	43-00132	43-16431	43-46710
.125 [3.18]	.625 [15.88]	.125 [3.18]	.125 [3.18]	43-13972	43-43972	43-16110	43-46101	43-13981	43-43981	43-16410	43-46410
.125 [3.18]	.750 [19.05]	.125 [3.18]	.125 [3.18]	43-00202	43-43175	43-16112	43-00262	43-00107	43-43178	43-00040	43-00177
.125 [3.18]	.750 [19.05]	.125 [3.18]	.250 [6.35]	43-00203	43-43162	43-00244	43-00263	43-00108	43-00134	43-00153	43-00178
.187 [4.75]	.250 [6.35]	.187 [4.75]	.125 [3.18]	43-00204	43-00227	43-00246	43-00265	43-00109	43-43161	43-00155	43-00180
.187 [4.75]	.375 [9.53]	.187 [4.75]	.125 [3.18]	43-13974	43-43974	43-16206	43-46206	43-13983	43-43983	43-16506	43-46506
.187 [4.75]	.500 [12.70]	.187 [4.75]	.125 [3.18]	43-13115	43-00228	43-16208	43-46208	43-00110	43-00135	43-16508	43-46508
.187 [4.75]	.625 [15.88]	.187 [4.75]	.125 [3.18]	43-13975	43-43975	43-16210	43-46210	43-13984	43-43984	43-16510	43-46510
.187 [4.75]	.625 [15.88]	.187 [4.75]	.250 [6.35]	43-00205	43-00229	43-00247	43-00266	43-00111	43-00136	43-00156	43-00181
.187 [4.75]	.750 [19.05]	.187 [4.75]	.250 [6.35]	43-00206	43-00230	43-00248	43-00267	43-00112	43-00137	43-00157	43-00182
.250 [6.35]	.250 [6.35]	.250 [6.35]	.125 [3.18]	43-00207	43-00231	43-16304	43-00020	43-00113	43-43142	43-00159	43-00184
.250 [6.35]	.375 [9.53]	.250 [6.35]	.125 [3.18]	43-13977	43-43977	43-16306	43-46306	43-13986	43-43986	43-16606	43-46606
.250 [6.35]	.500 [12.70]	.250 [6.35]	.125 [3.18]	43-00208	43-00232	43-16308	43-46308	43-00114	43-00138	43-16608	43-46608
.250 [6.35]	.625 [15.88]	.250 [6.35]	.125 [3.18]	43-13978	43-43978	43-16310	43-46310	43-13987	43-43987	43-16610	43-46610

TWIN MESH DUOSTRIP

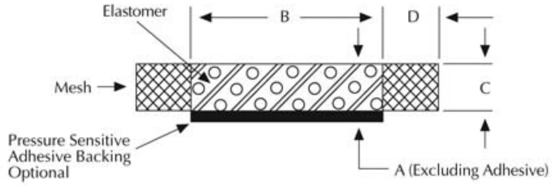


Figure 2.

DIMENSIONS in. [mm]				PLAIN		TECKSTIK ADH.		PLAIN		TECKSTIK-SIL. ADH.	
A	B	C	D	MONEL	SN/CU/FE	MONEL	SN/CU/FE	MONEL	SN/CU/FE	MONEL	SN/CU/FE
.125 [3.18]	.250 [6.35]	.125 [3.18]	.125 [3.18]	43-13335	43-43123	43-16718	43-46131	43-00324	43-00331	43-00042	43-00344
.125 [3.18]	.375 [9.53]	.125 [3.18]	.125 [3.18]	43-13141	43-00306	43-16726	43-46137	43-00325	43-00332	43-00339	43-46138
.125 [3.18]	.500 [12.70]	.125 [3.18]	.250 [6.35]	43-00302	43-00309	43-00315	43-00320	43-00328	43-00335	43-00341	43-00347
.187 [4.75]	.250 [6.35]	.187 [4.75]	.125 [3.18]	43-00303	43-00310	43-00316	43-00321	43-13707	43-00336	43-00342	43-00348

Duostrips, Duogaskets Cont.

U.S. Customary
[SI Metric]

OPTIONAL CONSTRUCTIONS

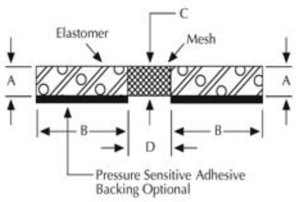


Figure 3. Twin Elastomer Duostrip

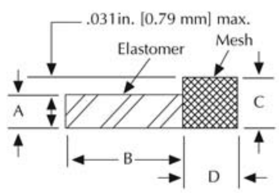


Figure 4. Solid Elastomer Duostrip

DUOGASKET DRAWING STANDARDS

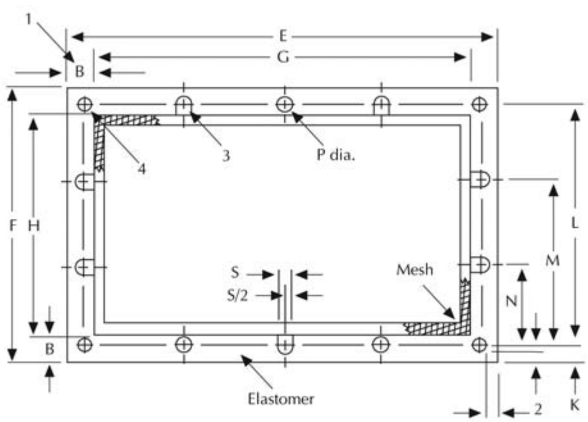


Figure 5.

NOTES:

1. Minimum sealing gasket with (B) is .125 in. [3.18 mm] but not less than gasket thickness (A).
2. Minimum distance from bolt hole or compression stop to edge of sealing gasket is not less than thickness of gasket material nor less than .062 in. [1.57 mm].
3. If bolt holes must be closer than shown in Note 2, use U-shaped slots (S).
4. Minimum hole diameter not less than gasket thickness nor less than .094 in. [2.39 mm]

DUOSTRIP AND DUOGASKET TOLERANCES

ELASTOMER CROSS SECTION TOLERANCES

	Dimensions	Sponge Rubber	Solid Rubber
A .	under .100 in. [2.54 mm]	± .016 in. [.40 mm]	± .016 in. [.40 mm]
	100 in. to .200 in. [2.54 to 5.08 mm]	± .031 in. [.79 mm]	± .016 in. [.40 mm]
	.200 to .500 in. [5.08 to 12.7 mm]	± .047 in. [1.19 mm]	± .031 in. [.79 mm]
B	under 1.00 in. [25.4 mm]	± .031 in. [.79 mm]	± .031 in. [.79 mm]
	1.00 to 2.00 in. [25.4 to 50.8 mm]	± .063 in. [1.59 mm]	± .063 in. [1.59 mm]

WIRE MESH CROSS SECTION TOLERANCES

Dimensions	Gasket Height & Width	Tolerance
C,D	.062 to .187 in. [1.57 to 4.75 mm]	+ .016, - 0 in. [+ 0.41, - 0 mm]
	.188 to .500 in. [4.78 to 9.53 mm]	+ .031, - 0 in. [+ 0.79, - 0 mm]

DUOGASKET TOLERANCES

	Dimensions	Sponge Rubber	Solid Rubber
E,F,G,H	under 6 in. [152.4 mm]	± .031 in. [.79 mm]	± .016 in. [.40 mm]
	each additional 1 in. [25.4 mm]	± .005 in. [.13 mm]	± .003 in. [.08 mm]
K,L,M,N	under 6 in. [152.4 mm]	± .016 in. [.40 mm]	± .016 in. [.40 mm]
	each additional 1 in. [25.4 mm]	± .003 in. [.08 mm]	± .003 in. [.08 mm]
P,S	-	± .016 in. [.40 mm]	± .016 in. [.40 mm]

NOTE: All tolerances are based on gasket thicknesses of .125" or less. For gaskets thicker than .125", contact factory for applicable tolerances. All parts available with tin-plated phosphor bronze mesh.

DESIGN AND THICKNESS CONSIDERATIONS

Most DUOSTRIP and DUOGASKET applications use sponge materials, however; any of the standard cross sections shown in Figures 1-3 are available using solid elastomers. For DUOSTRIPS and DUOGASKETS designed with solid elastomers, the thickness of the knitted wire mesh EMI gasket is always 0.031 in. [0.79 mm] thicker than the elastomer for optimum shielding and sealing (see Figure 5). With a sponge-elastomer, the knitted wire mesh EMI gasket thickness is generally the same as that of the elastomer (see Figure 1).

The most common thickness specified for the elastomer portion of DUOSTRIPS and DUOGASKETS is 0.125 in. [3.18 mm] and should be specified whenever possible. Also available are 0.062 in. [1.57 mm], 0.093 in. [2.36 mm], 0.187 in. [4.75 mm] and 0.250 in. [6.35 mm] thick elastomer.

COMPRESSION STOPS

TECKNIT can provide disc or washer-type compression stops on sponge or solid elastomer DUOSTRIP and DUOGASKETS to minimize over-compressing and bowing of flanges between bolt locations. TECKNIT stops are fabricated from standard tubing materials in either aluminum or stainless steel.

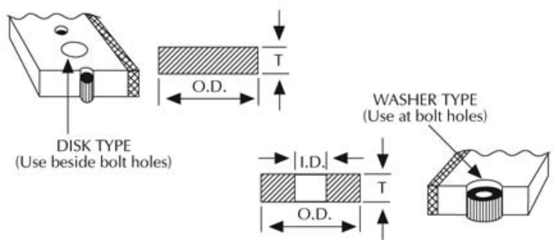


Figure 6. Compression Stop Design

STANDARD ±.005 in. [± 0.13 mm]						
O.D.	.062	.093	.125	.188	.250	.375
	[1.57]	[2.36]	[3.18]	[4.78]	[6.35]	[9.53]
I.D.	-	-	-	.93	.125	.250
	-	-	-	[2.36]	[3.18]	[6.35]

MATERIAL	T DIMENSION in.[mm]	TOLERANCES in.[mm]
	.040 - .090	±.006
Aluminum	[1.02 - 2.29]	[0.15]
	.090 - .130	±.008
	[2.29 - 3.30]	[0.20]
Stainless Steel	.130 - .190	±.010
	[3.30 - 4.83]	[0.25]

Selected from std. gauge sheets, rod and tubing materials only.

ADHESIVE BACK GASKETS AND STRIPS

DUOSTRIPS and DUOGASKETS are available with TECKSTIK, a pressure-sensitive adhesive backing on the elastomer portion of the gaskets, which holds them in place temporarily for installation. TECKSTIK shelf life is one year when stored at or below 73°F [23°C].

DUOSTRIPS - SPECIAL LENGTHS AND FINISHED ENDS

Standard DUOSTRIPS are supplied in 25 ft. ± 1 in. [7.60 ± 0.03 m] rolls. DUOSTRIPS can also be cut to specific lengths with square or miter-cut ends, or strips with finished EMI gasket ends.

DUOGASKETS-SIZES AVAILABLE

The sealing portion of the DUOGASKETS is diecut from sheet elastomer. One-piece, jointless sealing gaskets are available up to 36 in. x 36 in. [914 mm x 914 mm]. Larger gaskets are normally spliced using one of the splicing methods shown in Figure 7. These techniques should be considered if a jointless design results in a large waste of elastomer. In preparing drawings, indicate whether or not elastomer splices are permitted. Molded sealing gaskets are also available to suit special flange configurations. The elastomer portion of the gasket may be molded for high volume, custom applications.

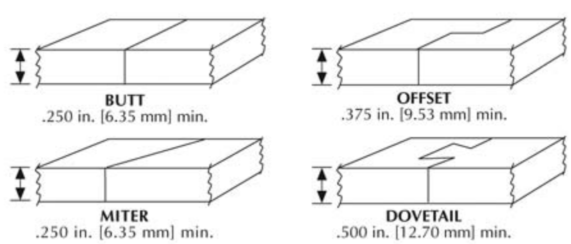


Figure 7. Four basic splicing techniques.

ORDERING INFORMATION

To order a standard 25 ft. ± 1 in. [7.60 m ± 0.03 m] roll of DUOSTRIP, specify dimensions and part number. For any DUOSTRIP variation, supply a sketch and indicate special elastomer requirements and EMI gasketing. For design assistance, contact your nearest TECKNIT area representative or factory location.

Teckstrip®

WIRE MESH WITH ALUMINUM STRIP

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKSTRIP is a combination of resilient EMI shielding mesh crimped in a solid aluminum mounting strip. A jaw-type construction of the aluminum extrusion ensures secure fastening of EMI shielding mesh. In addition, the aluminum extrusion provides a positive compression stop, minimizing compression set of the EMI shielding mesh. TECKSTRIP can be supplied as ready-to-mount frames or in custom or bulk lengths.

APPLICATION INFORMATION

TECKSTRIP greatly simplifies shielding gasket installation. TECKSTRIP can be attached directly to the enclosure to be shielded by spot welding, bolting, riveting, or similar fastening techniques. The aluminum frame permits accurate positioning, is easy and economical to install, and when attached to sheet metal enclosures, provides rigidity and enhances structural strength.

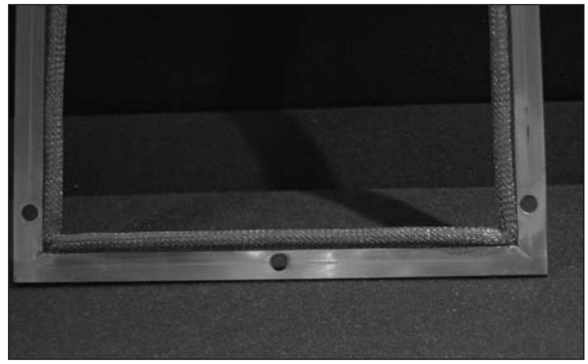
EMI SHIELDING PERFORMANCE*

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Sn/Ph/Bz	80	130	100	100
Monel	60	130	90	80
Sn/Cu/Fe	80	130	105	95

*Based on 127 mm x 127 mm aperature.

FABRICATED STRIPS AND FRAMES

TECKSTRIP may be supplied as a finished frame assembly manufactured to custom specifications. Individual prefabricated strips may also be utilized to construct a custom, TECKSTRIP frame. These prefabricated sections may be supplied with holes, slots, and countersinks. Custom frame constructions are also available to meet customer requirements. See Figures 1 and 2 for frame and strip dimensioning and the table following Figure 2 for standard tolerances.



SPECIFICATIONS

MATERIAL DESCRIPTION

TECKSTRIP Extrusion: Aluminum alloy 6063-T6 per QQ-A-200/9 (ASTM-B-221) (Chromate conversion coating per MIL-C-5541 Class 1A optional).

Wire Mesh:

- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.
- **Sn/Cu/Fe (Tin Coated, Copper Clad Steel):** .0045 in. [0.114 mm], diameter per ASTM B-520.
- **Monel:** .0045 in. [0.114 mm] diameter per QQN-281 or AMS-4730.

Elastomer Core (when specified): Neoprene sponge per MIL-R-6130, Type II, Grade A, Condition Medium (ASTM-D-6576).

Silicone sponge per SAE-AMS-3195.

PERFORMANCE CHARACTERISTICS

Temperature Range:

-24°F to 212°F [-30°C to 100°C] for Neoprene sponge.

-103°F to 401°F [-75°C to 205°C] for Silicone sponge.

U.S.A.: 908-272-5500 • U.K.: 44-1476-590600 • Spain: 34-91-4810178

EXTRUSION STYLE

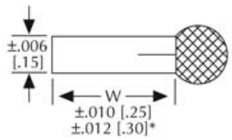
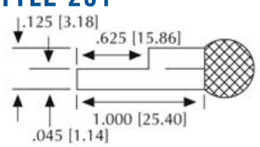


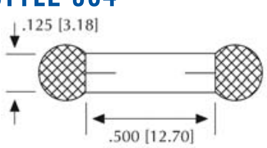
Table 1.

EXTRUSION SELECTION in. [mm]			
W	T	Extrusion Style	Bulk Strip Code (A)
.375 in. [9.53 mm]	.093 in. [2.36 mm]	165	0
.375 in. [9.53 mm]	.125 in. [3.18 mm]	153	1
.437 in. [11.10 mm]	.093 in. [2.36 mm]	169	2
.437 in. [11.10 mm]	.125 in. [3.18 mm]	178	3
.500 in. [12.70 mm]	.125 in. [31.8 mm]	160	4
.625 in. [15.88 mm]	.125 in. [3.18 mm]	174	5
.750 in. [19.05 mm]	.125 in. [3.18 mm]	150	6
1,000 in. [25.40 mm]*	.125 in. [3.18 mm]	155	7
		251	8
		384	9

EXTRUSION STYLE 251



EXTRUSION STYLE 384



EMI GASKETING MATERIAL Table 2.

EMI GASKET DIM. in. [mm]	EMI GASKET DESCRIPTION	MESH STRIP MATERIAL	MESH STRIP NUMBER	GASKET SHAPE CODE B	WIRE TYPE CODE C
.188+.031-0 [4.78+0.79-0]	Solid TECKNIT Strip	Monel Sn/Cu/Fe Sn/Ph/Bz	12150 42250 62250	1	0 1 2
Rubber Dimensions* .188±.031 [4.78±0.79]	Strip with Neoprene Sponge Core	Monel Sn/Cu/Fe Sn/Ph/Bz	12152 42252 62252	2	0 1 2
Rubber Dimensions* .188±.031 [4.78±0.79]	Custom Strip with Silicone Sponge Core	Monel Sn/Cu/Fe Sn/Ph/Bz	13452 43252 63252	3	0 1 2

*Overall dimensions: Add .031 in. [0.79 mm] to rubber dimension. Resulting dimensions are applicable to parts under a 4 oz. [113g] load using .750 in. [19.05 mm] anvils.

Table 3.

BULK STRIP LENGTH	FINISH	LENGTH CODE (D)
5 Feet	No Finish	0
	Chromate	1
7.5 Feet	No Finish	2
	Chromate	3
15 Feet	No Finish	4
	Chromate	5

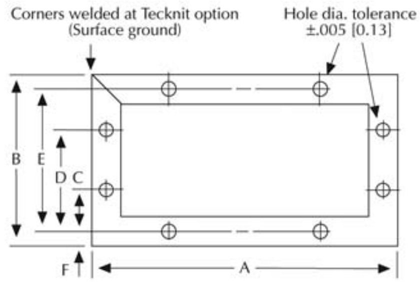


Figure 1. Frame dimensions (Mesh not shown)

BULK AND FINISHED LENGTHS

TECKSTRIP can be supplied in standard bulk lengths of 5 ft. [1.5 m], 7.5 ft. [2.25 m], or 15 ft. [4.5 m]. Ends are rough cut to a tolerance of ±1.0 in. [2.5 cm] in bulk lengths. Finished mesh ends can be supplied to any desired length up to 15 ft. [4.5 m] at nominal additional cost.

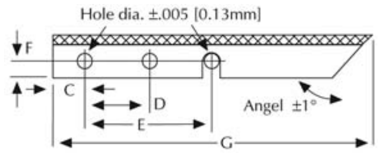


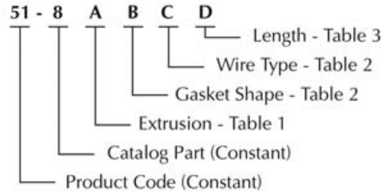
Figure 2. Finished strip dimensions

FINISHED STRIP AND FRAME TOLERANCES in. [mm]				
	0-12	12-24	24-36	36-48
DIM	[0-305]	[305-610]	[610-915]	[915-1220]
A,B,G	±.015[±0.38]	±.031[±0.79]	±.047[±1.19]	±.060[±1.52]
C,D,E,F	±.015[±0.38]	±.020[±0.51]	±.031[±0.79]	
G	Over 48 in. [1220 mm], check with TECKNIT Engineers.			

ORDERING INFORMATION

Select TECKSTRIP by extrusion style and EMI gasketing material by mesh strip number. Provide a sketch of all fabrication details. Part numbers will be assigned by TECKNIT when the part description is complete. For bulk material, order by part number. Part numbers are constructed as follows.

BULK STRIP DESIGNATION



For assistance and for other selected extrusion crosssections and EMI gasket materials contact your nearest TECKNIT area representative or factory location.

Duosil®

COMPOSITE WIRE MESH AND SILICONE OR FLUOROSILICONE RUBBER STRIP

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

DUOSIL is a composite material which provides an effective EMI shield and an optimum environmental seal. It is produced by employing a patented process and state-of-the-art elastomer extrusion technology. This process accomplishes the fusion of specially shaped silicone or fluorosilicone rubber to a knitted wire mesh shielding strip. During manufacture, a controlled amount of elastomer is permitted to penetrate the porous boundary face of the shielding strip. Following curing, the result is an inseparable composite combining the high reliability of both materials into a single rugged structure.

APPLICATION INFORMATION

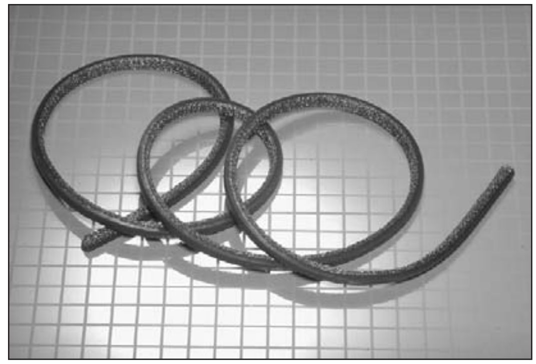
DUOSIL was initially developed as a radiation and environmental seal for outdoor, all-weather commercial electronic VHF and UHF equipment. Proven to be an ideal shield and seal in these severe commercial environments, DUOSIL has also been used with great effectiveness in demanding military applications. DUOSIL EMI shielding gasket material is ideally suited for installation into the narrow grooves in cast enclosures. Its small cross section composite saves space and weight without sacrificing shielding or sealing effectiveness.

EMI SHIELDING PERFORMANCE*

TECKNIT DUOSIL Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01, based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Monel	60	130	90	80
Sn/Ph/Bz	90	135	105	95

*Based on 127 mm x 127 mm aperature.



SPECIFICATIONS

MATERIAL DESCRIPTION

Shielding Wire Mesh

- **Monel:** per QQ-N-281, .0045 in. [0.114 mm] diameter or AMS 4730
- **Phosphor Bronze:** .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C50700), tin-plated per ASTM B-33.

Sealing Elastomer

- **Silicone rubber:** per ZZ - R - 765 Class 2, Grade 50 (AA-59588).
- **Fluorosilicone rubber:** ref MIL-R-25988B, Class I, Grade 40, Type II (SAE-AMS-R-25988).

PERFORMANCE CHARACTERISTICS

	Silicone	Fluorosilicone
Hardness, Shore A Durometer ASTM D-2240	50 ± 7	40 ± 5
Temperature Range	-80°F to 500°F [-62°C to 260°C]	-67°F to 257°F [-55°C to 125°C]
Brittle Point ASTM D-746	-100°F [-73°C]	-81°F [-63°C]
Composite Peel Strength (min.)	3 lbf/in. [525 N/m]	3 lbf/in. [525 N/m]
Color	Gray	Blue

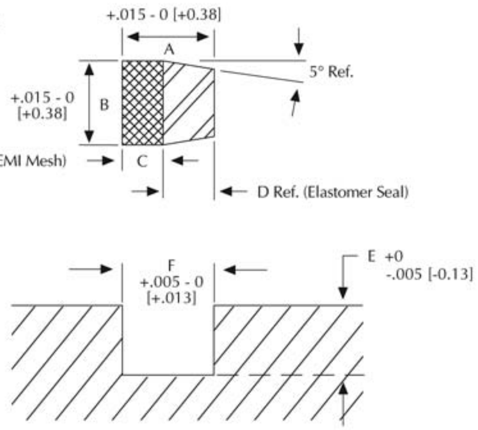
DUOSIL DESIGN CONSIDERATIONS

Standard cross-sections are listed below. In addition, DUOSIL can be manufactured for custom designed cross-sections. Custom designed cross-sections become cost effective as the result of the elimination of costly conventional mesh to elastomer bonding techniques.

Contact TECKNIT factory personnel for custom design assistance and/or application information concerning DUOSIL.

STANDARD DUOSIL - CROSS SECTIONS AND GROOVE DESIGN DATA

Figure 1.



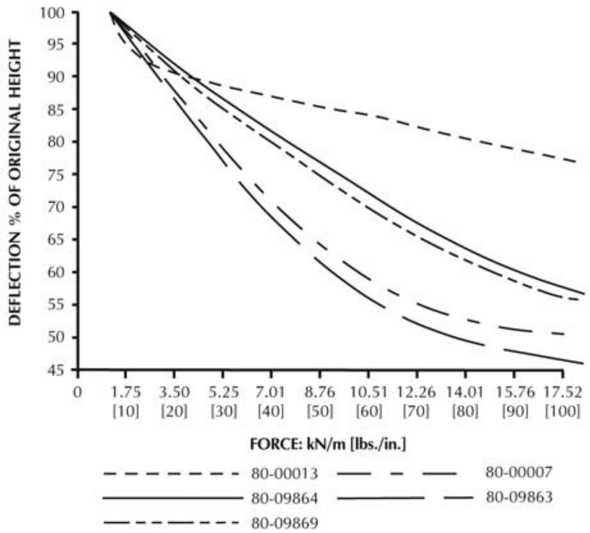


Figure 2. Compression Deflection data.

ORDERING INFORMATION

When ordering DUOSIL, specify reuqired length and TECKNIT Part Number. For assistance, contact your nearest TECKNIT area representative or factory location.

STANDARD SILICONE ELASTOMER DUOSIL DIMENSIONS

Part Number	Gasket Dimensions inches [mm]			Groove Dimensions inches [mm]		
	A	B	C	D	E	F
80-10008	.070	.098	.035	.035	.088	.088
	[1.77]	[2.48]	[0.88]	[0.88]	[2.23]	[2.23]
80-09863	.093	.125	.046	.046	.113	.110
	[2.36]	[3.18]	[1.17]	[1.17]	[2.87]	[2.79]
80-00013	.125	.062	.062	.062	.056	.163
	[3.18]	[1.57]	[1.57]	[1.57]	[1.42]*	[4.14]
80-00007	.125	.175	.062	.062	.158	.135
	[3.18]	[4.45]	[1.57]	[1.57]	[4.01]	[3.43]
80-09864	.156	.156	.062	.093	.141	.174
	[3.96]	[3.96]	[1.57]	[2.36]	[3.58]	[4.42]
80-00250	.180	.165	.090	.090	.150	.185
	[4.57]	[4.19]	[2.28]	[2.28]	[3.80]	[4.69]
80-09869	.188	.188	.093	.093	.169	.192
	[4.78]	[4.78]	[2.36]	[2.36]	[4.29]	[488]

*Groove (E) tolerance + 0 - .002 [0.05]

Section B: Metal Fibers and Screens

U.S. Customary
[SI Metric]

Duolastic™

WIRE MESH GASKET MATERIAL

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

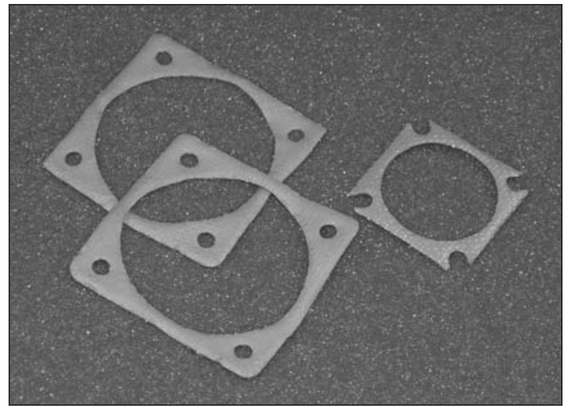
TECKNIT DUOLASTIC* material consists of a woven aluminum wire screen impregnated with neoprene or silicone elastomer. DUOLASTIC provides both EMI shielding and environmental sealing. The aluminum wire screen provides electrical contact between mating surfaces, while the elastomer material fills the gaps between the individual wires of the screen to ensure a fluid tight seal.

APPLICATION INFORMATION

TECKNIT DUOLASTIC is the thinnest TECKNIT gasket material available. Parts are manufactured from sheets 0.016 or 0.020 in. [0.41 or 0.51 mm] thick. The physical properties of DUOLASTIC allow gaskets of intricate shapes to be manufactured. DUOLASTIC should be used in applications where space limitations require a gasket of minimum thickness.

EMI SHIELDING PERFORMANCE

When properly installed, DUOLASTIC will provide a total E-Field shielding effectiveness of 75 to 100 dB, out to 1 GHz.



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Wire Screen:** Aluminum alloy 5056 per SAE-AMS-4182.
- **Sealing Elastomer:** Neoprene per SAE-AMS-3222 or Silicone per AMS 3302D.

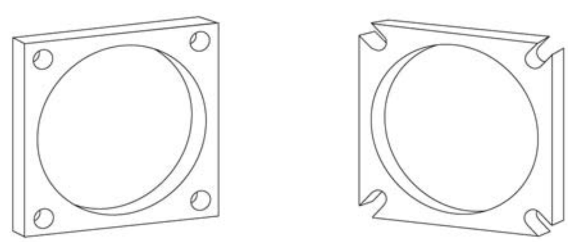
PERFORMANCE CHARACTERISTICS

Temperature Range:
-40°F to 212°F [-40°C to 100°C] for Neoprene.
-75°F to 500°F [-60°C to 260°C] for Silicone.

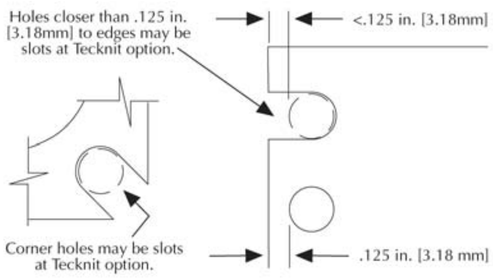
Recommended Closing Force: 100 psi [690 kPa].

CABLE CONNECTOR GASKET

(Mounting Flange Type)
TECKNIT offers many EMI materials which can be formed into cable Connector Gaskets. DUOLASTIC is the thinnest gasket material available for applications where space limitations require a gasket of minimum thickness and has proven to be a very reliable EMI material in such applications. Refer to TECKNIT Standard Cable Connector Gaskets.



HOLES VS. SLOTS



PARTS NUMBERS

MATERIAL NUMBER	THICKNESS in. [mm]	SEALING MATERIAL
42-80000	.020 ± .004 [0.51 ± 0.10]	Neoprene
42-60000	.020 ± .004 [0.51 ± 0.10]	Silicone
42-80500	.016 ± .004 [0.41 ± 0.10]	Neoprene
42-60500	.016 ± .004 [0.41 ± 0.10]	Silicone

TOLERANCES

DUOLASTIC gaskets less than 10 in. can be cut to ± .015 in.; greater than 10 in. but less than 20 in.: ± .030 in.; for gaskets 20 in. and greater: ± .040 in.

ORDERING INFORMATION

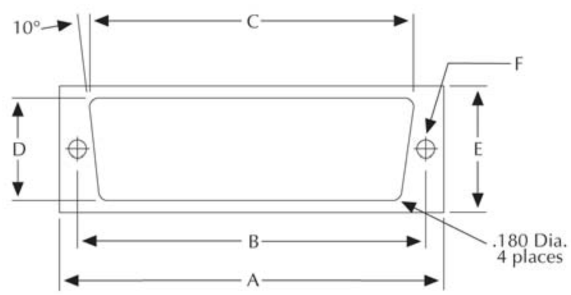
DUOLASTIC gaskets can be fabricated in virtually any shape or size. Wall thickness should be not less than .075 in. [1.91 mm] to avoid breakout. DUOLASTIC materials are also available in bulk form 8 in. [203 mm] wide and up to 50 ft. [15.24 m] in length. When ordering DUOLASTIC, specify all gasket dimensions and TECKNIT part number. For assistance, contact the TECKNIT area representative or factory nearest you.

"D" Subminiature Connector Gaskets

ALUMINUM WOVEN WIRE SCREEN IMPREGNATED WITH ELASTOMER

DUOLASTIC is also used to manufacture "D" subminiature connector gaskets. The woven aluminum wire screen is provided with either neoprene or silicone elastomer to meet individual design requirements where effective electrical contact between mating surfaces is essential. In addition, the elastomer material fills in between the individual wires of the screen affording environmental protection.

* See section H: EMI Connector Gaskets for additional information



GASKET DIMENSIONS

PART NUMBER	MOUNTING METHOD	NUMBER OF CONNECTOR PINS	A ± .020	B ± .005	C ± .010	D ± .010	E ± .020	F ± .005
42-X1700	Front Mounting	9	1.313	.984	.782	.450	.750	.140
42-X1701	Rear Mounting		1.313	.984	.665	.370	.750	.140
42-X1702	Front Mounting	15	1.641	1.312	1.110	.450	.750	.140
42-X1703	Rear Mounting		1.641	1.312	.993	.370	.750	.140
42-X1704	Front Mounting	25	2.188	1.852	1.650	.450	.750	.140
42-X1705	Rear Mounting		2.188	1.852	1.533	.370	.750	.140
42-X1706	Front Mounting	37	2.829	2.500	2.298	.450	.750	.140
42-X1707	Rear Mounting		2.829	2.500	2.181	.370	.750	.140
42-X1708	Front Mounting	50	2.740	2.406	2.200	.562	.860	.140
42-X1709	Rear Mounting		2.740	2.406	2.087	.480	.860	.140

NOTE: When ordering .020 Silicone Filled Duolastic, replace the "X" in the Part Number with a "6".
When ordering .020 Neoprene Filled Duolastic, replace the "X" in the Part Number with an "8".

Teckfelt™

SINTERED METAL FIBER GASKET MATERIAL

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKFELT is a sintered metal fiber felt structure produced in sheet form. It can be filled with silicone elastomer for applications requiring an environmental or fluid seal. TECKFELT can also be supplied unfilled when EMI is the sole consideration.

APPLICATION INFORMATION

The randomly arranged compacted metal fibers characteristic of TECKFELT provide a highly conductive path between mating surfaces. This makes TECKFELT an ideal material for EMI or EMP shielding, grounding, and static discharge applications, especially in corrosive environments.

SEALING PROPERTIES

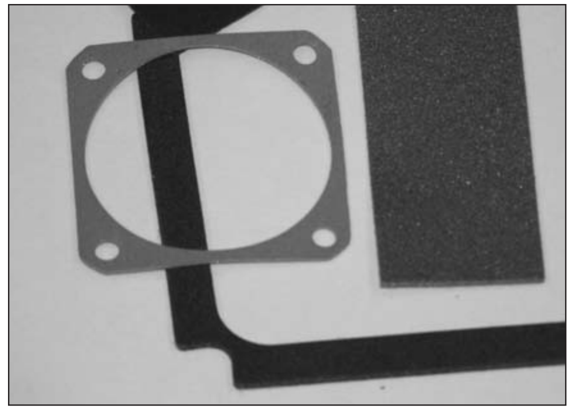
TECKFELT elastomer impregnated gaskets have been compared to other types of thin, dual-purpose gaskets and are proven to have the lowest air leak rate and best sealing properties of all thin EMI gasket materials.

EMI SHIELDING PERFORMANCE*

TECKNIT TECKFELT Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Teckfelt	70	130	85	70

*Based on 127 mm x 127 mm Aperture



SPECIFICATIONS

MATERIAL DESCRIPTION

Metals: Corrosion resistant steel.

- **Fiber Diameter:** 0.0004 to 0.004 in. [0.01 to 0.1 mm] mean diameter range.
- **Density:** 1.5 g/cm3 (unfilled).

Filler (when specified): Commercial Grade Silicone elastomer

Temperature Range (with filler): -75°F to 392°F [-60°C to 200°C].

TECKFELT SHEETS

Standard sheet size is 12 in.x 15 in. [305x380mm].

MATERIAL TYPE	SHEET THICKNESS*	PART NUMBER
Unfilled	.031 in. [0.79 mm]	45-09810
	.063 in. [1.59 mm]	45-09812
Filled	.031 in. [0.79 mm]	45-09811
	.063 in. [1.59 mm]	45-09813

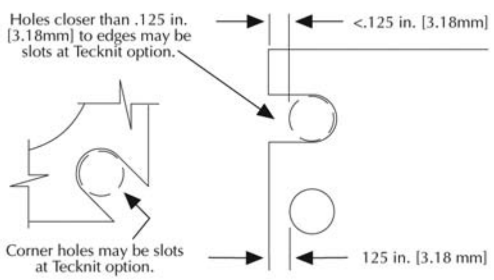
*Sheet thickness tolerance ±.005 in. [0.13 mm]

CUSTOM TECKFELT GASKETS

TECKFELT gaskets can be manufactured in a wide range of shapes and sizes.

When designing custom TECKFELT gaskets, it is important to maintain a minimum wall thickness of 0.090 in. [2.29 mm] between the outside edge of the gasket and the edge of any internal opening, such as at mounting holes, to avoid break out of thin gasket sections. For standard TECKFELT connector flange gaskets, see EMI Connector information.

HOLES VS. SLOTS



TOLERANCES

TECKFELT gaskets less than 10 inches can be cut to ± .015 inches. For each additional 5 inches add an additional ± .015 inches to tolerance.

CUSTOM TECKFELT SHEETS

Sheets thicker than standard sheet size can be manufactured by bonding two or more standard TECKFELT sheets using a silicone adhesive.

ORDERING INFORMATION

When ordering TECKFELT Gaskets, specify gasket dimensions and TECKNIT part number. To order CUSTOM TECKFELT or for other assistance, contact your nearest TECKNIT area representative or factory location.

Teckspan™

EXPANDED METAL GASKETS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKSPAN materials are manufactured from sheets of aluminum or monel expanded metal to produce a conductive material with over 200 contact points per square inch of gasket surface. The small openings of the expanded metal can be filled with a silicone elastomer which effectively provides an environmental seal in addition to an EMI shield. Where EMI shielding only is required, metal gaskets may be easily stamped from the unfilled sheets of TECKSPAN.

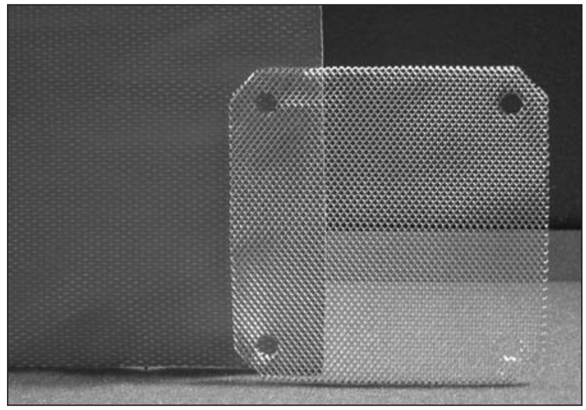
APPLICATION INFORMATION

TECKSPAN is one of the TECKNIT family of thin EMI shielding materials. TECKSPAN can be used in shielding electronic enclosures where size limitations necessitate the use of thin gasket materials and where closure pressures are 50 psi or greater. When filled with a silicone elastomer, TECKSPAN provides good fluid sealing properties at moderate flange pressures. The many expanded metal contact points of both filled and unfilled TECKSPAN also provide a low impedance contact surface.

EMI SHIELDING PERFORMANCE

TECKNIT TECKSPAN Shielding Effectiveness has been tested in accordance with TECKNIT Test Methods TSETS-01 and based upon modified MIL-STD- 285. Typical values for a 5" square size are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Monel	60	125	85	50
Aluminum	50	85	70	40



SPECIFICATIONS

MATERIAL DESCRIPTION

Expanded Metal

- **Monel:** per QQ-N-281.
- **Aluminum alloy:** QQ-A-250/2 (ASTM-B-209).
- **Openings:** Diamond shaped, .100 in. x .100 in. [2.54 mm x 2.54 mm] approximately.
- **Contact Points:** 200-250 per in.2 [31-39 per cm2].

Sealing Elastomer

- **Silicone rubber:** per ZZ-R-765 (AA-59588), Class 2b, Grade 50, Color gray.
- **Fluorosilicone Rubber:** per MIL-R-25988B Class 1 Grade 40. (SAE-AMS-25988)

PERFORMANCE CHARACTERISTICS

Temperature: -75°F to 500°F [-60°C to 260°C]

Recommended Closing Force: 50 psi [345 kPa] minimum.

CABLE CONNECTOR GASKETS

(Mounting Flange Type)

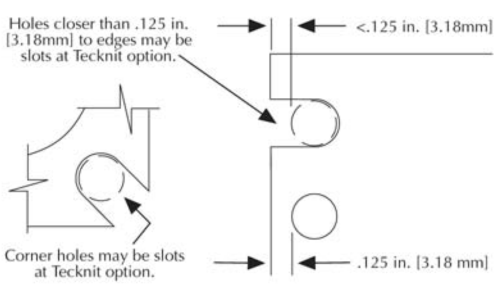
TECKNIT has many EMI shielding materials that can be used for manufacturing cable connector gaskets. TECKSPAN has proven to be a very reliable EMI material for such applications. Refer to TECKNIT Standard EMI Connector Gaskets data.

STANDARD BULK SHEET

THICKNESS ±.004 in. [±.10mm]	METAL EMI SHIELD	ELASTOMER SEAL	PART NUMBER
.020 [0.51]	Monel	Silicone	48-09862*
.020 [0.51]	Aluminum	Silicone	48-09863*
.020 [0.51]	Monel	Fluorosilicone	48-01094**
.032 [0.81]	Monel	None	48-00476
.032 [0.81]	Aluminum	None	48-00481
.032 [0.81]	Monel	Silicone	48-09860
.032 [0.81]	Aluminum	Silicone	48-09866

*Not stocked
**Standard Width 11.50 in.
NOTE: Except where noted, all materials are available 7.50" wide.

HOLES VS. SLOTS



TOLERANCES

TECKSPAN gaskets less than 10 inches can be cut to ± .015 inches. For each additional 5 inches add an additional ± .015 inches to tolerance.

ORDERING INFORMATION

TECKSPAN gaskets are available in many shapes and sizes. TECKSPAN gaskets can be fabricated to minimum tolerances of .015 in. [± 0.38 mm]. Wall thickness should not be less than .125 in. [3.18 mm] to avoid "breakout". All materials, except where noted, are available in bulk form-7.50 in. [190 mm] maximum width and from 10 ft. [3.05 m] to 50 ft. [15.25 m] maximum lengths. Use TECKNIT Part Numbers for specifying materials. For specification assistance, contact your nearest TECKNIT area representative or factory location.

Section C: Oriented Wires

U.S. Customary
[SI Metric]

Elastomet®

ORIENTED WIRES IN SOLID SILICONE RUBBER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT ELASTOMET is a patented composite gasket material consisting of scores of individual fine wires embedded and bonded in a solid silicone or fluorosilicone elastomer.

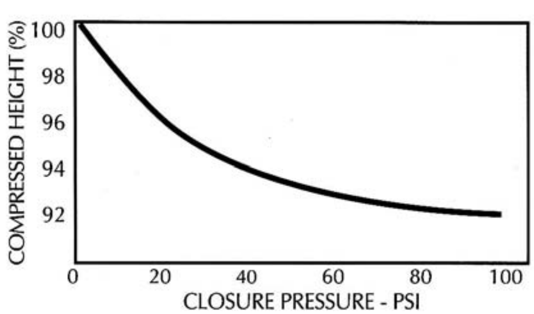
FEATURES

- Effective broadband shielding and environmental sealing at moderate closure forces.
- Low contact resistance.
- Electrochemically compatible with most metals and alloys.
- Wide operating temperature range.
- Available in sheets, strips, and stamped gaskets.
- All wires oriented perpendicular to mating surfaces.
- Convoluted wires acting like individual springs permit superior gasket rebound.
- Superior moisture resistance: absence of connections between wires prevents moisture channeling or "wicking."
- In accordance with DESC drawing No. 90046.
- Meets salt spray test per ASTM B117-03.

APPLICATION INFORMATION

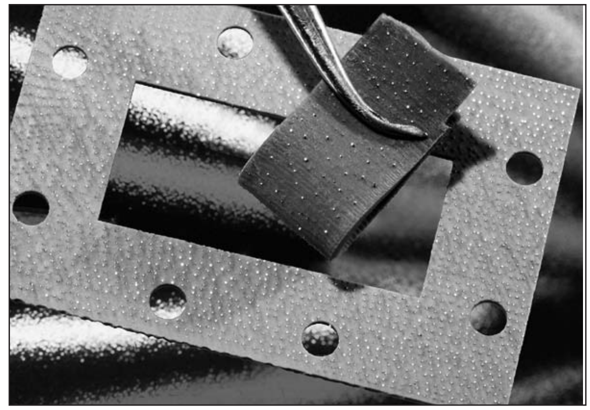
ELASTOMET is recommended for use in military, industrial, and commercial applications requiring EMI suppression, grounding, or static discharge in conjunction with the following design criteria; environmental sealing, medium to high closure forces, and absence of loose wire fragments which could cause electrical or mechanical damage to equipment. For applications with severe joint uneveness, low closure forces, and where greater compressibility is required, use ELASTOFOAM® shielding material. Refer to ELASTOFOAM page for information.

COMPRESSION/DEFLECTION CURVE



EMI SHIELDING PERFORMANCE*

TECKNIT ELASTOMET Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01, based upon modified MIL-STD- 285. Typical values are given below.



MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Monel	75	130+	110	100
Phosphor Bronze	80	130+	115	100

SPECIFICATIONS

MATERIAL DESCRIPTION

Wire

- **Standard:** Monel, .0045 in. [0.114 mm] dia., per QQ-N-281.
- **Special:** Aluminum Alloy 5056, .005 in. [0.127 mm] dia., per SAE-AMS-4182 (except max. tensile strength is 75,000 psi).
  Phosphor Bronze, .0045 in. [0.114 mm] dia. per ASTM B 105, Alloy 30 (CDA C50700).

Elastomer

- **Standard:** Solid Silicone Rubber per ZZ-R-765, Class 3A, Grade 30. (30 + 5, - 10 Shore A Durometer) (AA-59588).
- **Color:** Gray.
- **Special:** Fluorosilicone* per MIL-R-25988B Class 1 Grade 40, Type II (SAE-AMS-R-25988).
- **Color:** Light Blue.

Wire Population: 960/1in.^{2} [150 cm^2] ±15%.**

PERFORMANCE CHARACTERISTICS

Temperature Range:
-65°F to 392°F [-55°C to 200°C].

Recommended Closure Force: 50 psi to 100 psi.

Recommended Compression: 5% min.

*Fluorosilicone available only with phosphor bronze wire.
** Minimum of 4 wires required in cross-section for effective shielding.

STANDARD SHEETS (Table 1.)

Standard ELASTOMET sheets are Monel wire in solid silicone, 3 in. [76 mm], 6 in. [152 mm], and 9 in. [229 mm] wide by 3 ft. [0.9 m] long. Custom widths will be formed by bonding together sheets.

Table 1. Standard Sheets

Height in. [mm]	Width in. [mm]	Part No. Monel	Height in. [mm]	Width in. [mm]	Part No. Monel
				3 [76]	82-55312
**	3 [76]	82-55303	.125[3.18]	6 [152]	82-55612
.030[0.76]	6 [152]	82-55603		9 [229]	82-55912
	3 [76]	82-55304		3 [76]	82-55315
.045[1.14]	6 [152]	82-55604	.156 [3.96]	6 [152]	82-55615
**	9 [229]	82-55904		9 [229]	82-55915
	3 [76]	82-55306		3 [76]	82-55318
.062[1.57]	6 [152]	82-55606	.187 [4.75]	6 [152]	82-55618
	9 [229]	82-55906		9 [229]	82-55918
	3 [76]	82-55309		3 [76]	82-55325
.093[2.36]	6 [152]	82-55609	.250 [6.35]	6 [152]	82-55625
	9 [229]	82-55909		9 [229]	82-55925

Change third digit of part number from -5 to -4 to specify "custom ALUMINUM ELASTOMET".
Change the third digit of part number -5 to -B to specify "custom PHOSPHOR BRONZE ELASTOMET".
Change third digit of part number -5 to -F to specify "custom PHOSPHOR BRONZE FLUOROSILICONE ELASTOMET".
Change fourth digit from -5 to -6 to specify "PRESSURE SENSITIVE ADHESIVE BACKING".
** Not available with Phosphor Bronze Wire or Fluorosilicone Elastomer.

STANDARD ELASTOMET STRIPS (Table 2.)

Standard strips are nominally 11 ft. [3.4 m] in length. Bonded continuous lengths are available on special orders. Custom strips are available with aluminum and with Phosphor Bronze wires. Pressure sensitive adhesive backing is available for Monel, aluminum, and phosphor bronze strips. Contact TECKNIT for thicknesses greater than .500 in. [12.70 mm].

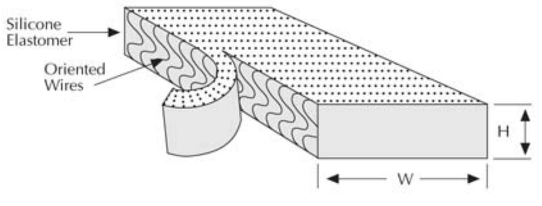


Figure 1.

Table: 2 - Standard Elastomer Strips

Width in. [mm]	Height in. [mm]	Part No. Monel	Width in. [mm]	Height in. [mm]	Part No. Monel
.093 [2.36]	**.030 [.076]	82-12651	.500 [12.70]	**.030 [0.76]	82-12665
.093 [2.36]	.062 [1.57]	82-12628	.500 [12.70]	.062 [1.57]	82-12281
.093 [2.36]	.093 [2.36]	82-12021	.500 [12.70]	.093 [2.36]	82-12286
.093 [2.36]	.125 [3.18]	82-12026	.500 [12.70]	.125 [3.18]	82-12291
.093 [2.36]	.156 [3.96]	82-12629	.500 [12.70]	.156 [3.96]	82-12296
-	-	-	.500 [12.70]	.187 [4.75]	82-12301
.125 [3.18]	**.030 [0.76]	82-12655	.500 [12.70]	.250 [6.35]	82-12306
.125 [3.18]	.062 [1.57]	82-12041	-	-	-
.125 [3.18]	.093 [2.36]	82-12046	-	-	-
.125 [3.18]	.125 [3.18]	82-12051	-	-	-
.125 [3.18]	.156 [3.96]	82-12056	.625 [15.88]	**.030 [0.76]	82-12667
.125 [3.18]	.187 [4.75]	82-12061	.625 [15.88]	.062 [1.57]	82-12336
-	-	-	.625 [15.88]	.093 [2.36]	82-12341
.187 [4.75]	**.030 [0.76]	82-12657	.625 [15.88]	.125 [3.18]	82-12346
.187 [4.75]	.062 [1.57]	82-12086	.625 [15.88]	.156 [3.96]	82-12351
.187 [4.75]	.093 [2.36]	82-12091	.625 [15.88]	.187 [4.75]	82-12356
.187 [4.75]	.125 [3.18]	82-12096	.625 [15.88]	.250 [6.35]	82-12361
.187 [4.75]	.156 [3.96]	82-12101	.625 [15.88]	.375 [9.53]	82-12371
.187 [4.75]	.187 [4.75]	82-12106	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
.250 [6.35]	**.030 [0.76]	82-12659	.750 [19.05]	**.030 [0.76]	82-12669
.250 [6.35]	.062 [1.57]	82-12126	.750 [19.05]	.062 [1.57]	82-12391
.250 [6.35]	.093 [2.36]	82-12131	.750 [19.05]	.093 [2.36]	82-12396
.250 [6.35]	.125 [3.18]	82-12136	.750 [19.05]	.125 [3.18]	82-12401
.250 [6.35]	.156 [3.96]	82-12141	.750 [19.05]	.156 [3.96]	82-12406
.250 [6.35]	.187 [4.75]	82-12146	.750 [19.05]	.187 [4.75]	82-12411
.250 [6.35]	.250 [6.35]	82-12151	.750 [19.05]	.250 [6.35]	82-12416
-	-	-	.750 [19.05]	.375 [9.53]	82-12426
-	-	-	.750 [19.05]	.500 [12.70]	82-12431
-	-	-	-	-	-
.375 [9.53]	**.030 [0.76]	82-12663	1.000 [25.40]	**.030[0.76]	82-12671
.375 [9.53]	.062 [1.57]	82-12226	1.000 [25.40]	.062 [1.57]	82-12446
.375 [9.53]	.093 [2.36]	82-12231	1.000 [25.40]	.093 [2.36]	82-12451
.375 [9.53]	.125 [3.18]	82-12236	1.000 [25.40]	.125 [3.18]	82-12456
.375 [9.53]	.156 [3.96]	82-12241	1.000 [25.40]	.156 [3.96]	82-12461
.375 [9.53]	.187 [4.75]	82-12246	1.000 [25.40]	.187 [4.75]	82-12466
.375 [9.53]	.250 [6.35]	82-12251	1.000 [25.40]	.250 [6.35]	82-12471
.375 [9.53]	.375 [9.53]	82-12261	1.000 [25.40]	.375 [9.53]	82-12481
-	-	-	1.000 [25.40]	.500 [12.70]	82-12486

Change third digit of part number from -1 to -2 to specify "custom ALUMINUM ELASTOMET".
Change the third digit of part number -1 to -B to specify "custom PHOSPHOR BRONZE ELASTOMET".
Change third digit of part number -1 to -F to specify "custom PHOSPHOR BRONZE FLUOROSILICONE ELASTOMET".
Change fourth digit from -2 to -3 to specify "PRESSURE SENSITIVE ADHESIVE BACKING".
Use of the pressure-sensitive adhesive is restricted to strips and gaskets having a minimum cross-section width of .250 in. [6.35 mm].
** Not available with Phosphor Bronze Wire or Fluorosilicone Elastomer.

Elastomet, Cont.

U.S. Customary
[SI Metric]

TWIN ELASTOMET STRIPS (Table 3.)

TWIN ELASTOMET is a variation of the standard ELASTOMET strip in that the oriented wires occupy only a portion of the total strip width. See Figure below.

TWIN ELASTOMET STRIPS are available standard with Monel or custom with phosphor bronze or aluminum wires. Minimum custom width (W) is .375 in. [9.5 mm]. Width and height tolerances are the same as those specified for ELASTOMET strips. Contact TECKNIT offices for minimum order requirements for TWIN ELASTOMET.

Figure 2.

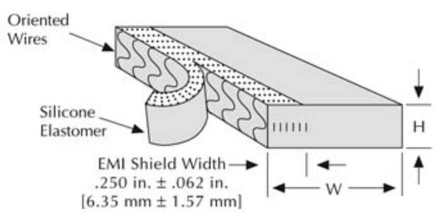


Table 3.

STANDARD TWIN ELASTOMET STRIPS

W in. [mm]	H in. [mm]	Part Number *
.625 [15.88]	.062 [1.57]	82-12972
.625 [15.88]	.125 [3.18]	82-12911
.625 [15.88]	.187 [4.75]	82-12936
.625 [15.88]	.250 [6.35]	82-12956
.750 [19.05]	.062 [1.57]	82-12973
.750 [19.05]	.125 [3.18]	82-12916
.750 [19.05]	.187 [4.75]	82-12941
.750 [19.05]	.250 [6.35]	82-12961
1.000 [25.40]	.062 [1.57]	82-12974
1.000 [25.40]	.125 [3.18]	82-12921
1.000 [25.40]	.187 [4.75]	82-12946
1.000 [25.40]	.250 [6.35]	82-12966

* Change fourth digit from 2 to 3 to specify pressure sensitive adhesive backing.

PRESSURE-SENSITIVE ADHESIVE

ELASTOMET can be furnished with an acrylic pressure-sensitive adhesive applied to the mounting surface. Use of the pressure-sensitive adhesive is restricted to strips and gaskets having a minimum cross-section width of .250 in. [6.35 mm]. Shelf life is one year from date of receipt when stored at or below room temperature (23°C).

Table 4.

SHEET & STRIP CROSS-SECTION TOLERANCES

Dimension in. [mm]	Height in. [mm]	Width in. [mm]
.030 to .092	+ .010 - .005	N/A
[.76 to 2.36]	[+ .25 - .13]	-
.093 to .250	± .010	± .016
[2.36 to 6.36]	[± .25]	[± .40]
.251 to .750	± .010	± .031
[6.37 to 19.05]	[± .25]	[± .79]
over .750 [over 19.05]	± .015 [± .38]	± .047 [± 1.19]
3 [76]	N/A	± .13 [± 3.2]
6 [152]	N/A	± .25 [± 6.4]
9 [229]	N/A	± .38 [± 9.7]
36 [91.4]	N/A	± 1.00 [± 2.54]

SPECIFYING DIE-CUT GASKETS

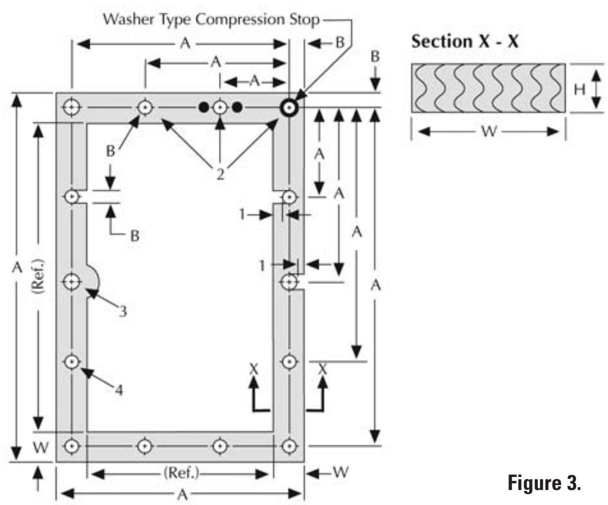


Figure 3.

FABRICATED GASKETS TOLERANCES

The following tolerances and notes refer to the dimensions illustrated in Figure 3.

CUSTOM FABRICATED GASKET TOLERANCES

Symbol	Dimension in. [mm]	Tolerances in. [mm]
A	up to 6 [152] Each Additional 1 in. [25.4]	± .016 [± .40] ± .003 [± .08]
B	1 in. [up to 25.4] 1 in. [over 25.4]	± .016 [± .40] ± .031 [± .79]
W, H		See Tolerance For Strips

ORDERING INFORMATION

For standard sheets and strips, specify TECKNIT Part Number and quantity required. For nonstandard items contact your TECKNIT area representative or factory location.

NOTES:
1. Bolt holes closer to the gasket edge than the gasket thickness must be u-shaped slots, or see note 3.
2. Distance from compression stop to edge of sealing gasket must not be less than gasket thickness.
3. Bolt holes closer to gasket edge than gasket thickness can be with edge protrusion.
4. Hole diameter must not be less than gasket thickness, nor less than .093 inches diameter.

Elasto-Bond® Adhesive

GENERAL DESCRIPTION

ELASTO-BOND is a ready to use one component non-conductive silicone rubber based adhesive sealant. The adhesive system is an RTV that cures by reacting with moisture in the air. The compound is ready to use and does not require additional preparation or mixing.

APPLICATION INFORMATION

ELASTO-BOND adhesive sealant is recommended wherever a flexible bond is required between a metal surface and an ELASTOMET® or ELASTO-FOAM® gasket. To ensure optimum performance the bond thickness should not exceed .005 to .010 in. Depending on the degree of adhesion required, gaskets can be spot bonded or continuously bonded.

SURFACE PREPARATION

Metal surfaces should be lightly abraded with Scotch Brite or an equivalent, degreased with 1,1,1 trichloroethane and then wiped with acetone or MEK before applying primer. Gaskets should be cleaned with isopropanol before applying adhesive.

SPECIFICATIONS

MATERIAL DESCRIPTION

Part Number: 72-00177

Resin: Silicone RTV

Uncured Consistency: Nonslumping Paste

Cured Condition: Flexible

PERFORMANCE CHARACTERISTICS

Temperature Range: -76°F to 399°F [-60°C to 204°C]

Peel Strength (min.): ASTM D-1002 60 psi [.414 MPa]

Color: Grey

Shelf Life (unopened container): 6 mos. min. (when stored at 21°C)

Recommended Cure: 72 hours at room temperature and 50% RH

Full Cure: 7 Days

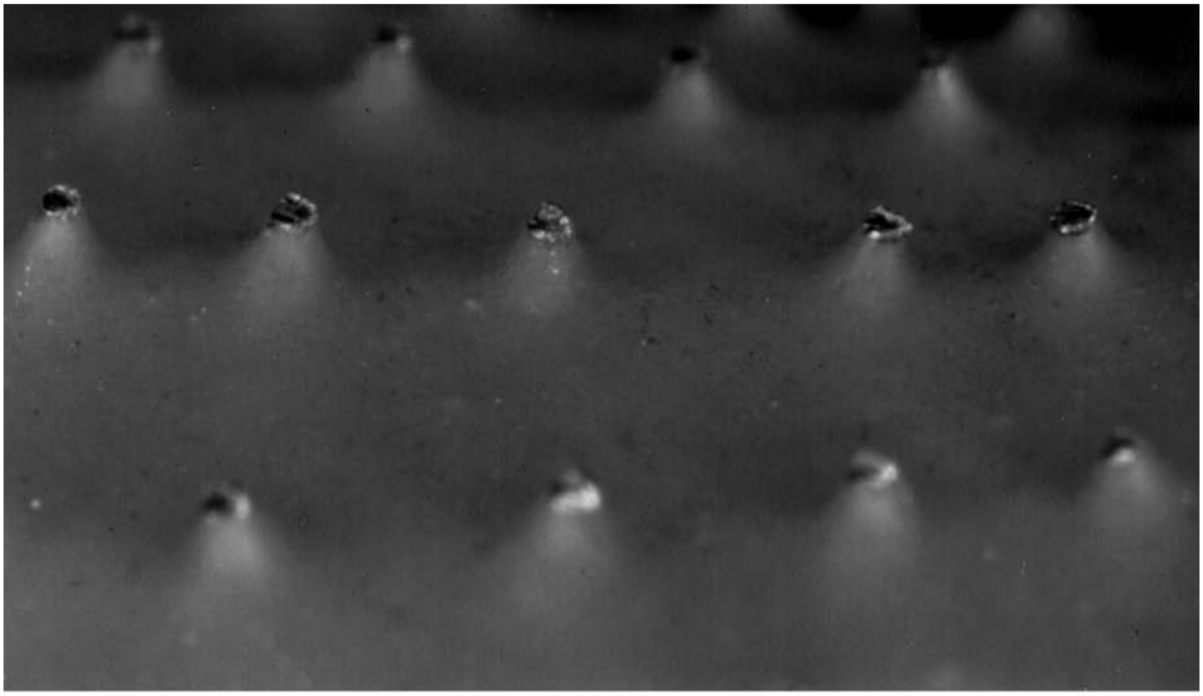
Clean Up Solvent: Denatured Alcohol

Packaging**:** Tube 1.5 oz. [43 g]

**Primer supplied in separate vial.

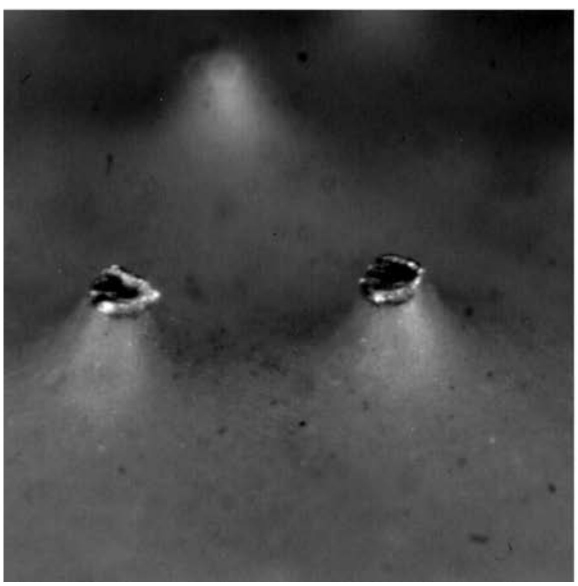
Elastomet, Cont.

U.S. Customary
[SI Metric]



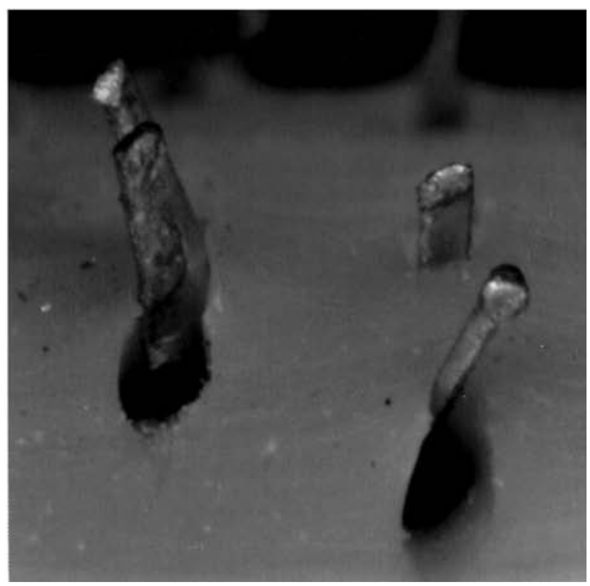
TECKNIT ELASTOMET®

Tecknit Elastomer is a patented composite gasket material consisting of scores of individual fine wires embedded in and bonded in a solid silicone elastomer.



TECKNIT ELASTOMET SAMPLE

Tecknit Elastomet's patented chemical bonding wire loss.



COMPETITVE SAMPLE

Elastofoam®

ORIENTED WIRES IN SOFT SILICONE SPONGE

GENERAL DESCRIPTION

ELASTOFOAM is a patented, composite EMI shielding and environmental sealing gasket material consisting of scores of individual fine wires embedded and bonded in a soft closed cell silicone sponge elastomer. The material is characterized by outstanding compressibility, recovery and wire retention.

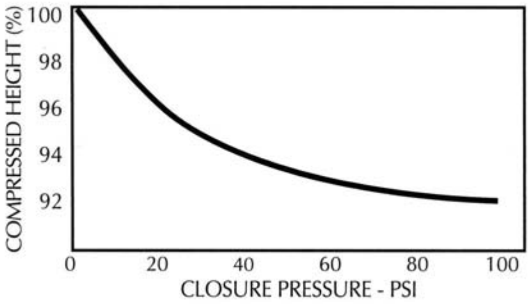
FEATURES

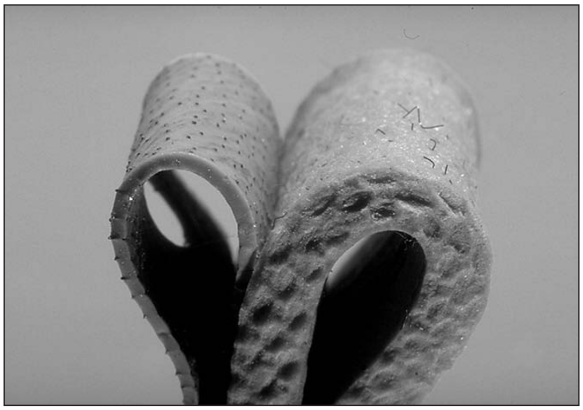
- All wires oriented perpendicular to mating surfaces.
- Effective broadband shielding and environmental sealing at low closure forces.
- Convoluted wires acting like individual springs permit superior gasket rebound.
- Wires chemically bonded to elastomer-will not fall out.
- Low compression set.
- Accommodates a broad range of surface irregularities.
- Good moisture resistance: closed cell sponge plus absence of connections between wires pre vents moisture channeling or “wicking.”
- Compatible with most metals and alloys.
- Wide operating temperature range.
- Meets salt spray test per ASTM B117-03.
- In Accordance with DESC drawing No. 90046.

APPLICATION INFORMATION

ELASTOFOAM is recommended for use in military, industrial, and commercial application requiring EMI suppression, grounding, or static discharge in conjunction with the following design criteria: low closure forces, severe joint uneveness, environmental sealing, repeated opening and closing of access doors and panels, and absence of wire fragments which could cause electrical or mechanical damage to equipment. For applications requiring medium to high closure forces, use ELASTOMET. Refer to the ELASTOMET page.

COMPRESSION/DEFECTION CURVE





SPECIFICATION

MATERIAL DESCRIPTION

Wire

- **Standard:**
- **Monel,** .0020 in. [0.05 mm] dia. per QQ-N-281.
- **Special:**
- **Aluminum alloy,** 5056, .0050 in. [0.127mm] per SAE-AMS-4182 (except max. tensile strength is 75,000 psi).
- **Phosphor Bronze,** .0020 in. [0.05 mm] dia. per ASTM B-105, Alloy 30 (C50700)

Wire Population

650/in.^{2} [100/cm2] ± 15%

Elastomer

- **Closed cell silicone sponge:** per SAE-AMS-3195, except density is .028 lb./in.3 [0.78 g/cm3]
- **Color:** Gray

PERFORMANCE CHARACTERISTICS

Temperature Range: -65°F to 338°F [-55°C to 170°C].

Recommended Closure Force: 10 PSI to 40 PSI

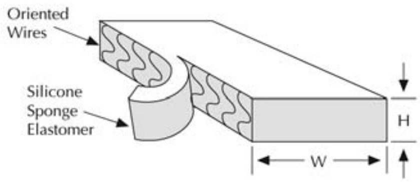
Recommended Compression: 10% min.

Elastofoam, Cont.

U.S. Customary
[SI Metric]

STANDARD STRIPS

Strips are available in standard widths from .125 to 1.000 in. [3.18 to 25.40 mm]. Standard strip length is 11 ft. [3.4 m]. Bonded continuous lengths are available on special order.



TWIN ELASTOFOAM (Monel Wire Only)

TWIN ELASTOFOAM is a variation of the standard ELASTOFOAM Strip in that the oriented wires occupy only a portion of the total strip width. See Figure 1.

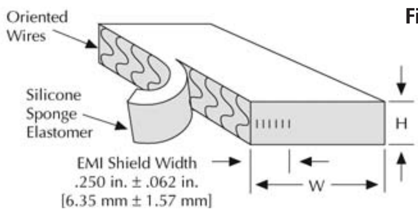


Figure 1.

RECOMMENDED GROOVE DEPTH in. [mm]	
1	.047 [1.19] + 0 - .003 [+ 0 - 0.08]
2	.075 [1.91] + 0 - .003 [+ 0 - 0.08]
3	.099 [2.51] ± .004 [± 0.10]
4	.125 [3.18] ± .005 [± 0.13]
5	.150 [3.81] ± .006 [± 0.15]
6	.200 [5.08] ± .006 [± 0.15]
7	.300 [7.62] ± .006 [± 0.15]
8	.400 [10.16] ± .006 [± 0.15]

EMI SHIELDING PERFORMANCE

TECKNIT ELASTOFOAM Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
Monel	60	130	105	95

STRIP CROSS-SECTIONAL TOLERANCES

DIMENSION in. [mm]	HEIGHT (H) in. [mm]	WIDTH (W) in. [mm]
.062 to .092 [1.57 to 2.34]	+.010 [.25], -.005 [.13]	±.015 [.38]
.093 to .125 [3.26 to 3.18]	±.010 [.25]	±.015 [.38]
.126 to .250 [3.2 to 6.35]	±.010 [.25]	±.031 [.787]
.251 to .750 [6.37 to 19.05]	±.010 [.25]	±.047 [1.19]
.751 to 1.00 [19.08 to 25.4]	±.015 [.381]	±.062 [1.57]

STANDARD STRIPS

W in. [mm]	H in. [mm]	Rec. Groove Depth	TECKNIT Part No.**	W in. [mm]	H in. [mm]	Rec. Groove Depth	TECKNIT Part No.**
.125 [3.18]	.062 [1.57]	1	88-12653	.500 [12.70]	.187 [4.75]	5	88-12302
.125 [3.18]	.093 [2.36]	2	88-12047	.500 [12.70]	.250 [6.35]	6	88-12307
.125 [3.18]	.125 [3.18]	3	88-12052	.500 [12.70]	.375 [9.52]	7	88-12317
.125 [3.18]	.156 [3.96]	4	88-12057	.500 [12.70]	.500 [12.70]	8	88-12322
.125 [3.18]	.187 [4.75]	5	88-12062	.625 [15.88]	.062 [1.57]	1	88-12337
.187 [4.75]	.062 [1.57]	1	88-12087	.625 [15.88]	.093 [2.36]	2	88-12342
.187 [4.75]	.093 [2.36]	2	88-12092	.625 [15.88]	.125 [3.18]	3	88-12347
.187 [4.75]	.125 [3.18]	3	88-12097	.625 [15.88]	.156 [3.96]	4	88-12352
.187 [4.75]	.156 [3.96]	4	88-12102	.625 [15.88]	.187 [4.75]	5	88-12357
.187 [4.75]	.187 [4.75]	5	88-12107	.625 [15.88]	.250 [6.35]	6	88-12362
.187 [4.75]	.250 [6.35]	6	88-12112	.625 [15.88]	.375 [9.52]	7	88-12372
.250 [6.35]	.062 [1.57]	1	88-12127	.750 [19.05]	.062 [1.57]	1	88-12392
.250 [6.35]	.093 [2.36]	2	88-12132	.750 [19.05]	.093 [2.36]	2	88-12397
.250 [6.35]	.125 [3.18]	3	88-12137	.750 [19.05]	.125 [3.18]	3	88-12402
.250 [6.35]	.156 [3.96]	4	88-12142	.750 [19.05]	.156 [3.96]	4	88-12407
.250 [6.35]	.187 [4.75]	5	88-12147	.750 [19.05]	.187 [4.75]	5	88-12412
.250 [6.35]	.250 [6.35]	6	88-12152	.750 [19.05]	.250 [6.35]	6	88-12417
.375 [9.52]	.062 [1.57]	1	88-12227	.750 [19.05]	.375 [9.52]	7	88-12427
.375 [9.52]	.093 [2.36]	2	88-12232	.750 [19.05]	.500 [12.70]	8	88-12432
.375 [9.52]	.125 [3.18]	3	88-12237	1.000 [25.40]	.062 [1.57]	1	88-12447
.375 [9.52]	.156 [3.96]	4	88-12242	1.000 [25.40]	.093 [2.36]	2	88-12452
.375 [9.52]	.187 [4.75]	5	88-12247	1.000 [25.40]	.125 [3.18]	3	88-12457
.375 [9.52]	.250 [6.35]	6	88-12252	1.000 [25.40]	.156 [3.96]	4	88-12462
.375 [9.52]	.375 [9.52]	7	88-12262	1.000 [25.40]	.187 [4.75]	5	88-12467
.500 [12.70]	.062 [1.57]	1	88-12282	1.000 [25.40]	.250 [6.35]	6	88-12472
.500 [12.70]	.093 [2.36]	2	88-12287	1.000 [25.40]	.375 [9.52]	7	88-12482
.500 [12.70]	.125 [3.18]	3	88-12292	1.000 [25.40]	.500 [12.70]	8	88-12487
.500 [12.70]	.156 [3.96]	4	88-12297				

NOTES: ** 1. To specify ALUMINUM ELASTOFOAM STRIP, change the third digit of the part number from -1 to -2. Contact factory for availability.
2. To specify TWIN ELASTOFOAM STRIP, change the THIRD digit of the part number from -1 to -3. Minimum available width is .375 in. [9.53 mm]
3. To specify PHOSPHOR BRONZE ELASTOFOAM STRIP, change the THIRD digit of the part number from -1 to -7. Contact factory for availability.
4. To specify PRESSURE SENSITIVE ADHESIVE BACKING, change the FOURTH digit from -2 to -3. Use of the pressure-sensitive adhesive is restricted to strips and gaskets having minimum cross-section width of .250 in. [6.35 mm].

STANDARD DIE-CUT GASKETS

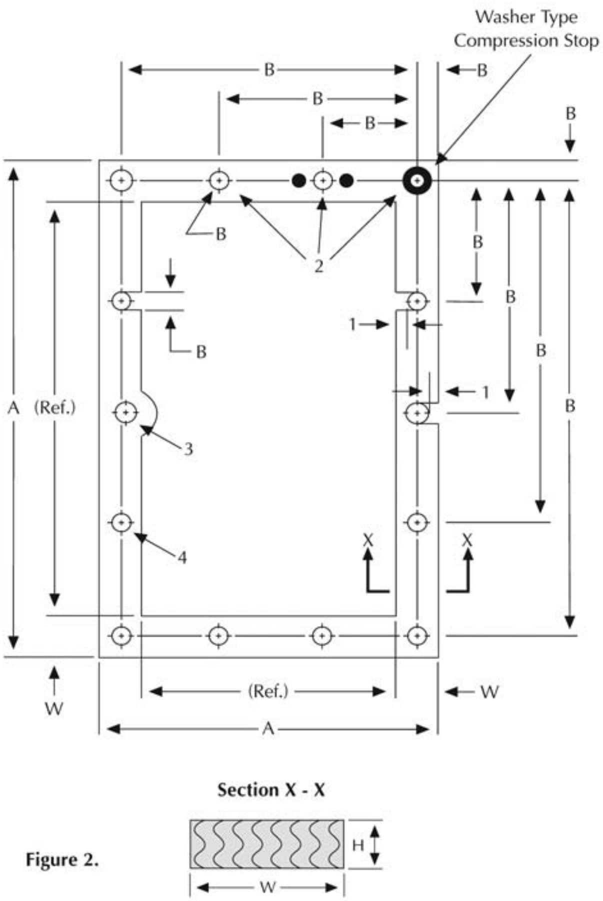


Figure 2.

PRESSURE-SENSITIVE ADHESIVE

ELASTOFOAM can be furnished with an acrylic pressure-sensitive adhesive applied to the mounting surface. Use of the pressure-sensitive adhesive is restricted to strips and gaskets having minimum cross-section width of .250 in. [6.35 mm]. Shelf life is one year from date of receipt when stored at or below room temperature (23°C).

FABRICATED GASKET TOLERANCES

The following tolerances and notes refer to the dimensions illustrated in Figure 2.

CUSTOM FABRICATED GASKET TOLERANCES		
SYMBOL	**DIMENSION in. [mm]**	**TOLERANCES in.[mm]**
A	0 - 6 in. [0 - 152] Each additional 1 in. [25.4]	± .020 [.508] ± .007 [.178]
B	0 - .250 in. [0 - 6.3] .251 - 6 in. [6.4 - 152] Each additional 1 in. [25.4]	± .020 [.508] ± .031 [.787] ± .005 [.127]
H,W		See tolerances for strips

Notes:

1. Bolt holes closer to gasket edge than gasket thickness must be u-shaped slots, or see note 3.
2. Distance from compression stop to edge of sealing gasket must not be less than gasket thickness.
3. Bolt holes closer to gasket edge than gasket thickness can be with edge protrusion.
4. Hole diameter must not be less than gasket thickness, not less than .125 in diameter.

ORDERING INFORMATION

To order standard parts specify the TECKNIT Part Number and the quantity in feet. For assistance with nonstandard strips or assembled gaskets, contact your nearest TECKNIT area representative or factory location.

Section D: Conductive Elastomer

U.S. Customary
[SI Metric]

U.S. Customary
[SI Metric]

Elastomer Shielding Design Guide

This Elastomer Shielding Design Guide describes design techniques by which the gasket can be incorporated into an enclosure. These techniques cover:

a. Seam Design
b. Gasket Design
c. Groove Design
d. Fastener Spacing

Seam Design

The primary function of an EMI seam gasket is to minimize the coupling efficiency of a seam. The reflection and absorption functions of the EMI gasket are to a large extent masked by metal cover plates and fasteners which provide the major contribution towards the restoration of the enclosure integrity. This fact does not diminish the important role of the EMI gasket in the enclosure design nor the adequate design of the enclosure to minimize enclosure discontinuities.

In the design of a shielding enclosure, the impedance between the mating seam surfaces should be as nearly equal to the enclosure material as possible to permit uniform current flow throughout the enclosure. Any significant difference in seam impedance, including that introduced by the gasket materials, can produce nonuniform current flow resulting in the generation of EMI voltages. These voltages can then be sources of radiated energy both into or out of the enclosure. To provide effective shielding, the seam design should incorporate the following features:

a. Mating surfaces should be as flat as economically possible.
b. Flange width should be at least five (5) times the maximum expected separation between mating surfaces.
c. Mating surfaces requiring dissimilar materials should be selected from one of the electrochemical groups shown in Table 6-3.
d. Mating surfaces should be cleaned to remove all dirt and oxide films just prior to assembly of the enclosure parts.
e. Protective coatings having conductivity much less than half that of the mating surfaces should be avoided or the coating removed in the area of mating surfaces.
f. Surfaces requiring a protective coating should be plated with tin, nickel, zinc or cadmium.
g. Fasteners should be tightened from the middle of the longest seam toward the ends to minimize buckling.
h. Bonded surfaces should be held under pressure during adhesive curing to minimize surface oxidation.
i. Edges of exposed seams should be sealed with a suitable protective compound (caulk) and preferably one which is conductive to prevent the intrusion of moisture. Even with these precautions in the manufacturing, preparation and assembly of enclosure parts, mating surfaces are seldom perfect.

Gasket Design

In EMI shielding, many mechanical and electrical design considerations are interdependent. One of the more important ones is joint uneveness. Joint uneveness refers to the degree of mismatch between mating seam surfaces. It results when the mating surfaces make contact at irregular intervals due to surface roughness or to bowing of cover plates because of improper material selection, thinness of the cover plate, too few fasteners, excessive bolt tightening, or improper gasket selection. Ideally, gaskets should make firm, continuous and uniform contact with seam surfaces. Performance of any shielding product can be degraded by improper application. Joint uneveness is an excellent example of a mechanical restraint which can have an adverse effect on the electrical performance of a gasket.

Figure 7-1 depicts an enlarged cross sectional view of an enclosure seam. Figure 7-la shows the seam without gasketing material joining only at the irregular high spots between the surfaces. In fact, if the cover plate were weightless and zero pressure applied between parts by fasteners, the enclosure and cover plate would only make contact at the three highest points. As pressure is applied, the irregular high spots become flattened resulting in more surface area and more points coming in contact to support the plate. Basically it is the function of a resilient gasket which bridges these gaps but at a much lower closing pressure. The ideal gasket will bridge irregularities within its compression-deflection capabilities without losing its properties of resiliency, stability or conductivity.

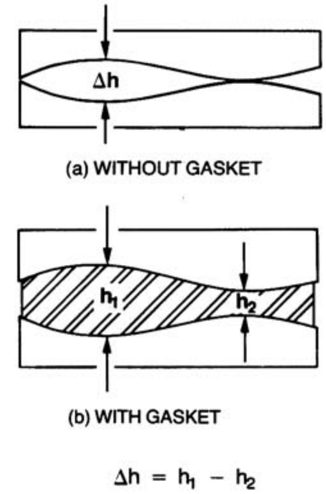


Figure 7-1, Seam Joint Uneveness

The maximum joint uneveness is the dimension of the maximum separation between the flanges of the seam when the two surfaces are just touching. This separation is designated as Δh as shown in Figure 7-1a.

With a gasket in place, the maximum spacing (h1) between mating surfaces occurs at the minimum gasket compression. Conversely, the minimum spacing (h2) occurs at the maximum gasket compression. The difference between the maximum (h1) and the minimum (h2) spacing is h. The gasket under these extreme conditions undergoes its severest mechanical test at the maximum deflection and severest electrical test at the minimum deflection.

There are, therefore, four important properties of an EMI gasket which must be considered before it is incorporated into an enclosure. These properties are compression (or deflection), compression set, shielding effectiveness and environmental seal. Compression, the reduction in volume of a gasket under pressure, is usually applied to sponge materials or products that are formed with hollow cores. Deflection, the reduction of a dimension due to pressure without necessarily resulting in a change in volume, is applicable to all materials including solid elastomers. Since these terms have been used interchangeably, the term compression is used here. Compression set is the permanent loss of the original height of a gasket after being compressed. It is important therefore to understand the various types of joints in order to determine which gasket properties are most important to a particular design.

Types of Joints: There are traditionally three types of joints classified by usage:
Type I Permanently mounted cover plates or assemblies. Generally compression set is not of concern in these applications even though high pressures may be encountered. For applications requiring an environmental seal in addition to an EMI seal under high closing forces, an elastomerfilled flat gaskets such as TECKNIT Duolastic Teckfelt or Teckspan are most applicable.

Type II Access cover plate with high joint uneveness which is opened frequently but always closes on the same portion of the gasket. A hinged door is an example of a Type II joint. Most of the elastomeric gaskets are suitable for this type of application where the closure pressures are under 100 psi. In the lowest closure pressures, the hollow-shaped elastomers are most suitable. TECKNIT extruded conductive elastomer materials would meet these requirements for low closure force with low compression set. These gaskets need only be replaced as the result of wear and aging or whenever the gaskets are removed.

Type III Removable cover plate with a symmetrical mounting pattern which is replaceable but not necessarily in the original orientation. Gaskets for this type of application are removable and reusable. Gasket materials which exhibit low closure force and low compression set would be suitable in most applications.

Environmental Seals

In many applications, it is desirable to incorporate an environmental seal (fluid or gas) such as neoprene or silicone solid or closed cell sponge elastomer. As a general rule, the degree of seal effectiveness is a function of the gasket deformation or percent compression. These seals must:

a. Be impervious to the fluid(s) or gas(es) being excluded.
b. Be compatible with the environment (including pressure, temperature and vibration) while retaining the original characteristics of resiliency, cohesion and softness (compressibility).
c. Conform uniformly to mating surface irregularities.

There are elastomeric materials besides neoprene and silicone which are suitable environmental seals. The listing below presents the most important characteristics of the more common elastomers.

a. Neoprene This elastomer is used commonly in EMI gaskets and will withstand temperatures ranging from
—54°C to +100°C for solid and —32°C to +100°C for sponge (closed cell) elastomers. Neoprene is lightly resistant to normal environmental conditions, moisture and to some hydrocarbons. It is the least expensive of the synthetic rubber materials, and is best suited from a cost standpoint for commercial applications.

b. Silicone This material has outstanding physical characteristics and will operate continuously at temperatures ranging from —62°C to +260°C for solid and —75°C to +205°C for closed cell sponge elastomers. Even under the severest temperature extremes these materials remain flexible and are highly resistant to water and to swelling in the presence of hydrocarbons.

c. Buna-n Butadiene-Acrylonitrile resists swelling in the presence of most oils, has moderate strength and heat resistance although it is not generally suited for low temperature applications.

d. Natural Rubber This material has good resistance to acids and alkalies (when specially treated) and can be used to 160°C, is resilient and impervious to water. Rubber will crack in a highly oxidizing (ozone) atmosphere and tends to swell in the presence of oils.

Since most seals used with EMI gaskets have elastomeric properties of stretch and compressibility, some guidelines are needed when specifying the dimensional tolerance of these materials: Figure 7-2 shows some of the common errors encountered in gasket design.

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Elastomer Shielding Design Guide

COMMON ERRORS IN GASKET DESIGN

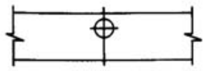
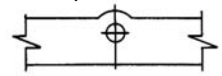
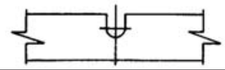
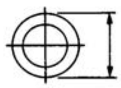
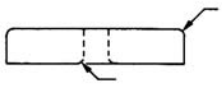
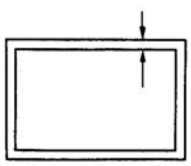
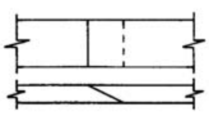
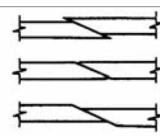
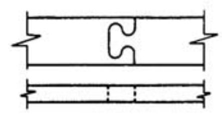
Detail	Why faulty	Suggested remedy
 Bolt holes close to edge	Causes breakage in stripping and assembling	Projection or ear"  Notch instead of hole 
 Metalworking tolerances applied to gasket thickness, diameters, length, width, etc.	Results in perfectly usable parts being rejected at incoming inspection. Requires time and limits. Increases cost of parts and tooling. Delays deliveries.	Most gasket materials are compressible. Many are affected by humidity changes. Try standard or commercial tolerances before concluding that special accuracy is required.
 Transference of fillets, radii, etc., from mating metal parts to gasket	Unless part is molded, such features mean extra operations and higher cost.	Most gasket stocks will conform to mating parts without preshaping. Be sure radii, chamfers, etc., are functional, not merely copied from metal members
 Thin walls, delicate cross section in relation to overall size.	High scrap loss; stretching or distortion in shipment or use. Restricts choice to high tensile strength materials.	Have the gasket in mind during early design stages.
 Large gaskets made in sections with beveled joints	 Extra operations to skive. Extra operations to glue. Difficult to obtain smooth, even joints without steps or transverse grooves.	 Die-cut dovetail joint

Figure 7-2, Gasket Design Errors

a. Minimum gasket width should not be less than one half of the thickness (height).
b. Minimum distance from bolt hole (or compression stop) to nearest edge of sealing gasket should not be less than the thickness of the gasket material. When bolt holes must be closer, use U-shaped slots.
c. Minimum hole diameter not less than gasket thickness.
d. Tolerances should be conservative whenever possible. Standard tolerances for die-rule cut gaskets (Table 7-1) should not be closer than:

Figure 7-1, Gasket Tolerances

Solld elastomer:	Tolerances
Up to 150mm (6.0"):	± 0.4mm (0.016")
Over 150mm (6.0"):	± 0.8mm (0.032")
Holes:	± 0.4mm (0.016)
Sponge elastomer:	**Tolerances**
Up to 100mm (4.0"):	± 0.8mm (0.032")
Over 100mm (4.0"):	± 1.6mm (0.063")
Holes:	± 0.8mm (0.032')

e. Cross section tolerances (Table 7-2) of elastomer strips should be:

(1) WIdth Dimensions	Tolerance	
	Solid	**Sponge**
Up to 3.2mm (0.125")	± 0.4mm (0.016")	± 0.4mm (0.016")
32 to 6.4mm (0.125"-0.250")	± 0.4mm (0.016")	± 0.8mm (0.032")
6.4 to 19mm (0.250"-0.750")	± 0.8mm (0.032")	±1.2mm (0.047")
Over 19mm (0.7509)	± 1.2 mm (0.047")	± 1.6mm(0.063")
(2) Height Dimensions	**Tolerance**	
	Solid	**Sponge**
Up to 19mm (0.750"):	± 0.25mm (0.010")	± 025mm (0.010")

Note: Check specific product data sheet specification for tolerance limitations.

Closure Pressure

Shielding effectiveness and closure pressure have a general relationship as shown in Figure 7-3. The minimum closure force (Pmin) is the recommended applied force to establish good shielding effectiveness and to minimize the effects of minor pressure difference. The maximum recommended closure force (Pmx) is based on two criteria: (1) maximum compression set of 10% and/or (2) avoidance of possible irreversible damage to the gasket material when pressure exceeds the recommended maximum. Higher closure pressures may be applied to most knitted wire mesh gaskets when used in Type I joints, but the gaskets should be replaced when cover plates are removed, i.e., whenever the seam is opened.

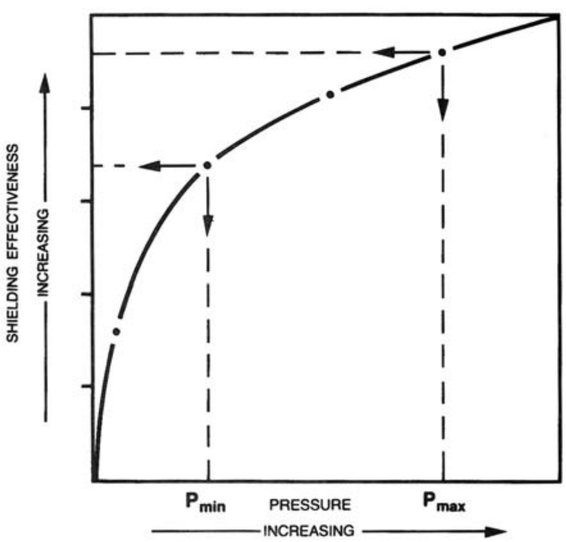


Figure 7-3, Shielding Effectiveness Versus Closure Force (Typical characteristics at a given frequency)

Compression Set

Selection of a gasketing material for a seam which must be opened and closed is to a large extent determined by the compression set characteristics of the gasket material. Most resilient gasket materials will recover most of their original height after a sufficient length of time when subjected to moderate closing forces. The difference between the original height and the height after the compression force is removed is compression set. As the deflection pressure is increased, the compression set increases (See Figure 7-4).

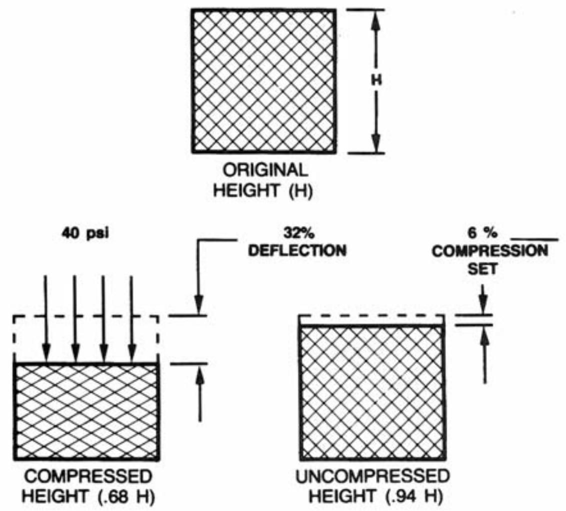


Figure 7-4, Compression Set

General Compression/Deflection Curves

Compression/deflection curves can be used to determine the following gasket characteristics:

1. Gasket height needed to compensate for joint uneveness.
2. Gasket closing pressure needed to assure good shielding.
3. Gasket compression set as a function of applied pressure.

The data presented is representative of the general characteristics of the materials depicted. Variation in the values presented can be expected as a result of manufacturing tolerances, density of material, variation in hardness (durometer) and variations in cross sections. Figures 7-5 through Figure 7-8 cover knitted wire mesh, oriented wires in solid elastomer, oriented wires in a sponge elastomer and a medium durometer (45) elastomer Minimum gasket height can be calculated from the data presented for rectangular cross sections.

Example, Figure 7-5 knitted wire mesh gasket shows a minimum recommended closing pressure of 138 kPa (20 psi) and a maximum recommended closing pressure of 414 kPa (60 psi). Below 138 kPa (20 psi), a significant falloff in shielding effectiveness can be expected while above 414 kPa (60 psi) high compression iet may result. Using these minimum (Pmjn) and maximum (Pmax) pressure values and extending them to the compression/deflection curve, minimum and maximum compression values (percentage of original gasket height H) can be determined. In the case of the knitted wire mesh, the minimum recommended deflection is 80% of the original

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height (or 0.8H), and the maximum recommended deflection is 60% (or 0.6H). The difference in gasket height then is:

$$\Delta h = 0.8H - 0.6H = 0.2H$$

Using this value with the known or anticipated joint un- eveness, the minimum gasket height can be calculated. For purposes of this example, assume joint uneveness (h) is 0.06".

$$\Delta h = h_1 — h_2 = 0.06"$$

For minimum gasket height, the maximum compression difference (Δh) must equal the maximum joint uneveness (Δh), ΔH = Δh. Substituting for ΔH (0.2H) and for Δh (006")

$$0.2H = 0.06"$$

$$H_{min} = \frac{0.06}{0.2} = 0.30"$$

This value is the minimum gasket height which will accommodate the required pressure range, shielding effectiveness, compression set and joint uneveness when using a knitted wire mesh gasket. Any gasket with a height greater than 0.30" should be suitable for the depicted example.

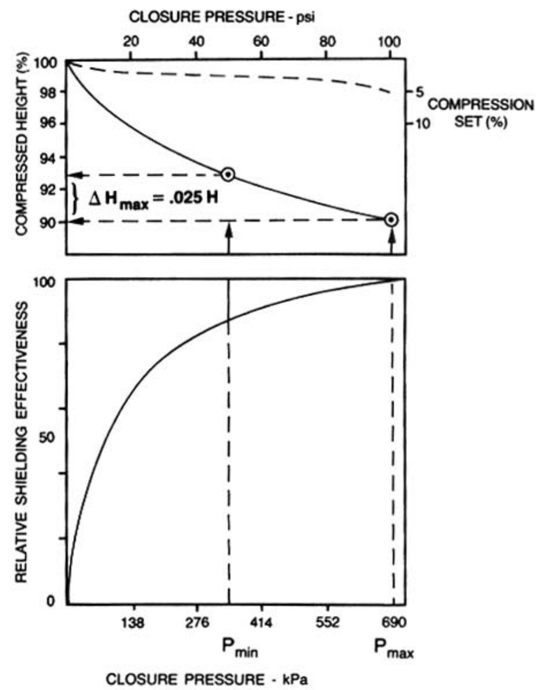

Figure 7-5, Knltted Wire Mesh Gasket

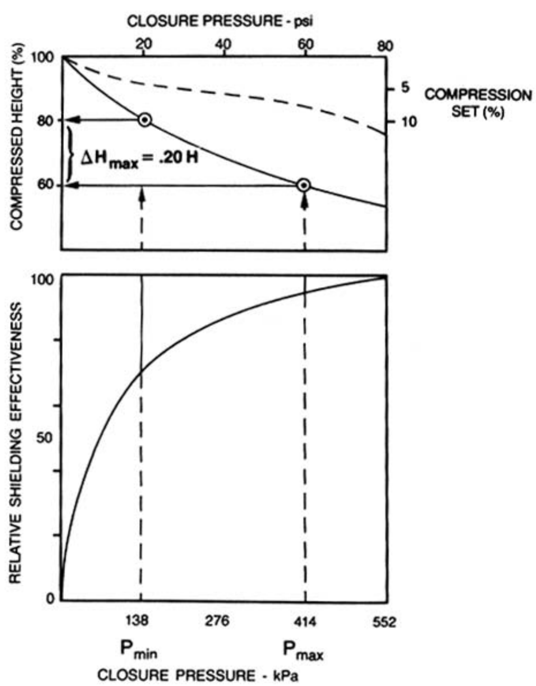

Figure 7-6, Orlented Wires in Solid Elastomer

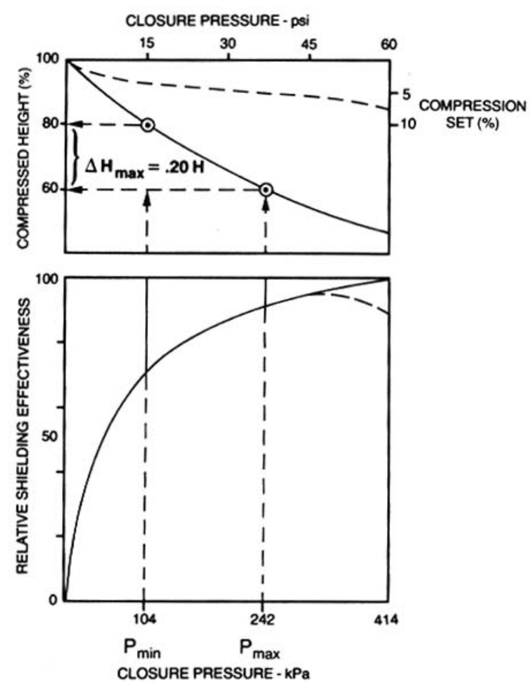

Figure 7-7, Oriented Wires in Sponge Elastomer

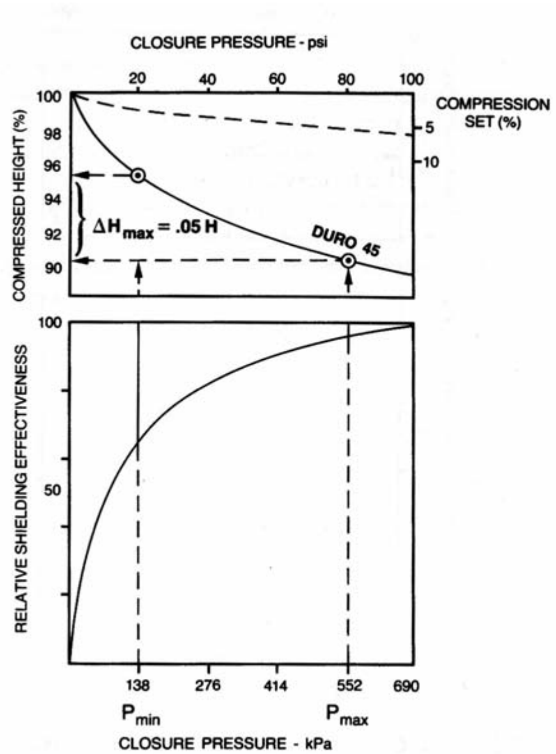

Figure 7-8, Conductive Solid Elastomer (CONSIL)

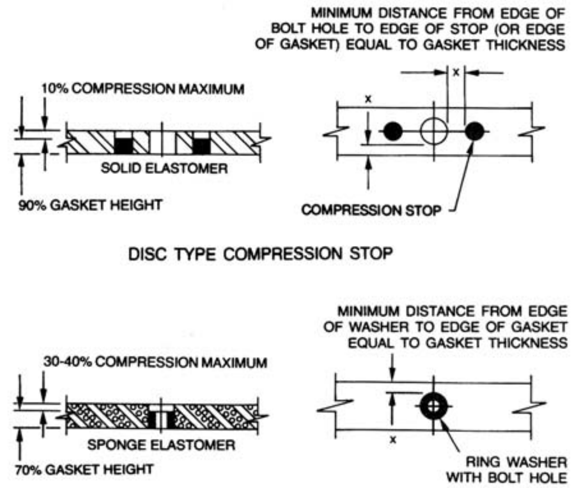

Figure 7-9, Compression Stops

Compression Stops

In order to avoid damage to the gasket or excessive bowing of the cover plate from gasket overcompression, discs or washer type compression stops can be provided as an integral part of the gasket assembly. Compression stops are stamped out from standard gauge sheet or Cut to thickness from rod or tubing. Materials commonly used are aluminum and stainless steel. For sponge elastomers, such as DUOSTRIPS/DUOGASKETS or ELASTOFOAM, compression stops should be cut to a maximum of 80% of the elastomer thickness and a minimum of 65%. For solid elastomers, such as ELASTOMET or CONSIL materials the compression stops should be 90% to 95% of the gasket height.

Some typical compression stop assemblies are shown in Figure 7-9. Another form of compression stop is to confine the gasket by means of a groove such that the cover plate flange mates with enclosure flange, thereby effecting a compression stop.

Groove Design

A groove for retaining a gasket assembly provides several advantages:

1. Can act as a compression stop.
2. Prevents overcompression.
3. Provides a fairly constant closure force under repeated opening and closing of the seam.
4. Provides a moisture and pressure seal when properly designed.
5. Cost effective in lowering assembly time and cost of gasketing material.
6. Best overall EMI sealing performance.

Solid elastomers are not compressible. They are easily deformed but do not change in volume as do sponge elastomers. Therefore, allowance for material flow must be considered in the groove design. If the groove cross section (volume), when the cover flange is fully closed, is insufficient to contain the fully deflected material, proper closure of the flange may be difficult. In addition, over- stressing of the material may degrade electrical and physical properties of the shielding material. Figure 7-10 depicts the various conditions of groove design.

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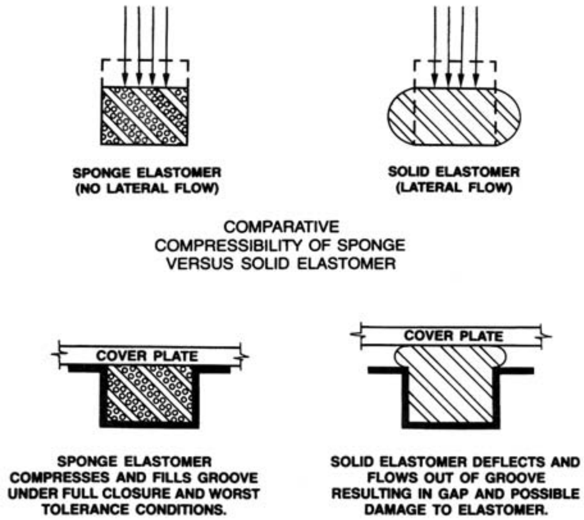
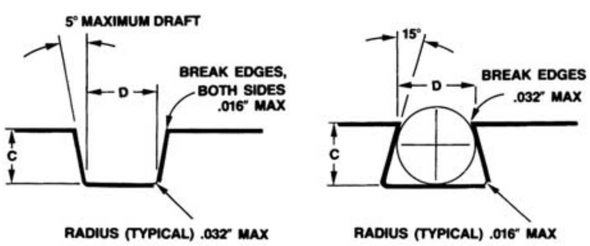


GROOVE DESIGNS

Figure 7-10, Groove Design Considerations

Figure 7-11 shows the design for two different grooves. Figure 7-11a depicts a typical rectangular groove, while Figure 7-11b shows a design which can mechanically retain circular cross section (cords) gaskets by side friction.



UNRETAINED-
GASKET GROOVE
(MOST CROSS SECTIONS)

RETAINED-
GASKET GROOVE

Figure 7-11, Groove Designs

The design of the rectangular groove is relatively simple. The critical dimension is dimension “C”, the depth of the groove as shown in Figure 7-11.

Groove design must also take into account the dimensional tolerances of the groove and the elastomer gasket. For small gasket cross sections up to 2.5 mm (0.10”), the best tolerances are obtained from extruded materials. Table 7-2 lists typical standard tolerances for strip and molded products and Table 7-3 (below) lists typical tolerances for extruded products such as CONSIL-E and SC-CONSIL.

Table 7-3, Extruded Product Tolerances

DIMENSIONS	TOLERANCES
Under 2.5 mm (0.10”):	± 0.13 mm (0.005”)
2.5 to 5.1 mm (0.10” to 0.20”):	± 0.25 mm (0.010”)
5.1 to 7.6 mm (0.20” to 0.30”):	± 0.38 mm (0.015”)
Over 7.6 mm (0.30”):	± 0.51 mm (0.020”)

Use the following steps to calculate the “C” and “D” groove dimensions:

1. Determine the maximum useful compression as a percentage of the original gasket height. This value should be the maximum compression which will not result in permanent damage to the gasket shielding or sealing properties (refer to Figures 7-5 through 7-8 for typical properties and to specific data sheets where applicable).
2. Determine the minimum useful compression value from Figures 7-5 through 7-8.
3. Calculate the maximum cross section of the gasket by adding the plus tolerance to the nominal value. Table 7-4 provides form-factors for three common cross sections.

Table 7-4 Gasket Configuration

Shape	Maximum Height (H max)	Minimum Height (H mm)	Form Factor	Maximum Cross Section Area (S max)
Rectangular (H x W)	(H + tol)*	(H - tol)	1	(H + tol)(W + tol)
Round (dia)	(dia + tol)	(dia - tol)	0.785	0.785 (dia + tol)^2
“D” Shape (A)	(A + tol)	(A - tol)	0.893	0.893 (A + tol)2

tol = tolerance = one half of the total allowable tolerance around the nominal value.

After determining the maximum and minimum gasket height and the maximum cross section area of the gasket (see Table 7-4), the C-dimension can be calculated from the following relationships:

C_{min} = minimun groove depth
C_{max} = maximum groove depth
C_{nom} = nominal groove depth (average)
C_{01} = maximum compression as a fraction of original height

C_{02} = minimum compression as a fraction of original height and

$$C_{min} = (C_{01})\ (H_{max}),$$

where H_{max} = nominal height (H_o) of gasket before compression plus the upper tolerance (H_o + tol).

$$C_{max} = (C_{02})\ (H_{min}),$$

where H_{min} = nominal height (H_o) of gasket before compression minus the lower tolerance (H_o - tol).

$$C_{nom} = \frac{C_{min} + C_{max}}{2}$$

The D-dimension (groove width) can be calculated from:

$$D_{min} = \frac{S_{max}}{C'_{min}},$$

where S_{max}, maximum cross sectional area of gasket (reference Table 7-4, and:

$C'_{min} = C_{nom}$ — lower tolerance
$D_{nom} = D_{min}$ + lower tol + allowance
$D_{max} = D_{nom}$ + upper tol,

where the upper tolerance is the value of the positive tolerance, and:

D_{nom} = nominal value of the groove width
D_{max} = maximum value of the groove width
Allowance = an added value to account for the use of adhesives and for groove design features such as inside radii.

EXAMPLE, calculate the groove dimensions for a 0.125" diameter round cross section solid elastomer gasket with a diameter tolerance of plus and minus 0.010". Determine first C_{min} and C_{max} from a 70% maximum compression (C_{01}) and a 90% minimum compression (C_{02}):

$C_{min} = (C_{01})\ (H_{max})$=(0.7) (0.125+0.010)=0.0945"
$C_{max} = (C_{02})\ (H_{min})$=(0.9) (0.125-0.010)=0.1035"
$$C_{nom} = \frac{0.0945+0.1035}{2} = 0.099 \pm 0.0045$$

The tolerance on the C-dimension is critical in maintaining the compression range within the limits specified, especially for the smaller cross sections. A maximum tolerance for the C-dimension for this size gasket should be limited to ± 0.0045.

It is sometimes desirable to specify a unilateral (one directional) tolerance which is permitted to vary in only one direction from the nominal or design size. Unilateral tolerances should be used in the design of the groove depth where it is important to ensure that the design favors either the high compression or low compression forces. A negative (minus) unilateral tolerance tends to favor slightly higher compression forces while a positive (plus) unilateral tolerance tends to favor slightly lower compression forces.

In the groove example, since the tolerance is tight, it is desirable to use a unilateral tolerance for the depth dimension to ensure that the gasket is not overcompressed. Using a unilaterial tolerance of + 0.006", which should favor the lower compression forces, the C-dimension would be expressed as 0.096," + 0.006/—0.000 and the C_{min} would equal 0.096", the C_{max} would equal 0.102, well within the mm/max dimensions calculated.

The groove width (D) can now be calculated using the groove width equations above and Table 7-4. For the above example:

$$D_{min} = \frac{S_{max}}{C'_{min}} = \frac{(.785)\ (.125 + .010)^2}{(0.096 - 0.000)} = 0.149"$$

$D_{min} = D_{min}$+ lower tolerance+ allowance
=0.149 .006+.010=0.165"

where tolerance for the width dimension is ±0.006", see Table 7-6.

Tables 7-5 (rectangular strips), Table 7-6 (round strips) and Table 7-7 ("0" shape strips) provide suggested values for "C" and "D" groove dimensions with suggested tolerances which will maintain the gasket within the suggested compression range of 70% to 90% of original height.

Table 7-5, Groove Dimensions
Rectangular Gasket
C_{01} = .7 (max compresson)
C_{02} = .9 (min compression)

Strip H (inches)	Strip W (inchs)	Groove Dimension (Inch) C ± tol	Groove Dimension (Inch) D ± 006"
.030 ± .005	.125 ± .010	.022 ± .002 - .000	.231
.060 ± .005	.125 ± .010	.045 + .004 - .000	.211
.093 ± .005	.188 ± .010	.071 + .006 - .000	.289
.125 ± 010	.250 ± 015	.096 + .006 - .000	.389
.188 ± .010	.375 ± .020	.150 ± .006	.559
.250 ± 015	.500 ± .020	.199 ± .006	.730

Relerence TECKNIT Data Sheet D-810

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Table 7-6, Groove Dimensions
Round Gasket
C_{01} = .7 (max compresson)
C_{02} = .9 (min compression)

Diameter (inch)	Groove Dimensions (inch) Depth C ± tol	Width D ± .006
.062 ± .005	.046 +.006 -.000	.093
.093 ± .005	.071 +.006 -.000	.122
.103 ± .005	.087	.135
.125 ± .010	.096 +.006 -.000	.165
.188 ± .010	.150 ± .006	.230
.250 ± .015	.199 ± .006	.302
.375 ± .020	.298 ± .006	.436

Relerence TECKNIT Data Sheet D-810

Table 7-7, Groove Dimensions
"D" SHAPE Gasket
C_{01} = .7 (max compresson)
C_{02} = .9 (min compression)

A (inch)	Groove Dimensions (inch) Depth C ± tol	Width D ± .006
.062 ± .005	.046 +.006 -.000	.103
.093 ± .005	.071 +.006 -.000	.137
.125 ± .010	.096 +.006 -.000	.186
.188 ± .010	.146 +.006 -.000	.256
.250 ± .015	.199 +.006 -.000	.336
.375 ± .020	.295 +.006 -.000	.488

Relerence TECKNIT Data Sheet D-810

Fastener Spacing

Fasteners are normally required between cover plate and enclosure to provide enough closing force along the seam length to insure adequate contact pressure and to compensate for joint uneveness. Fastener spacing, cover plate thickness, minimum-maximum pressures, gasket compressibility and material characteristics are important parameters in the cover plate design.

Maximum gasket deflection occurs at the fastener locations where the maximum compressive force is applied. Frequently the closure forces required to compress a resilient gasket is sufficient to cause bowing of the cover plate. The amount of bowing depends on several interrelated factors. Figure 7-12 shows the result of high fastener pressure on cover plate bowing. The bowing can be severe enough that insufficient pressure is applied at the mid section of the gasket resulting in little or no shielding or even the development of a slit gap. These effects can be minimized by proper spacing, proper cover plate thickness and proper selection of gasket materials. The basic equation for bolt spacing (reference Figure 7-13) is given as:

$$C = \left[\frac{480\,(a/b)\,E\,t^3\,\Delta H}{13P_{min} + 2P_{max}}\right]^{1/4}$$

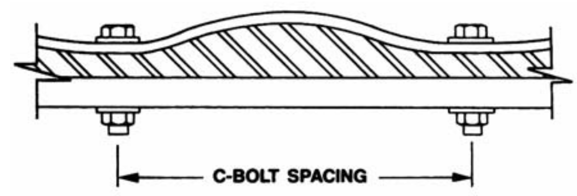

Figure 7-12, Bowed Cover Plate

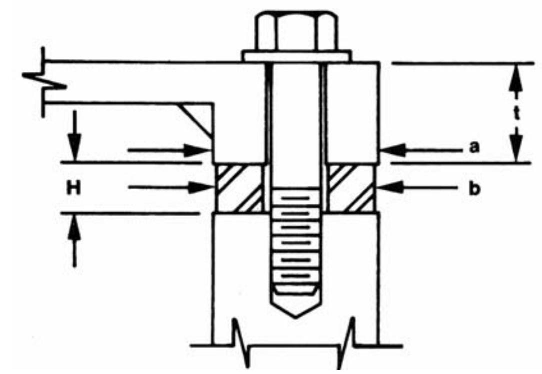

Figure 7-13, Cover Plate arid Gasket Dimension

where a=width of cover plate flange at seam
b=width of gasket
C=bolt spacing
E=modulus of elasticity of cover plate
$\Delta H = H_1 - H_2$
H_1=minimum gasket deflection
H_2= maximum gasket deflection
H=gasket height
P_{min} /P_{max} = minimum/maximum gasket pressure
t=thickness of cover plate

The equation can be tremendously simplified by making two assumptions which can be shown to have only slight affect on the result or which can be used to provide a close approximation for bolt spacing. These assumptions are:

1. **Width of gasket equals width of cover plate flange (a=b).** This condition is the limiting condition since the cover plate flange dimension (a) is always equal to or greater than the gasket width (b). For a gasket width equal to one half of the flange width, the bolt spacing correction is less than 1.19 times the value obtained for a=b or (a/b=1). The actual correction factor is the fourth root of the a/b ratio or (a/b)1/4. Using (a=b) actually provides a safety factor over any other relationship between (a) and (b).

2. **Maximum pressure (P_{max}) equals three times the minImum pressure (P_{min})** For almost all resilient

gaskets, P_{max} is usually greater than twice P_{min} Using the ratio $P_{max}/P_{min} = 3$, bolt spacing is reduced by less than 7% for P_{max} to P_{min} ratio of 6. Actual correction factors for other values of P_{max} to P_{min} ratios and P_{min} are given in Table 7-8.

Table 7-8
Correction Factors For Bolt Spacing
(Reference FIgures 7-14 and 7-15)

P_{max}/P_{min} Correction

P_{max}/P_{min}	Correction Factor
2	1.02
3	1.00
4	.98
5	.95
6	.94

P_{min} Correction

P_{min}	Correction Factor
10	1.19
20	1.00
30	.90
40	.84
50	.80

Incorporating these two assumptions into the basic equation, the bolt spacing is:

$$C = 2.242 \left[\frac{Et^3 \Delta H}{P_{min}} \right]^{1/4} \quad \text{where } a/b = 1, \quad P_{max}/P_{min} = 3$$

and for $P_{min} = 20$ psi, typical of elastomeric gaskets,

$$C = 59.62 \left[t^3 \Delta H \right]^{1/4}, \text{ aluminum plate } (E = 10^7 \text{ psi})$$

$$C = 78.46 \left[t^3 \Delta H \right]^{1/4}, \text{ steel plate } (E = 3 \times 10^7 \text{ psi})$$

Figures 7-14 and 7-15 show sets of curves representing deflection as a percentage of gasket height (ΔH) for aluminum and steel plates respectively. The ΔH value is the difference between the maximum and the minimum gasket height under compression (reference Figures 7-5 through 7-8). Knowing the cover plate thickness and the gasket differential (ΔH), the bolt spacing can be easily determined. Since the P_{min} for both figures has been selected as 20 psi, a correction factor is provided for P_{min} values from 10 through 50 psi (see Table 7-8).

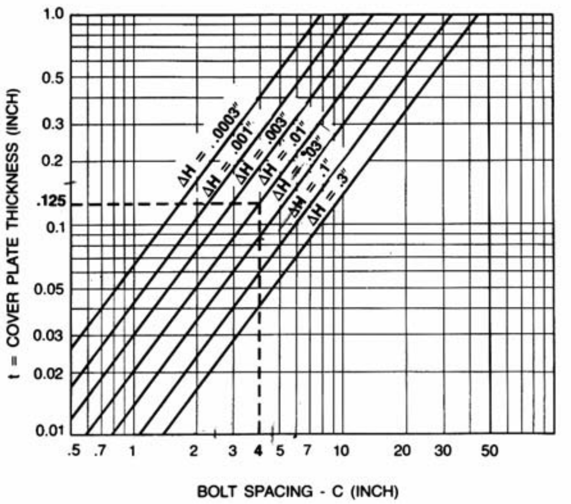

Figure 7-14, Bolt Spacing - Aluminum Cover Plate

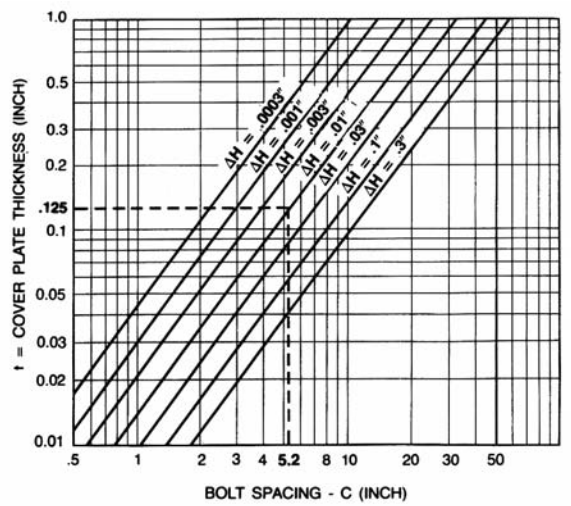

FIgure 7-15, Bolt Spacing - Steel Cover Plate

EXAMPLE, assume a design which uses a steel cover plate thickness of .125" with an anticipated gasket variation of .010" (ΔH) under a minimum pressure (P_{min}) of 20 psi and a maximum pressure (P_{max}) of 60 psi. Figure 7-15 shows a bolt spacing for steel at the stated pressure range of 20 to 60 psi to be 5.2 inches. For the same conditions using an aluminum plate, the bolt spacing is 4.0 inches (see Figure 7-14). The charts can also be used in reverse. For example, when it is desired to limit the number of fasteners for easier disassembly or removal of a cover plate. Select the desired bolt spacing and gasket differential (ΔH) to determine the required cover plate flange thickness.

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EXAMPLE, assume a 10 inch bolt spacing is desirable and a maximum gasket differential (ΔH) of 0.03” is anticipated. The questions which need to be answered are (1) what is the necessary thickness of the cover plate flange and (2) what gasket materials are most suited for that application. Referring to Figure 7-14 (aluminum), draw an imaginery line from the point at the bottom of the chart which represents a 10 inch bolt spacing to the point representing H0.03” at the intersect of the 10 inch bolt spacing line and ΔH=.03”, draw an imaginery horizontal line to the left scal (coordinate) to find the minimum thickness of the cover plate flange (t). In this case, t=.3 inch. The larger the ΔH values for the specific compression conditions established by the pressure range of 20 to 60 psi, the softer and more resilient are the gaskets needed to satisfy the large variations in joint uneveness caused by flange bowing.

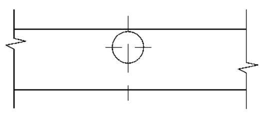
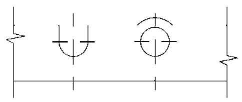
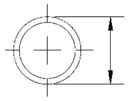
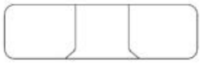
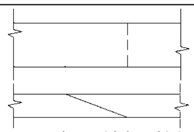
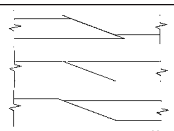
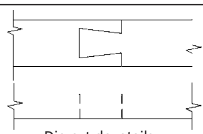
CONSIL SILICONE ELASTOMER PRODUCT CHART

Tecknit Consil Silicone Elastomer Product Chart

	SC Consil FR861/ FR862	SC Consil 860/861 862/864	Consil A 895	Consil A 897	Consil NC 750/751 770	Consil NC FR750/ FR751	Consil E 811/815	Consil II 841/842	Consil R 855	Consil R 856/857	Consil N 891	Consil C 871/874	Consil C 873	Consil C 875
Material Grade	Commercial		MIL-G-83528 Type B / Comm.	MIL-G-83528 Type D / Comm.	Commercial							MIL-G-83528 Type A	Commercial	MIL-G-83528 Type C
Elastomer	Silicone			Fluoro-silicone	Silicone									Fluoro-silicone
Filler	Carbon		Silver plated Aluminum particles		Nickel coated Graphite		Silver plated Glass particles		Pure Silver		Silver plated Nickel particles	Silver plated Copper particles		
Temperature	-60°F to 351°F [-51°C to 177°C]	-60°F to 351°F [-51°C to 177°C]	-67°F to 350°F [-55°C to 177°C]	-67°F to 350°F [-55°C to 177°C]	-67°F to 350°F [-55°C 160°C]	-67°F to 350°F [-55°C 160°C]	-60°F to 351°F [-51°C to 177°C]	-60°F to 351°F [-51°C to 177°C]	-67°F to 392°F [-55°C to 200°C]	-60°F to 351°F [-51°C to 177°C]	-67°F to 257°F [-55°C to 125°C]	-67°F to 257°F [-55°C to 125°C] / -55°F to 125°F [-48°C to 52°C]	-49°F to 257°F [-45°C to 125°C]	-67°F to 257°F [-55°C to 125°C]
Specific Gravity ASTM-D-297	1.16 ±0.03	1.28 ±0.03 / 1.2 ±0.03	2.0 ±13%	2.0 ±13%	2.0 ±13%	2.1 / 2.0 ±13%	1.86 ±0.25	1.80 ±0.25 / 1.86 ±0.25	3.5 ±13%	1.7 / 2.5 ±0.25	4.0 ±13%	3.5 / 3.7 ±13%	3.5 ±13%	4.0 ±13%
Hardness Shore A ASTM-D-2240	+10 / -5	70 ±5	65 ±7	70 ±7	55 ±7/70 ±7	60 ±10	60 ±5	47 ±7/70 ±7	65 ±5	40 ±5/50 ±5	75 ±7	65 ±7	85 ±7	75 ±7
Tensile Strength, Min. ASTM-D-412	650 psi	500 psi / 650 psi	200 psi	180 psi	150 psi	150 psi	50 psi	100 psi / 120 psi	300 psi	100 psi	200 psi	200 psi	400 psi	180 psi
Elongation, Min.-ASTM-D-412	100 %	100 %	100%	60%	100%	100%	50%	120%	200%	100%	100%	100%	100%	100%
Tear Strength, Min. ASTM-D-624	50 ppi	50 ppi / 60 ppi	30 ppi	35 ppi	50 ppi / 40 ppi	50 ppi	35 ppi / 20 ppi	45 ppi	40 ppi	25 ppi / 44 ppi	30 ppi	25 ppi	40 ppi	35 ppi
Forms 1- extruded, 2- molded, 3- injection molded	2/1	1/2/1/3	1 & 2		2/1/1	2/1	1	2 & 3	2			1 & 2	2	1 & 2
Volume Resistivity- ohm-cm max.	15/24	3-24	0.008	0.012	0.1	0.1	0.03	0.01	0.002	0.015/0.006	0.005	0.004	0.005	0.01
Shielding Effectiveness 1GHz (E-field) dB	55	65	110	100	100	90	100	100	120	100	110	115		115
Flammability Rating	UL94 V0	NONE				UL94 V0	NONE							
Recommended Adhesive	Teckbond NC		Teckbond A		Teckbond NC		CON/RTV-II		Cond. Adhesive 72-00002 or CON/RTV-II		CON/RTV-Ni	Teckbond C		

ENGINEER'S ELASTOMER DESIGN REFERENCE CHART

Suggested Remedies in Gasket Design

Fault	Why Faulty	Suggested Remedy
 Bolt holes close to edge.	Causes breakage in stripping and assembly.	 Use 'ear' or 'notch'.
 Metalworking tolerances applied to gasket.	Results in rejection of perfectly good parts. Requires time and correspondence to reach acceptable level. Costly and slow.	Most gasket materials are compressible and affected by humidity. Use commercial tolerances in preference to special tolerances.
 Transference of fillets and radii from metal parts to gasket.	Unless molded part, this results in unnecessary costs.	Most gasket stock will conform without shaping. Ensure features are functional, not copied from metalwork.
Thin walls in relation to size.	High scrap, distortion during ship or in use. High tensile materials only.	Have gasket in mind early in design process.
 Large gaskets with bevel joints.	 Extra ops. Smooth joint difficult.	 Die-cut dovetails.

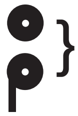
Recommended Deflection of Silver Filled Elastomers

The deflection of conductive elastomer gaskets should never exceed the maximum

 7-10% of thickness

 18-20% of diameter

 12-15% of height

 Approx. 50% but not more than 100% of void width

CONDUCTIVE ELASTOMER TOLERANCES

SHEETS, RULE DIE CUT AND MOLDED GASKETS

U.S. Customary
[SI Metric]

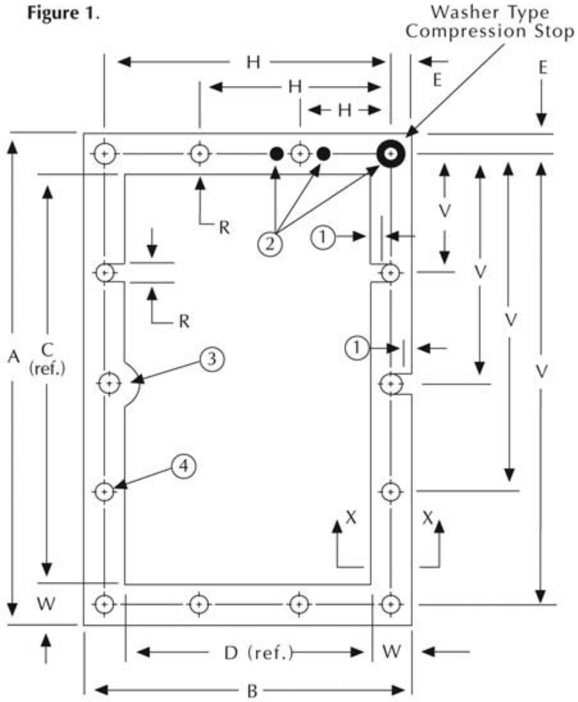
RULE DIE CUT AND MOLDED GASKETS

The following tolerances refer to the dimensions illustrated in Figure 1.

CUSTOM FABRICATED CONDUCTIVE ELASTOMER TOLERANCES

SYMBOL	DIMENSION	TOLERANCE
A, B, V, W	up to 6 in. [152]	± .016 [.40]
H	each additional 1 in. [25.4]	± .003 [.08]
E, R	up to 1 in. [25.4]	± .016 [.40]
	over 1 in. [25.4]	± .031 [.79]
T		See Tolerance For Sheets

Figure 1.



NOTES:
1. Bolt holes closer to gasket edge than gasket thickness must be Ushaped slots, or see note 3.
2. Distance from compression stop to edge of sealing gasket must not be less than gasket thickness.
3. Bolt holes closer to gasket edge than gasket thickness can be with edge protrusion.
4. Holes diameter must not be less than gasket thickness, nor less than .125" in diameter.

CONDUCTIVE ELASTOMER SHEET TOLERANCES

THICKNESS	TOLERANCE
.020 to .032 [.51 to .81]	± .005 [.13]
.033 to .045 [.84 to .14]	± .007 [.18]
.046 to .062 [1.17 to 1.57]	± .008 [.20]
.063 to .090 [1.60 to 2.39]	± .010 [.25]
.091 to .125 [2.41 to 3.17]	± .012[.30]
over .126 [3.17]	± .015 [.38]
LENGTH & WIDTH TOLERANCE	
up to 12 x 18 [305 x 457]	± .125 [3.18]

NOTE: The above tolerances are based on gasket thickness of .125 or less. For gaskets thicker than .125, contact factory for applicable tolerances.

TOLERANCES
MOLDED X-SECTIONS

SYMBOL	DIMENSION	TOLERANCE
T, W, D, A	under .101 [2.56]	± .005 [0.127]
OD, ID, L	.101 - .250 [2.56 - 6.35]	± .010 [2.56]
	.251 - .499 [6.37 - 12.67]	± .015 [.381]
	.500 - .999 [12.7 - 25.37]	± .020 [.508]
	1.0 [25.4] and over	± .031 [0.787]

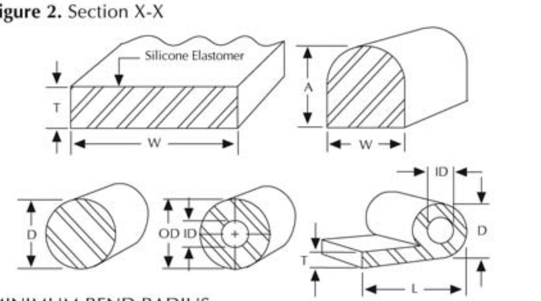
OVERALL DIMENSION-MOLDED PARTS

SIZE (INCHES)			FIXED
Above		**Incl.**	
0	-	.40 (0 - 10)	± .006
.40	-	.63 (102 - 16)	± .008
.63	-	1.00 (16 - 25)	± .010
1.00	-	1.60 (25 - 40)	± .013
1.60	-	2.50 (40 - 63)	± .016
2.50	-	4.00 (63 - 100)	± .020
4.00	-	6.30 (100 - 160)	± .025
6.30 & over multiply by .004			

EXTRUDED X-SECTIONS

SYMBOL	DIMENSION	TOLERANCE
T, W, D, A	under .201 [5.10]	± .005 [0.127]
OD, ID, L	.201 - .350 [5.10 - 8.89]	± .008 [0.203]
	.351 - .499 [8.915 - 12.674]	± .010 [0.254]
	.500 [12.7] and over	± .015 [0.381]

Figure 2. Section X-X



MINIMUM BEND RADIUS:
1/2 "W" for rectangle and "D" shape
1/2 "D" for cords
1/2 "OD" for tubes
1/2 "L" for P shape

CONDUCTIVE ADHESIVE TRANSFER TAPE

ACRYLIC PRESSURE SENSITIVE ADHESIVE

GENERAL DESCRIPTION

Tecknit conductive adhesive transfer tape is an economical and convenient product for use with Tecknit CONSIL conductive elastomers.

FEATURES

- Eliminates messy solvents.
- Easy to apply.
- No mixing or clean up.
- Instant tack for immediate bonding.
- No cure time.

STANDARD PART NUMBER DESIGNATION

WIDTH	PART NUMBER
0.187 inch	03-00000
0.250 inch	03-00001
0.500 inch	03-00002
1.000 inch	03-00003

SURFACE PREPARATION

To ensure the maximum adhesive bond strength and best electrical conductivity, surfaces to be bonded should be free of grease, oils, and dirt. Recommended surface cleaning solvents are denatured alcohol and water. Allow to dry before applying tape.

ORDERING INFORMATION

Tecknit conductive adhesive transfer tape is available in standard widths of .187", .250", .500" and 1.0" in 10 yard long rolls. Widths up to 27" and different lengths are available by special order. For assistance, contact your nearest Tecknit representative.

SPECIFICATIONS

MATERIAL DESCRIPTION

Adhesive	0.002 inch acrylic adhesive transfer tap with silver-plated conductive particles
Liner	0.0035 inch silicone treated low release paper liner

PERFORMANCE CHARACTERISTICS

Release Value	15 gram/inch width
Adhesion	40 ounce/inch width to stainless steel after 1 hour at room temperature
Resistance	0.01 ohm/square inch, maximum

Relative High Temperature Operation Range

Long Term (Days, Weeks)	158°F [70°C]
Short Term (Minutes, Hours)	248°F [120°C]

Temperature Resistance	-30°F to 225°F [-1°C to 107°C]
Shelf Life	12 months at room temperature and 50% relative humidity

TECKNIT

Vulcon™

MOLDED-IN PLACE CONDUCTIVE ELASTOMERS

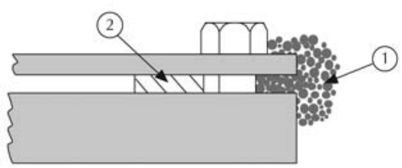
U.S. Customary
[SI Metric]

CORROSION

Corrosion can threaten the long-term performance of even the best EMI gaskets. In salt spray environments, the “quick-fix” has been to coat the outer flange area with an inert grease or RTV to provide an environmental seal. Both grease and RTV are messy and must be re-applied whenever the seal is broken. VULCON is the solution to these shortcomings. Figure 1 shows how VULCON uses the same concept of preventing exposure of the EMI gasket, but does so by being molded in place around the entire periphery of the enclosure cover, totally surrounding bolt holes. Alongside the nonconductive seal (towards the inside of enclosure), is the EMI seal. Each time the enclosure is resealed after servicing, the EMI seal is automatically protected without depending on the re-application of a protective lubricant or RTV. MIL-G- 83528 references this type of twin seal as the best method for prevention of EMI gasket corrosion. Silicone or fluorosilicone both provide excellent environmental seals and can be vulcanized directly to the enclosure cover.

OLD SOLUTION

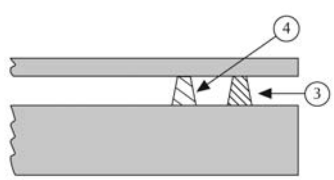
Figure 1a.



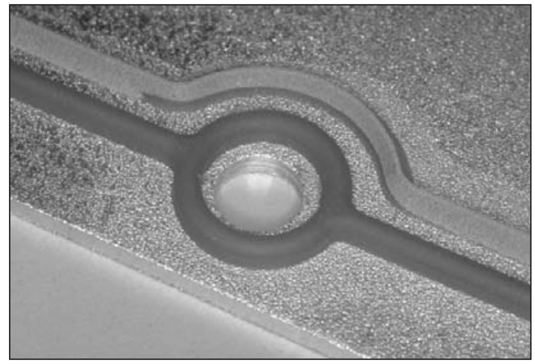
Grease or RTV (1) applied around flange perimeter to protect EMI gasket (2).

VULCON "TWIN SEAL"

Figure 1b.



Grease or RTV (1) applied around flange perimeter to protect EMI gasket (2).



TOP VIEW OF VULCON "TWIN SEAL".

Figure 1c.

TOLERANCE BUILDUP

As with any gasketing material, proper compression of an elastomer is crucial to its performance. Factors affecting the percent compression are:

- Tolerance of gasket thickness.
- Tolerance of flange surfaces.
- Fastener spacing.
- Deflection characteristics of flange materials.

In Figure 2, the critical dimension is the height of the gasket above the flange surface (A). If the gasket is too high, excessive closure force will be required. If the gasket is too low an effective environmental/ EMI seal will not be achieved. Differences between standard tolerances vs. VULCON tolerances are shown in Figure 2a and 2b.

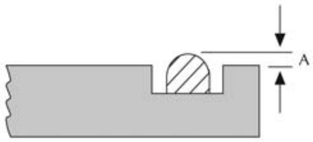
VULCON is the solution when proper gasket compression must be guaranteed:

- VULCON reduces standard gasket cross section tolerances to precision machined tolerances (±.003).
- VULCON precisely positions the top surface of the gasket to the flange surface (Figure 2b).
- VULCON controls the exact position of the gasket along the flange surface. By doing so, repeated closures can be made without the possibility of gasket being pinched by fastener.

TECKNIT can vulcanize to a customer supplied frame, flange, or enclosure cover. TECKNIT also has in-house CNC capabilities to provide both the vulcanized elastomer and metalwork as one finished part.

STANDARD GASKET IN GROOVE

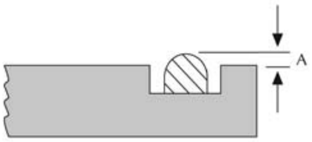
Figure 2a.



Groove Depth	.100" ± .005"
Elastomer Height	.125" ± .008"
"A" Dimension	.025" ± .013"
Gasket Compression	10% to 29%

VULCON SOLUTION

Figure 2b.



"A" Dimension	.013" ± .003"
Gasket Compression	10% to 17% (.096" gasket height)

INSTALLATION/GASKET POSITIONING

Conductive elastomer EMI gaskets are predominantly used in defense related electronic systems. Field servicing of these systems must be considered throughout the design cycle, taking into account "real world" considerations:

- Equipment must be capable of being dismantled and re-assembled in the field quickly, with a minimum of spare parts and under adverse conditions.
- Electronic "boxes" have to be serviced without their removal from the overall system (jet aircraft, shipboard control room etc.). Situations where the gasket has to be reinstalled in the vertical position can easily occur.
- EMI gasket must be in place for the equipment to function properly in an environment potentially saturated with electronic noise (radars, communications systems, jamming). Any opportunity for error in the installation of the EMI gasket (overstretching, replacing with nonconductive material, or omitting a gasket altogether) must be eliminated.

VULCON is the solution for the fastest, easiest and most reliable way to establish a guaranteed seal after field service, VULCON requires no adhesives, no tricky positioning or alignment of gasket, no special tools, and no messy tubes of grease or RTV. VULCON eliminates the chance of an environmental and/or EMI seal not being in place whenever the enclosure cover is installed.

Vulcon cont.

U.S. Customary
[SI Metric]

CUSTOM REQUIREMENTS

VULCON is inherently a custom process. No standard, "off the shelf" products exist for VULCON - each part is optimized to meet the specific requirements of the application.

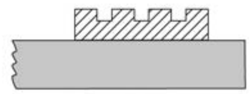
A variety of elastomers are offered, providing a broad range of physical and electrical properties. Table 1 lists the more common ones used. (For other elastomers, contact your nearest TECKNIT representative or call TECKNIT directly.

MOST COMMON ELASTOMERS FOR VULCON

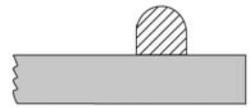
		MIL-G-83528 TYPE
Silicone	Nonconductive	-
Fluorosilicone	Nonconductive	-
CONSIL-C* (Silicone)	Conductive (Silver-Copper)	A
CONSIL-CF* (Fluoro)	Conductive (Silver-Copper)	C
CONSIL-A* (Silicone)	Conductive (Silver-Aluminum)	B
CONSIL-RHT (Silicone)	Conductive,high temp (Pure Silver)	-

* Commercial type materials also available.

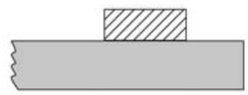
Cross sections are also custom designed for each application. Textured surfaces such as ribs aid in reducing closure pressure and improve sealing. Some of the more popular cross sections are shown in Figures 3a-e.



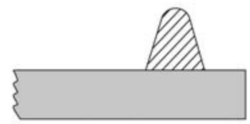
RIBBED Figure 3a.



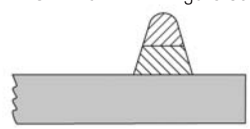
D-SHAPED Figure 3b.



RECTANGLE Figure 3c.



TRIANGLE Figure 3d.



TRIANGLE WITH DIFFERENT DUROMETER ON TOP AND BOTTOM Figure 3e.

ORDERING INFORMATION

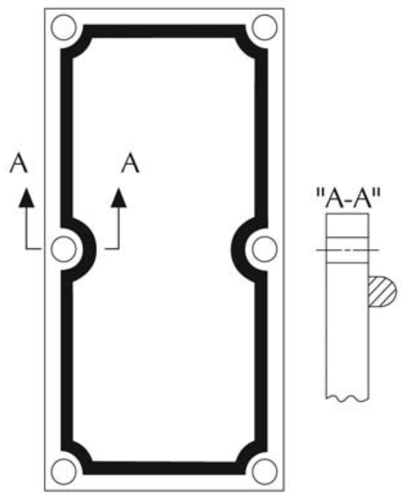
Contact your factory to discuss your application.

VULCON patterns on an enclosure cover can have many variations. Figures 4a - d show just some of TECKNIT's capabilities.

VULCON is the most versatile and adaptable gasketing concept available today.

VULCON SINGLE GASKET VULCANIZED TO PLATE

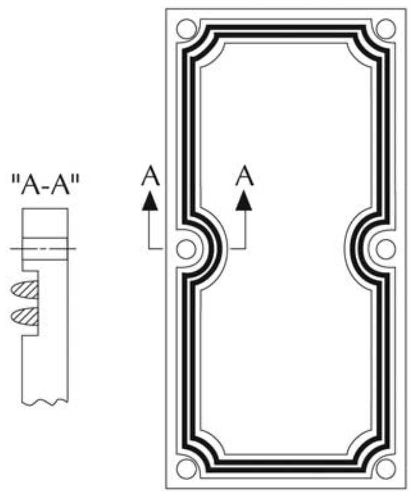
Figure 4a.



VULCON "TWIN SEAL" IN GROOVE

Figure 4c.

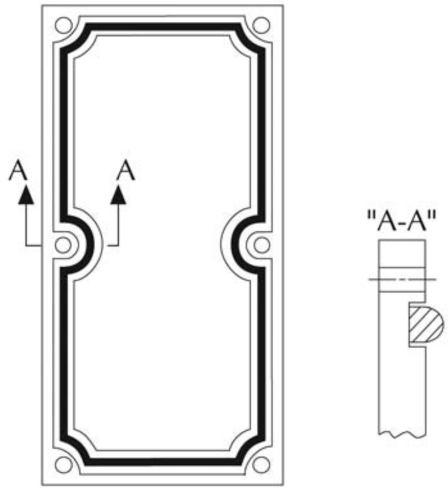
Makes excellent environmental and EMI Seal for harsh environment.



VULCON SINGLE GASKET IN GROOVE

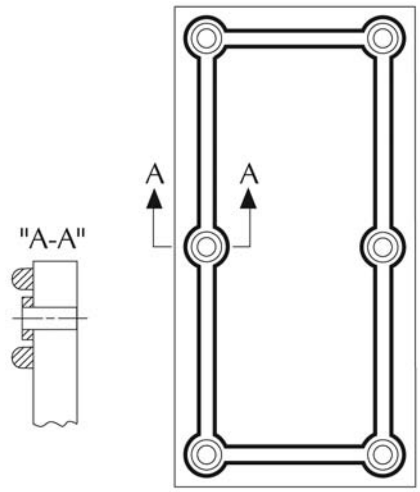
Allows for metal flanges to meet.

Figure 4b.



VULCON "TWIN SEAL" WITH COMPRESSION STOPS

Figure 4d.



Teckfip™ Gaskets

FORMED-IN-PLACE CONDUCTIVE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

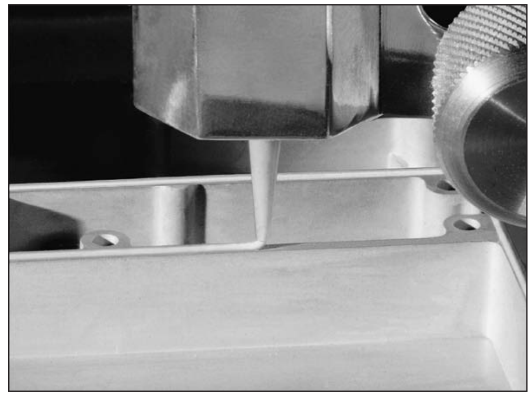
TECKFIP (FORM-IN-PLACE) gasketing is a custom process where a highly conductive silicone based gasket is dispensed on a part where an EMI shield is required. The materials range from a pure silver filled resin to silver/copper, silver/aluminum, silver/glass and our new tungsten/carbide filled resins that all cure to form a flexible EMI shields and environmental seals. They are precisely applied in a programmed pattern and are ideal solutions meeting the requirements and cost demands of commercial applications.

TECKFIP compounds are ideal for applications requiring a quick full cure gasket that meets wide temperature range demands. Most TECKFIP compounds adhere best to Aluminum (with chromate conversion per MIL-C-5441 Class 1A or 3A) or Zinc.

TECKFIP compounds have a Shore A hardness ranging from a soft 50 durometer to a firmer 70 durometer. Our soft 50 Shore A durometer material is ideal for lightweight fragile plastic or metal parts. It cures at room temperature as required by plastic applications and its low compression set helps the gasket withstand repeated assembly and compression. In addition, TECKFIP low durometer compounds adhere to most materials and are compatible with conductively coated plastics such as ABS, PVC, etc. The compounds can also be applied to bare metals sufaces such as aluminum, magnesium, steel,nickel, copper, silver chromated and nickel and other plated surfaces. Fast curing allows faster handling and shipping of finished parts.

TECKFIP FEATURES AND BENEFITS

- Excellent EMI shielding performance.
- Direct application of gasket to component part reduces assembly and handling.
- Able to be applied to enclosure walls and partitions in widths as small as .020 inches.
- Low compression set.
- Eliminates costly tooling resulting in faster turnaround and design changes.
- Minimizes material cost in comparison to die cut or molded gasket equivalency.
- Room temperature curing (ideal for shielded plastic components).
- Soft and compressible.
- Gaskets can be handled quickly after applying.



SPECIFICATIONS

MATERIAL DESCRIPTION

FIP-C: Ag/Cu

This compound is an all round high performance compound, and is very similar to a Consil C molded or extruded elastomer. It has been traditionally used for telecommunications base station shielding. This material has excellent adhesive strength, and the electrical conductivity remains stable even under long term mechanical loads such as vibration or periodic loading and temperature fluctuations.

This compound has long been established as the market leader in conductive Form-in-Place applications with the reliability and durability needed in the telecommunications marketplace. It is available in two forms, moisture cure (FIP-C) and heat cure (HC FIP-C).

FIP-C SP: Ag/Cu - small particle

This is the small particle version of the FIP-C compound. It was specifically designed for mobile cell phone applications, which require a high degree of EMI shielding. While the compound has been optimized for its overall shielding effectiveness, high cycling applications are not recommended for this material. This compound is ideally designed for projects that will not get opened and closed frequently, such as mobile phones.

FIP-E: Ag/glass

This is Tecknit's commercial grade FIP compound designed for moderate shielding performance. The Ag/glass particles are very smooth which leads to very low compression set value. The material is also available as a heat cured compound (HC FIP-E).

FIP-E SP: Ag/glass – small particle

FIP Comparison Reference

	FIP-X	FIP-R	FIP-N/FIP-N (LD)	FIP-E	FIP-E (SP)	FIP-C	FIP-C (SP)	FIP-A	HC FIP-C	HC FIP-E
Specifications:										
Metal Filler:	tungsten carbide	pure silver	silver/nickel	silver/glass Small Particle	silver/glass	silver/copper Small Particle	silver/copper	Silver Aluminium Heat Cure	silver/copper Heat Cure	silver/glass
Color:	dark gray	pale yellow	pale yellow	ivory	ivory	beige	beige	silver/tan	grey	ivory
Shore A hardness:	65 +/- 8	50 +/-7	60 +/-7/48+/-7	55 +/- 2	70+/-10	50 +/- 5	55 +/-5	60 +/-7	50 +/- 5	70+/-10
Specific Gravity +/- 15% :	1.74	2.7	3.5	1.8	1.8	2.5	2.11	3.5	2.6	1.8
Temp Range:	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C	-55 to +125C
Tack Free Time:	<12 min.	<12 min.	<12 min.	<12 min.	<12 min.	<3 min.	<6 min.	< 12 min	N/A	N/A
Cure Time:	<24 hours nom.	<24 hours nom.	<24 hours nom.	<24 hours nom.	<24 hours nom.	<24 hours nom.	<24 hours nom.	full 24 hours	1 hour @ 125C	1 hour @ 125C
Volume Resistivity:ohm-cm	0.031	0.005	0.02 max	0.007	0.009	0.008 (max)	0.018	0.01 (max)	0.01 (max)	0.01 (max)
Surface Resistivity:	1.5 ohms-cm	0.015	0.02 max	0.012	0.012	0.01	0.01	0.02 (max)	0.01 (max)	0.01 (max)
Aged Surface Resistivity: after 168 hours at 85C	0.046	0.02 max		0.012	0.012	0.012		0.02 (max)	0.03 (max)	0.03 (max)
Compression Set: After 22 hours ar 70C	31%	28%	28%	13%	7%	28%	57%	15%	27%	23%
Tensile Strength:	215psi	200psi	200 psi (min)	273 psi	273psi	110 psi	157 psi	90 PSI	200 PSI	200 PSI
Elongation:	90% min.	100%	50% min	71%	71%	100%	31%	30% min	50% min	50% min
Compression Range:	10-50%, 25% recom	10 - 25%	10 - 25%	30% recom.	10 - 25%	10 - 25%	10 - 25%	15 - 25%	10 - 25%	10 - 25%
Shielding Effectiveness:						10 MHz to 10 Ghz : > 65 dB				
Salt Spray Resistance:	Passed ASTM B117									
Adhesion Strength (N/cm_):	90 min	90 min	90 min	167.5 (typ)	90 min	90 min	90 min	90 min	90 min	90 min

PART NUMBERS										
700g cartridge	**69-10020X**	**69-10040R**	**69-10050N**	**69-10010E**	**69-10010ESP**	**69-10000C**	**69-10000CSP**	**69-10030A**	**69-10000CHC**	**69-10010EHC**
30cc syringe	**69-10021X**	**69-10041R**	**69-10051N**	**69-10011E**	**69-10011ESP**	**69-10001C**	**69-10001CSP**	**69-10031A**	**69-10001CHC**	**69-10011EHC**

Note: Shelf life for the 700g cartridge is 6 months; Shelf life for the 30cc syringe is 1 month.

Teckfip™ Gaskets cont.

U.S. Customary
[SI Metric]

This is the small particle version of the Ag/glass (FIP E) compound that was specifically designed for the mobile cell phone applications. It should be noted that this compound offers the lowest compression set value of all the compounds, making it ideally suited to applications where by the gasket is frequently compressed and uncompressed.

FIP-X: Al/WC

FIP-X is Tecknit's newest compound and features a conductive powder that is a unique particle combining tungsten carbide and aluminum. The premium advantage of this compound is its ability to be non-corrosive even in the most hostile of external environments. The compound has been exhaustively tested for hostile environments and easily exceeds the requirements of the ASTM B117 test specification. Tecknit also offers a flame-retardant version of this compound which has achieved the UL94-V0 rating.

FIP-A: Al/Cu

This compound is ideally suited to corrosion-concerned applications where the gasket is applied to an aluminum casting. The corrosion resistance is enhanced due to the galvanic compatibility between the casting and the conductive Aluminum/Copper particle used. The compression set performance is good and this compound offers a very stable EMI shielding performance even under large mechanical stress. The electrical conductivity performance and EMI shielding is very similar to the high performing FIP-C elastomer gasket.

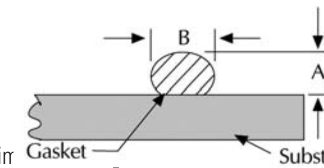
FIP-N: Al/Ni

This compound is similar in performance to FIP-A elastomer and hence offers a good non-corrosive EMI shield in harsh conditions. This material is one of our more cost effective FIP compounds

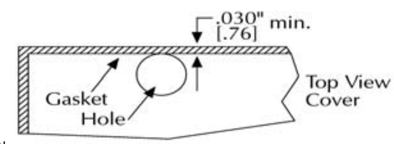
FIP-R: Ag

This compound is based on a very rugged pure silver particle. By using silver as the conductive medium, this compound offers great performance in terms of heat aged electrical conductive stability and prolonged mechanical vibration. In addition to this, the electrical conductivity performance is the highest of all Tecknit FIP compounds.

TECKFIP DESIGN GUIDELINES



"A" Dim	25" [3.18]
"B" Dimension Width:	"A" +10% (Ref.)
Profile Tolerance :	±10%



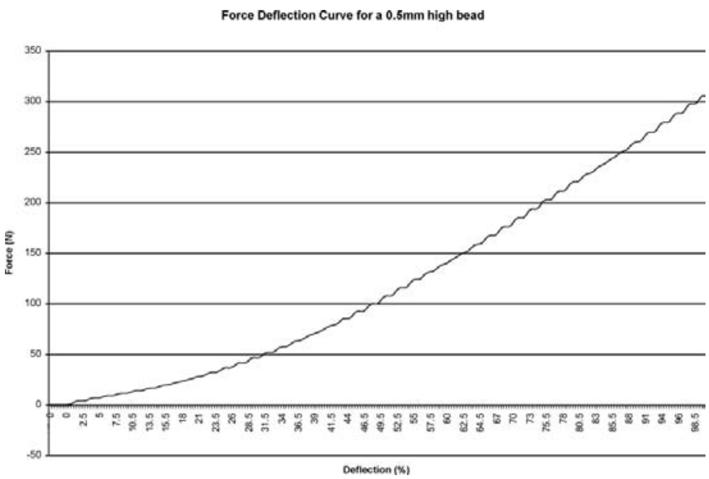
Minimu	
Outside Radius:	1/2 "B" Width Dimension
Inside Radius:	Sharp
Maximum Overall Size:	28" x 19" x 4" [711.2] x [482.6] x [101.6]
Recommended Compression:	25% of Gasket Height "A"
Gasket Path:	Can be comprised of any geometric shape connected together (ie. line, arc, circle, ellipse).

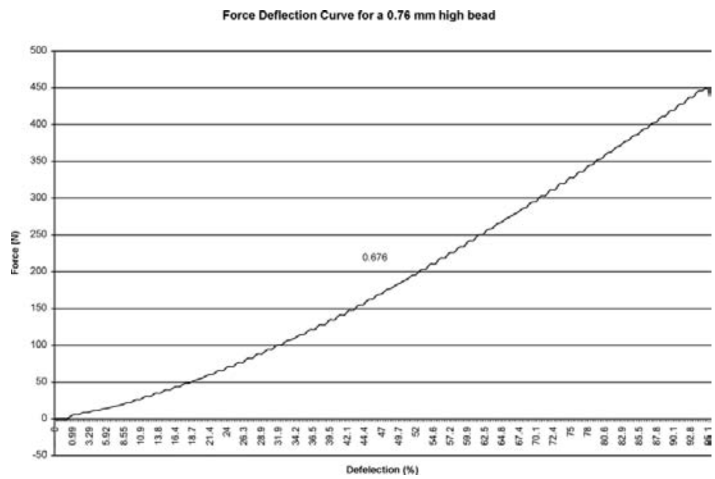
ORDERING INFORMATION

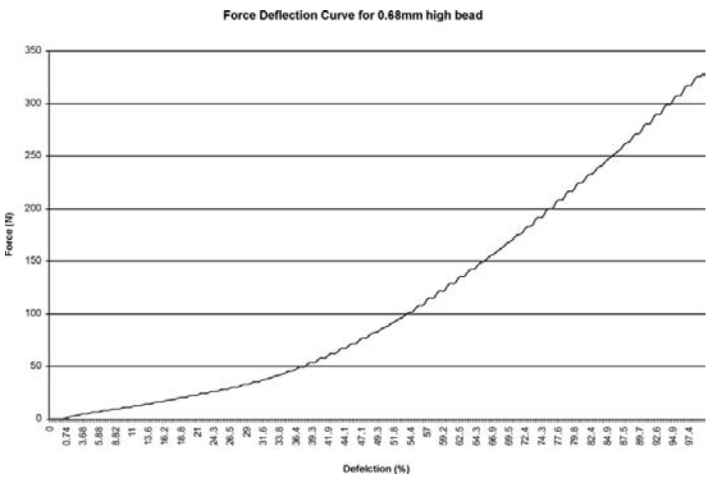
1. Teckfip can be applied to your part at any of our growing number of global application sites. Tecknit currently has sites in the US, UK, Spain, Mexico and China. Contact a Tecknit representative or our application support group to discuss your application.

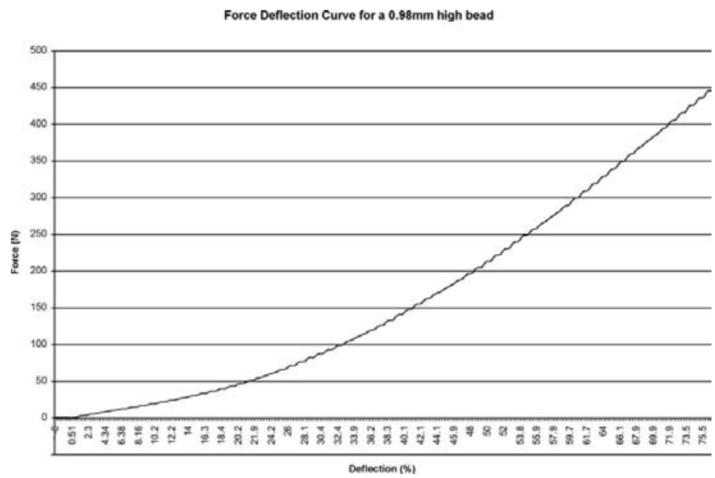
2. Teckfip compound can be applied in easy to use containers for gasket application at a customers site. The compounds are compatible with several application machines. Contact our application support group to confirm application machine compatibly.

TECKFIP FORCE/DEFLECTION









Consil®-E

EXTRUDED SILVER-FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-E is a continuously extruded silicone elastomer filled with silver-plated inert particles. It is a medium hardness material providing high electrical conductivity and moisture sealing. CONSIL-E is available in a variety of standard cross-sections: rectangular, round, “D” shape, “U” channels, “P” shapes and various thin wall constructions. Custom crosssections are available per customer specifications. CONSIL-E is designed to provide reliable cost effective shielding and is especially ideal for a wide range of commercial and telecommunications EMI applications.

APPLICATION INFORMATION

CONSIL-E is intended primarily for groove and flange mounting applications. In order to assure electrical conductivity and sealing reliability, recommended design compression is 7%-15% of original height for rectangular strips, 12%-30% for solid round and “D” shapes, and 20%-60% for tubing and “P” shapes. For small cross sections refer to the force vs. deflection graph on page D-10. The hollow shapes are designed for low closure pressure applications. Excessive deflection is not recommended since it can result in permanent compression set and degradation of electrical conductivity.

BONDING AND SPLICING

TECKNIT two part RTV Conductive Silicone Adhesive (Part Number 72-00036) is recommended for splicing, joining, and bonding CONSIL-E gaskets to enclosures. The material provides a flexible bond and resilient seal.

EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-E Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values are based on a 5" x 5" Aperture.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
811	65	130+	100+	90+
815	65	130+	100+	90+

SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-E Compound No.	811	815
Elastomer Binder	Silicone	Silicone
Conductive Filler Type	Silver-plated glass particles	
Color	Tan	Tan
Form Available	Extruded X-Sections	

PERFORMANCE CHARACTERISTICS

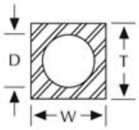
Specific Gravity ASTM D-792	1.86 ± .25	2.10 ± .25
Volume Res. (Max.)	0.03 ohm-cm	0.03 ohm-cm
Hardness (Shore A) ASTM D-2240	70 ± 15	60 ± 7
Tensile Strength (Min.) ASTM D-412	50 psi [345 kPa]	50 psi [345 kPa]
Elongation to break (Min.) ASTM D-412	50%	50%
Tear Strength (Min.) ASTM D-624	35 ppi	20 ppi
Temperature Range	-60°F to +350°F [-55°C to +177°C]	-60°F to +350°F [-55°C to +177°C]

ORDERING INFORMATION

Extruded materials are available in continuous lengths. For cross sections not listed above or custom specification requirements, contact your nearest TECKNIT area representative or factory location.

PART NUMBERS AND CROSS SECTIONS

HOLLOW SQUARE



Thickness & Width	Diameter	Compound	Part Number
.133 [3.37]	.078 [1.98]	815	81-50010

STANDARD TUBING

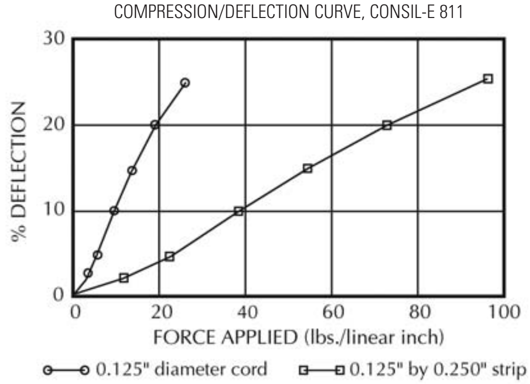
OD	ID	Compound	Part Number
.250 [6.35]	.125 [3.18]	811	81-20009
.375 [9.53]	.250 [6.35]	811	81-20010
.040 [1.01]	.020 [.050]	815	81-50000
.060 [1.52]	040 [1.01]	815	81-50001

STANDARD ROUND

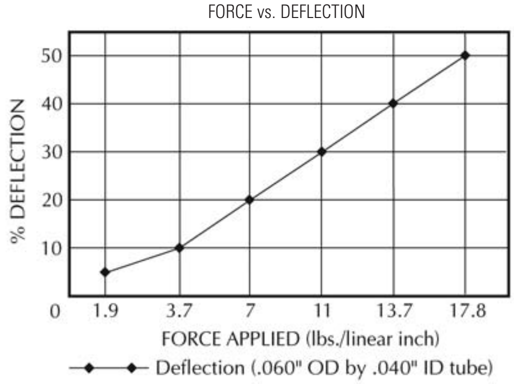
Diameter	Compound	Part	Diameter	Compound	Part Number
.062 [1.57]	811	81-20000	.188 [4.78]	811	81-20006
.070 [1.78]	811	81-20001	.250 [6.53]	811	81-20007
.093 [2.36]	811	81-20002	.375 [9.53]	811	81-20008
.103 [2.62]	811	81-20003	-	-	-
.125 [3.18]	811	81-20004	.040 [1.01]	815	81-50005
.139 [3.53]	811	81-20005	-	-	-

COMPRESSION AND DEFLECTION DATA

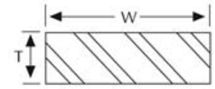
COMPRESSION/DEFLECTION CURVE, CONSIL-E 811



FORCE vs. DEFLECTION

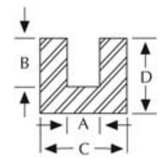


STANDARD RECTANGULAR



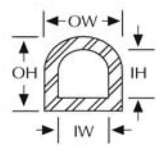
Thickness T	Compound	Width - W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
.032 [0.76]	811	81-20023	81-20024	81-20025	81-20026	81-20027
.062 [1.57]	811	81-20028	81-20029	81-20030	81-20031	81-20032
.093 [2.35]	811	81-20033	81-20034	81-20035	81-20036	81-20037
.125 [3.18]	811	81-20038	81-20039	81-20040	81-20041	81-20042
.188 [4.78]	811	-	81-20044	81-20045	81-20046	81-20047
.250 [6.35]	811	-	-	81-20050	81-20051	81-20052

STANDARD "U" SHAPES



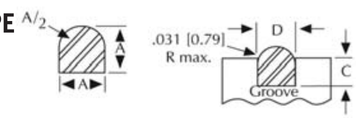
A	B	C	D	Compound	Part Number
.062 [1.57]	.125 [3.18]	.188 [4.78]	.188 [4.78]	811	81-20012
.125 [3.18]	.188 [4.78]	.250 [6.35]	.250 [6.35]	811	81-20013

HOLLOW "D" SHAPE



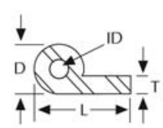
OH	IH	OW	IW	Compound	Part Number
.120 [3.04]	.080 [2.03]	.150 [3.81]	.110 [2.79]	815	81-50015

STANDARD "D" SHAPE



A	Compound	Part Number	Groove Dimensions C +.006 in. [0.15 mm] -0	D +.006 in. [0.15 mm]
.062 [1.59]	811	81-20014	.046 [1.17]	.103 [2.65]
.093 [2.36]	811	81-20015	.071 [1.80]	.137 [3.50]
.125 [3.18]	811	81-20016	.096 [2.44]	.188 [4.75]
.188 [4.78]	811	81-20017	.146 [3.71]	.256 [6.50]
.250 [6.35]	811	81-20018	.199 [5.05]	.336 [8.55]
.375 [9.35]	811	81-20019	.295 [7.49]	.488 [12.40]

STANDARD "P" SHAPES



D	ID	L	T	Compound	Part Number
.188 [4.78]	.125 [3.18]	.500 [12.70]	.062 [1.57]	811	81-20020
.250 [6.35]	.188 [4.78]	.750 [19.05]	.062 [1.57]	811	81-20021
.375 [9.53]	.250 [6.35]	1.00 [25.40]	.075 [1.91]	811	81-20022

TECKNIT

Consil®-II

MOLDED SILVER-FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-II is a molded silicone elastomer filled with silver-coated inert particles. It provides high electrical conductivity, broadband shielding and moisture sealing.

CONSIL-II is designed to provide reliable cost effective shielding for a wide range of EMI applications.

CONSIL-II is manufactured in sheets, molded parts, strips, and die cut flat gaskets.

APPLICATION INFORMATION

CONSIL-II should be used where there is a need for high broadband shielding combined with excellent moisture sealing properties.

In order to assure electrical conductivity and sealing reliability, recommended design compression is 7%- 15% of original height for sheets and rectangular strips, and 12%-30% for "O" and "D" shapes.

ADHERING AND JOINING

TECKNIT CON/RTV-II (Part Number 72-00036) is a two component, electrically conductive, silver silicone adhesive sealant of medium viscosity. It is recommended for splicing, joining, and bonding CONSIL- II gaskets to enclosures. The material provides a flexible bond and resilient seal.

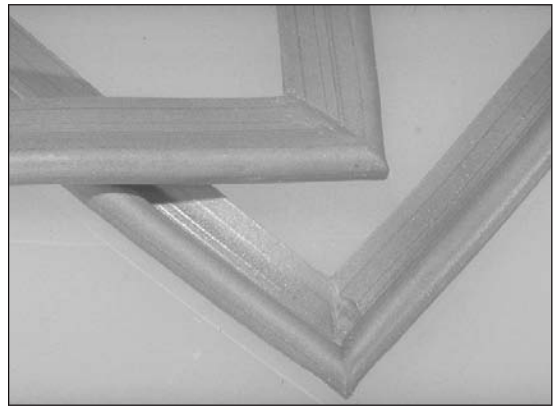
EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-II Shielding Effectiveness has been tested in accordance with TECKNIT Test Method

TSETS-01 and based upon modified MIL-STD-285. Typical shielding effectiveness values are based on a 5" square aperture.

TECKNIT CONSIL-II Shielding Effectiveness has been tested in accordance with the test method described in paragraph 4.6.12 of MIL-G-83528. Typical values are shown.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
841	75	130	100+	90
842	75	130	100+	90



SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-II - Compound No.	841	842
Elastomer Binder	Silicone	Silicone
Conductive Filler	Silver Plated Glass Particles	
Color	Tan	Tan
Form Available	Molded Sheets & Strips	Molded Sheets & Strips

PERFORMANCE CHARACTERISTICS

Specific Gravity ASTM D-792	1.80 ± .25	1.86 ± .25
Volume Resistivity (Max.)	0.01 ohm-cm	0.01 ohm-cm
Hardness (Shore A) ASTM D-2240	47 ± 10	70 ± 10
Tensile Strength (Min.) ASTM D-412	100 psi [690 kPa]	120 psi [830 kPa]
Elongation to break (Min.) ASTM D-412	120%	120%
Tear Strength (Min.) ASTM D-624	35 ppi [7.88 kN/m]	45 ppi [7.88 kN/m]
Temperature Range	-60°F to 351°F [-51°C to 177°C]	-60°F to 351°F [-51°C to 177°C]

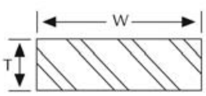
U.S.A.: 908-272-5500 • U.K.: 44-1476-590600 • Spain: 34-91-4810178

STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	 12 x 18 [305 x 457]
.020 [0.51]	841	84-30140	-
	842	84-30150	-
.032 [0.76]	841	84-30170	84-30180
	842	84-30175	84-30185
.040 [1.02]	841	84-30171	84-30181
	842	84-30176	84-30186
.062 [1.52]	841	84-30172	84-30182
	842	84-30177	84-30187
.093 [2.36]	841	84-30178	84-30183
	842	84-30178	84-30188
.125 [3.18]	841	84-30174	84-30184
	842	84-30179	84-30189

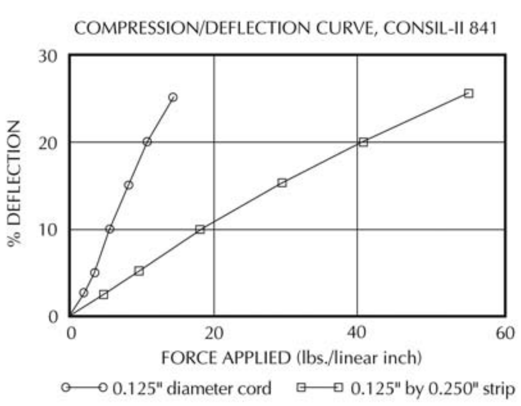
STANDARD RECTANGULAR

STANDARD LENGTH=18 in. [457 mm]



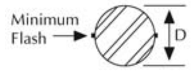
Thickness T	Com-pound	Width W .125 [3.18]	 .188 [4.78]	 .250 [6.35]	 .375 [9.53]	 .500 [12.70]
.032	841	84-70100	84-70101	84-70102	84-70103	84-70104
[0.76]	842	84-70105	84-70106	84-70107	84-70108	84-70109
.062	841	84-70110	84-70111	84-70112	84-70113	84-70114
[1.52]	842	84-70115	84-70116	84-70117	84-70118	84-70119
.093	841	84-70120	84-70121	84-70122	84-70123	84-70124
[2.36]	842	84-70125	84-70126	84-70127	84-70128	84-70129
.125	841	84-70130	84-70131	84-70132	84-70133	84-70134
[3.18]	842	84-70135	84-70136	84-70137	84-70138	84-70139
.188	841	-	84-70141	84-70142	84-70143	84-70144
[4.78]	842	-	84-70146	84-70147	84-70148	84-70149
.250	841	-	-	84-70152	84-70153	84-70154
[6.35]	842	-	-	84-70157	84-70158	84-70159

COMPRESSION AND DEFLECTION DATA



STANDARD ROUND

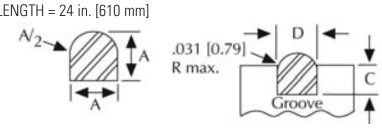
STANDARD LENGTH = 24 in. [610 mm]



Diameter	Com-pound	Part Number	Diameter	Com-pound	Part Number
.062	841	84-70020	.125	841	84-70022
[1.57]	842	84-70000	[3.18]	842	84-70002
.070	841	84-70021	.139	841	84-70025
[1.78]	842	84-70001	[3.53]	842	84-70005
093	841	84-70023	.188	841	84-70026
[2.36]	842	84-70003	[4.78]	842	84-70006
.103	841	84-70024	.250	841	84-70027
[2.62]	842	84-70004	[6.35]	842	84-70007

STANDARD "D" SHAPES

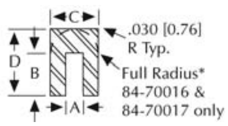
STANDARD LENGTH = 24 in. [610 mm]



A	Com-pound	Part Number	Groove Dimensions C +.006 -0 [0.15]	 D ±.066 [0.15]
.062	841	84-70070	.046	.103
[1.59]	842	84-70071	[1.17]	[2.65]
.093	841	84-70072	.071	.137
[2.38]	842	84-70073	[1.80]	[3.50]
.125	841	84-70074	.096	.188
[3.18]	842	84-70075	[2.44]	[4.75]
.188	841	84-70076	.146	.256
[4.78]	842	84-70077	[3.17]	[6.50]
.250	841	84-70078	.199	.336
[6.35]	842	84-70079	[5.05]	[8.55]

SPECIAL "U" SHAPES

STANDARD LENGTH = 24 in. [610 mm]



A	B	C	D	Com-pound	Part Number
.062	.188	.250	.250	841	84-70010
[1.57]	[4.78]	[6.35]	[6.35]	842	84-70011
.125	.375	.312	.500	841	84-70012
[3.18]	[9.53]	[7.92]	[12.70]	842	84-70013
.188	.375	.375	.500	841	84-70014
[4.78]	[9.53]	[9.53]	[12.70]	842	84-70015
.093	.312	.218	.421	841	84-70016*
[2.63]	[7.92]	[5.54]	[10.69]	842	84-70017*

ORDERING INFORMATION

For cross-sections not listed above and custom design applications and molded parts, contact your nearest TECKNIT area representative or factory location.

Consil®-R

PURE SILVER-FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-R is a pure silver filled elastomer available in a variety of durometers and compounds.

CONSIL-RHT 855 is a pure silver-filled silicone elastomer ideal for applications where high temperature is a concern.

CONSIL-R 856 offers the lowest durometer available for pure silver-filled elastomers. CONSIL-R 857 provides similar properties as 856, with a high durometer.

APPLICATION INFORMATION

To assure electrical conductivity and sealing reliability, the recommended design compression for sheets and rectangular strips is 7%-15% of original height and 12%-30% for round and "D" shapes.

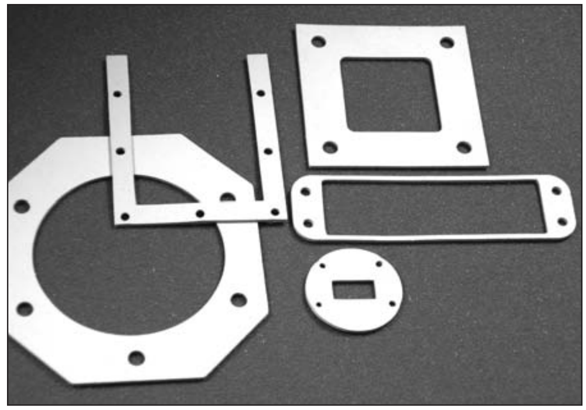
CONSIL-R is designed for use in low to moderate pressure applications. For compression and deflection data, see Figure 1. CONSIL-R is fungus inert thereby making it suitable for applications where micro-organism growth is a consideration.

CONSIL-RHT 855 silicone is used throughout industry for seals, gaskets, electrical connectors, electromagnetic shields and other applications subjected to severe operating conditions.

EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-R shielding effectiveness has been tested in accordance with the test method described in paragraph 4.6.12 of MIL-G-83528. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
856, 857	70+	130+	100+	90
855	70	120+	120	100



SPECIFICATIONS

MATERIAL DESCRIPTION

CONSIL-R Compound No.	855	856	857
Elastomer Binder	Silicone	Silicone	Silicone
Conductive Filler		Pure Silver	
Color	Red-Brown	Silver-Tan	Silver-Tan
Form Available		Molded, Sheets & Strips	

PERFORMANCE CHARACTERISTICS

	855	856	857
Specific Gravity ASTM D-792	3.5 ±13%	1.7 ±.25%	2.5 ±.25%
Volume Resistivity (Max.)	0.002 ohm-cm	0.015 ohm-cm	0.006 ohm-cm
Hardness (Shore A) ASTM D-2240	65 ± 5	40 ± 5	50 ± 5
Tensil Strength (Min.) ASTM D-412	300 psi [2.07 kPa]	100 psi [690 kPa]	100 psi [690 kPa]
Elongation to Break (Min) ASTM D-412	200%	100%	100%
Tear Strength (Min.) ASTM D-412	40 ppi [7 kN/m]	25 ppi [4.38 kN/m]	35 ppi [7.7 kN/m]
Temperature Range	-67°F to 392°F [-55°C to 200°C]	-60°F to 351°F [-51°C to 177°C]	-60°F to 351°F [-51°C to 177°C]

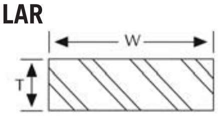
To order catalog parts made from Compound 855; use the same Part No. as Compound 856 except the third digit changes from "1" to "A". Example: Compound 856 standard "D" Part No. 85-10512 changes to No. 85-A0512 for Compound 855.

STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.032 [0.76]	856	85-10130	85-10030
	857	85-10131	85-10031
.040 [1.02]	856	85-10140	85-10040
	857	85-10141	85-10041
.062 [1.52]	856	85-10160	85-10060
	857	85-10161	85-10061
.093 [2.36]	856	85-10190	85-10090
	857	85-10191	85-10091
.125 [3.18]	856	85-10110	85-10010
	857	85-10111	85-10011

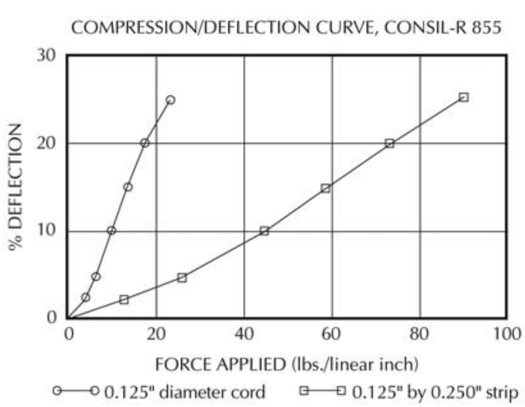
STANDARD STRIPS RECTANGULAR

STANDARD LENGTH=18 in. [457 mm]



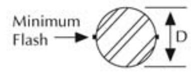
Thickness T	Com-pound	Width W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
032	856	85-10400	85-10401	85-10402	85-10403	85-10404
[0.76]	857	85-10405	85-10406	85-10407	85-10408	85-10409
.062	856	85-10415	85-10416	85-10417	85-10418	85-10419
[1.52]	857	85-10420	85-10421	85-10422	85-10423	85-10424
.093	856	85-10430	85-10431	85-10432	85-10433	85-10434
[2.36]	857	85-10435	85-10436	85-10437	85-10438	85-10439
.125	856	85-10445	85-10446	85-10447	85-10448	85-10449
[3.18]	857	85-10450	85-10451	85-10452	85-10453	85-10454
.188	856	-	85-10461	85-10462	85-10463	85-10464
[4.78]	857	-	85-10466	85-10467	85-10468	85-10469
.250 856	-	-	85-10477	85-10478	85-10479	
[6.35]	857	-	-	85-10482	85-10483	85-10484

COMPRESSION AND DEFLECTION DATA



STANDARD ROUND

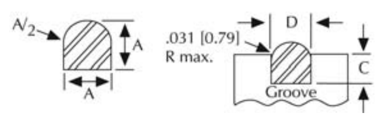
STANDARD LENGTH = 24 in. [610 mm]



Dia. in. (mm)	Com-pound	Part Number	Dia. in. (mm)	Com-pound	Part Number
.062	856	85-10550	.125	856	85-10553
[1.57]	857	85-10551	[3.18]	857	85-10554
.070	856	85-10563	.139	856	85-10572
[1.78]	857	85-10564	[3.53]	857	85-10573
.093	856	85-10566	.188	856	85-10590
[2.36]	857	85-10567	[4.78]	857	85-10591
.103	856	85-10569	.250	856	85-10593
[2.62]	857	85-10570	[6.35]	857	85-10594

STANDARD "D" SHAPES

STANDARD LENGTH = 24 in. [610 mm]



A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
.062	856	85-10500	.046	.103
[1.57]	857	85-10501	[1.17]	[2.65]
.093	856	85-10503	.071	.137
[2.36]	857	85-10504	[1.80]	[3.50]
.125	856	85-10506	.096	.186
[3.18]	857	85-10507	[2.44]	[4.75]
.188	856	85-10509	.146	.256
[4.78]	857	85-10510	[3.71]	[6.60]
.250	856	85-10512	.199	.336
[6.35]	857	85-10513	[5.05]	[8.55]

ORDERING INFORMATION

For standard sheets and strips, specify TECKNIT Part Number and quantity required. For cross sections not listed above and custom design applications, contact your nearest TECKNIT area representative or factory location.

SC-Consil®

CARBON-FILLED SILICONE ELASTOMER UL94 V-0 RATING AVAILABLE

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

SC-CONSIL is a silicone elastomer filled with carbon particles. It provides superior shielding and a reliable environmental seal. The combination of carbon particles and silicone allows SC-CONSIL to maintain its physical and electrical properties over an extremely wide temperature range. SC-CONSIL is manufactured in sheets, molded and continuously extruded strips, and in die-cut gaskets. There is a range of SC-CONSIL compounds available. Standard SC-CONSIL material has a volume resistivity of 8 ohm-cm for compression and injection molded parts and 24 ohm-cm for extruded parts. A special low volume resistivity compound is available for extruded parts at 3 ohm-cm. Flame Retardent UL94 V-O compounds for both extruded and molded parts are available.

APPLICATION INFORMATION

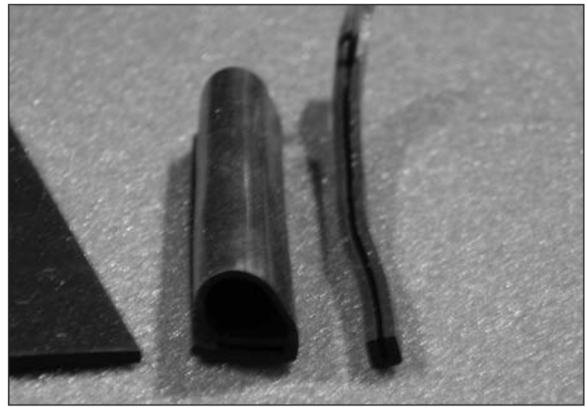
SC-CONSIL provides excellent voltage handling capabilities for grounding, lower current densities, and is ideal for static discharge and corona applications. Various extruded shapes designed for groove and flange mounting, such as tubes and P-shapes, provide maximum deflection at low to medium closure pressures. SC-CONSIL also provides a good environmental seal under moderate closing forces.

Recommended design compression is 5%-10% of original height for sheets and rectangular strips, 15%-20% for solid “O” and “D” shapes, and 20%-30% for thin tubing.

EMI SHIELDING PERFORMANCE

Tecknit Consil shielding effectiveness has been tested in accordance with the test method described in paragraph 4.6.12 of MIL-G-83528. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
860	93	77	68	88
861	94	73	59	85
862	91	76	65	83
864	91	76	67	89
FR861	93	72	56	88
FR862	93	72	56	88



SPECIFICATIONS

MATERIAL DESCRIPTION

Compound	860	861	862	864	FR861	FR862
Binder	Silicone	Silicone	Silicone	Silicone	Silicone	Silicone
Filler	Carbon	Carbon	Carbon	Carbon	Carbon	Carbon
Color	Black	Black	Black	Black	Black	Black
Form*	(1)	(2)	(1)	(3)	(2)	(1)
Flammability	-	-	-	-	UL94 VO**	
Form Available	-	-	-	-	UL Yellow Card No. E-48923S	

PERFORMANCE CHARACTERISTICS

	860	861	862	864	FR861	FR862
Specific Gravity ASTM D-792	1.28 ± .03	1.20 ± .03	1.27 ± .25	1.20 ± .25	1.25 ± .03	1.25 ± .03
Volume Res. (Max.)	3 ohm -cm	8 ohm -cm	24 ohm -cm	8 ohm -cm	15 ohm -cm	24 ohm -cm
Hardness (Shore A) ASTM D-2240	70 ±5	70 ±5	70 ±5	70 ±5	65±10/5	65±10/5
Tensile Strength (Min.) ASTM D-624	500 psi	650 psi	500 psi	500 psi	650 psi	650 psi
Elongation To Break (Min.) ASTM D-412	75%	100%	100%	100%	100%	100%
Tear Strength (Min.) ASTM D-624	50 ppi	50 ppi	60 ppi	60 ppi	50 ppi	50 ppi
Temp. Range	-60°F to 351°F[-51°C to 177°C]					

*(1) Extruded Strips, (2) Molded Sheets & Strips, (3) Injected Molded Parts.
**UL Yellow Card No. E48923S

STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.020 [0.51]	861	86-10198	-
.032 [0.76]	861	86-10015	86-10016
.047 [1.19]	861	86-10011	86-10012
.062 [1.57]	861	86-10021	86-10022
.093 [2.36]	861	86-10031	86-10032
.125 [3.18]	861	86-10041	86-10042
.188 [4.78]	861	86-10061	86-10062
.250 [6.35]	861	86-10068	86-10069

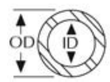
STANDARD ROUND

Dia. in. (mm)	Com-pound	Part Number	Dia. in. (mm)	Com-pound	Part Number
.047 [1.19]	862	86-10000	.125 [3.18]	862	86-10003
.062 [1.52]	862	86-10001	.139 [3.53]	862	86-10008
.070 [1.78]	862	86-10006	.188 [4.78]	862	86-10004
.093 [2.36]	862	86-10002	.250 [6.35]	862	86-10005
.103 [2.62]	862	86-10007	-	-	-

STANDARD TUBING

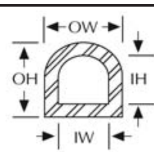
OD	ID	Compound	Part Number
.250 [6.35]	.125 [3.18]	862	86-10080
.375 [9.53]	.250 [6.35]	862	86-10082
.500 [12.70]	.375 [9.53]	862	86-10134

STANDARD THIN WALL TUBING



OD	ID	Compound	Part Number
.062 [1.52]	.032 [0.76]	862	86-10135
.075 [1.91]	.040 [1.02]	862	86-10136
.093 [2.29]	.062 [1.52]	862	86-10137
.125 [3.18]	.093 [2.29]	862	86-10138
.188 [4.78]	.125 [3.18]	862	86-10139
.250 [6.35]	.188 [4.78]	862	86-10140

HOLLOW "D" SHAPE

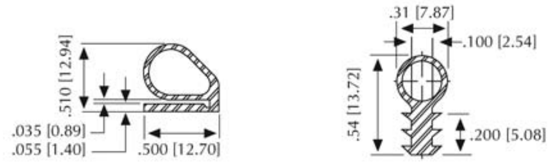


OH	IH	OW	IW	Compound	Part Number
0.187 [4.75]	0.087 [2.21]	0.187 [4.75]	0.087 [2.21]	862	86-10684

ORDERING INFORMATION

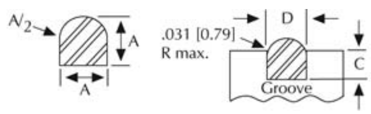
All sheeting thicknesses are available in continuous strip form up to 3 in. [76 mm] wide. SC-CONSIL extruded materials are available in continuous length from 25 ft. [7.62 m] min. to 50 ft. [15 m] max. For cross sections not lised above and custom design applications, contact your nearest TECKNIT area representative or factory location. To order parts made from compound 860, please contact TECKNIT. To order catalog parts made from FR 861 or FR 862, change the third digit of the part number to the letter "F".

STANDARD ENCLOSURE DOOR GASKETS



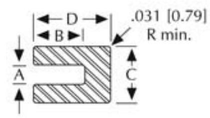
Compound 862 PN 86-10035. Compound 862 PN 86-10281.

STANDARD "D" SHAPES



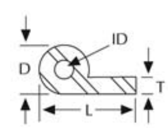
A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
.062 [1.59]	862	86-10090	.046 [1.17]	.103 [2.65]
.093 [2.38]	862	86-10091	.071 [1.80]	.137 [3.50]
.125 [3.18]	862	86-10092	.096 [2.44]	.188 [4.75]
.188 [4.78]	862	86-10093	.146 [3.71]	.256 [6.50]
.250 [6.35]	862	86-10094	.199 [5.05]	.336 [8.55]

STANDARD "U" SHAPES



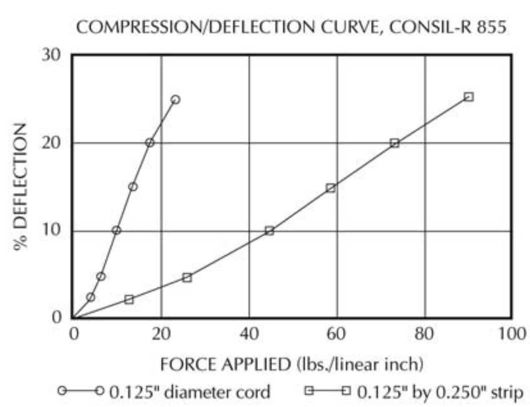
A	B	C	D	Com-pound	Part Number
.032 [0.76]	.125 [3.18]	.156 [3.96]	.156 [3.96]	862	86-10142
.062 [1.57]	.125 [3.18]	.188 [4.78]	.188 [4.78]	862	86-10143
.062 [1.57]	.188 [4.78]	.250 [6.35]	.250 [6.35]	862	86-10075
.093 [2.36]	.156 [3.96]	.128 [3.25]	.250 [6.35]	862	86-10144
.093 [2.36]	.312 [7.92]	.218 [5.54]	.421 [10.69]	862	86-10418
.125 [3.18]	.375 [9.53]	.312 [7.92]	.500 [12.70]	862	86-10076
.188 [4.78]	.375 [9.53]	.375 [9.53]	.500 [12.70]	862	86-10077

STANDARD "P" SHAPES



D	ID	L	T	Com-pound	Part Number
.188 [4.78]	.125 [3.18]	.500 [12.70]	.062 [1.57]	862	86-10192
.250 [6.35]	.188 [4.78]	.750 [19.05]	.062 [1.57]	862	86-10193
.375 [9.53]	.250 [6.35]	1.00 [25.40]	.075 [1.91]	862	86-10194

COMPRESSION AND DEFLECTION DATA



Consil®-C

SILVER-COPPER FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-C is a silicone or fluorosilicone elastomer filled with silver-plated copper particles designed to achieve maximum electrical conductivity. CONSIL-C provides one of the highest shielding effectiveness of any conductive elastomer material, in addition to offering excellent moisture sealing for all enclosure joints and seams. CONSIL-C is available in sheets and die-cut or molded gaskets. It can also be extruded into standard rectangular, round and "D"-shaped cross sections. Extruded hollow strip forms are available on special order.

APPLICATION INFORMATION

The MIL-DTL-83528 certified compounds meet the demanding requirements of many military and aerospace systems, and as gaskets for waveguides and connectors. In addition, CONSIL-C can also be used for EMP and TEMPEST applications. Recommended design compression is 6% at 100 psi closure force for rectangular cross sections. Closure forces will be lower for custom tubes or Pshaped extrusions. Aerospace applications demand fluorosilicone because of its inherent resistance to jet fuels and its ability to perform under extreme conditions.

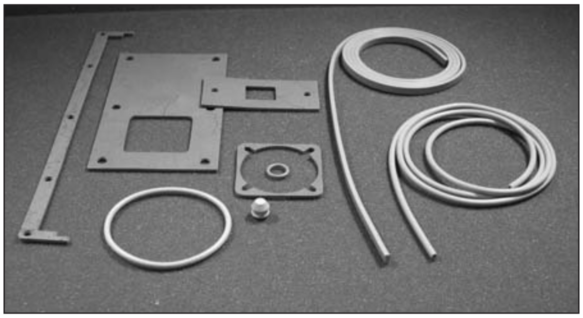
BONDING AND SPLICING

When required, TECKNIT conductive adhesives are available to bond CONSIL-C to metal enclosure surfaces or for splicing strips together. For flexible bonds and joint splices, use TECKNIT one-part RTV conductive silicone adhesive-sealant paste with silver plated copper filler (part number 72-00192).

EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-C Shielding Effectiveness has been tested in accordance with the test method described in paragraph 4.6.12 of MIL-DTL-83528. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
	dB	dB	dB	dB
871	75	120+	115	110
873	75	120+	115	110
875	75	120+	115	110



SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-C Compound No.	871	873	875
Conductive Filler	Silver Plated Copper Particles		
Elastomer Binder	Silicone	Silicone	Fluorosilicone
Type	A (MIL-DTL 83528)	Commercial	C (MIL-DTL 83528)
Color	Gray	Gray	Blue-Gray
Form Available	Molded & Extruded	Molded	Molded & Extruded

PERFORMANCE CHARACTERISTICS

Specific Gravity	3.5 ±13%	3.5 ±13%	4.0 ±13%
Volume Res.	.004 ohm-cm	.005 ohm-cm	.01 ohm-cm
Hardness (Shore A) ASTM D-2240	65 ±7	85 ±7	75 ±7
Tensile Strength (Min.) ASTM D-624	200 psi	400 psi	180 psi
Elongation to Break (Min/Max)	100%/ 300%	100%/ 300%	100%/ 300%
Tear Strength (Min.) ASTM D-624	25 ppi [4.38 kN/m]	40 ppi [7 kN/m]	35 ppi [6.13 kN/m]
Operating Temperature Range	67°F to 257°F [-55°C to 125°C]	-49°F to 257°F [-45°C to 125°C]	67°F to 257°F [-55°C to 125°C]

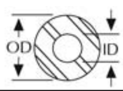
STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.020 [0.51]	871	87-10001	87-10006
	873	87-10041	87-10046
.032 [0.81]	871	87-10002	87-10007
	873	87-10042	87-10047
	875	87-50002	-
.062 [1.57]	871	87-10003	87-10008
	873	87-10043	87-10048
	875	87-50003	-
.093 [2.36]	871	87-10004	87-10009
	873	87-10044	87-10049
	875	87-50004	-
.125 [3.18]	871	87-10005	87-10010
	873	87-10045	87-10050
	875	87-50005	-

STANDARD ROUND

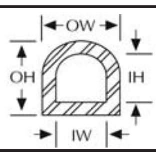
Dia.	Com-pound	Part Number	Dia.	Com-pound	Part Number
.062 [1.57]	871	87-10511	.125 [3.18]	871	87-10515
	875	87-50511		875	87-50515
.070 [1.78]	871	87-10512	.139 [3.53]	871	87-10516
	875	87-50512		875	87-50516
.093 [2.36]	871	87-10513	.188 [4.78]	871	87-10517
	875	87-50513		875	87-50517
.103 [2.62]	871	87-10514	.250 [6.35]	871	87-10518
	875	87-50514		875	87-50518

STANDARD TUBING



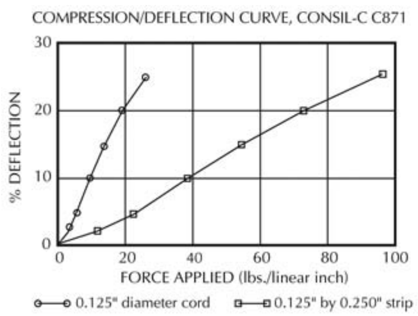
OD	ID	Compound	Part Number
0.103 [2.62]	0.040 [1.02]	871	87-12259
0.125 [3.18]	0.045 [1.14]	871	87-12260
0.156 [3.96]	0.102 [2.59]	871	87-12261
0.250 [6.35]	0.125[3.18]	871	87-12263
0.250 [6.35]	0.160 [4.06]	871	87-12262
0.375 [9.53]	0.250 [6.35]	871	87-12258

HOLLOW "D" SHAPE

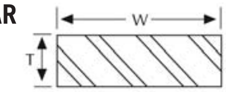


OH	IH	OW	IW	Compound	Part Number
0.187 [4.75]	0.087 [2.21]	0.187 [4.75]	0.087 [2.21]	871	87-12267
0.312 [7.92]	0.188 [4.78]	0.312 [7.92]	0.188 [4.78]	871	87-0110A

COMPRESSION AND DEFLECTION DATA

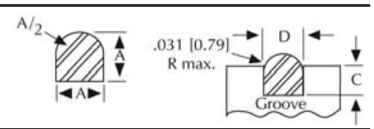


STANDARD STRIPS RECTANGULAR



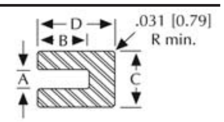
Thickness T	Com-pound	Width W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
.032 [0.76]	871	87-20031	87-20037	87-20043	87-20049	87-20055
	875	87-50031	87-50037	87-50043	87-50049	87-50055
.062 [1.52]	871	87-20032	87-20038	87-20044	87-20050	87-20056
	875	87-50032	87-50038	87-50044	87-50050	87-50056
.093 [2.36]	871	87-20033	87-20039	87-20045	87-20051	87-20057
	875	87-50033	87-50039	87-50045	87-50051	87-50057
.125 [3.18]	871	87-20034	87-20040	87-20046	87-20052	87-20058
	875	87-50034	87-50040	87-50046	87-50052	87-50058
.188 [4.78]	871	-	87-20041	87-20047	87-20053	87-20059
	875	-	87-50041	87-50047	87-50053	87-50059
.250 [6.35]	871	-	-	87-20048	87-20054	87-20060
	875	-	-	87-50048	87-50054	87-50060

STANDARD "D" SHAPES



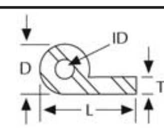
A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
.062 [1.59]	871	87-10606	.046 [1.17]	.103 [2.65]
	875	87-50606		
.093 [2.38]	871	87-10607	.071 [1.80]	.137 [3.50]
	875	87-50607		
.125 [3.18]	871	87-10608	.096 [2.44]	.188 [4.75]
	875	87-50608		
.188 [4.78]	871	87-10609	.146 [3.71]	.256 [6.50]
	875	87-50609		
.250 [6.35]	871	87-10610	.199 [5.05]	.336 [8.55]
	875	87-50610		

STANDARD "U" SHAPES



A	B	C	D	Com-pound	Part Number
0.047 [1.19]	0.081 [2.06]	0.175 [4.45]	0.156 [3.96]	871	87-12269
0.062 [1.57]	0.109 [2.77]	0.156 [3.96]	0.156 [3.96]	871	87-12270
0.090 [2.29]	0.310 [7.87]	0.220 [5.59]	0.420 [10.7]	871	87-12268
0.145 [3.68]	0.190 [4.83]	0.265 [6.73]	0.250 [6.35]	871	87-12271

STANDARD "P" SHAPES



D	ID	L	T	Com-pound	Part Number
0.200 [5.08]	0.080 [2.03]	0.625 [15.9]	0.062 [1.57]	871	87-12272
0.250 [6.35]	0.125 [3.18]	0.500 [12.7]	0.062 [1.57]	871	87-12273
0.250 [6.35]	0.125 [3.18]	0.625 [15.9]	0.062 [1.57]	871	87-12274
0.250 [6.35]	0.188 [4.78]	0.750 [19.1]	0.062 [1.57]	871	87-12275

ORDERING INFORMATION

Extruded strips are available in continuous lengths up to 50 ft. [15m] maximum, 25 ft. [7.5m] minimum lengths. Strips can also be molded in lengths of 24 in. [610 mm] using CONSIL-C compounds C871, C873, C875. For standard sheets and strips, specify TECKNIT part number and quantity required. For cross section not listed and custom specification requirements, contact your nearest TECKNIT area representative or factory location.

Consil®-N

SILVER-NICKEL FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-N is a silicone elastomer filled with silver-plated nickel particles and designed to provide high shielding effectiveness and corrosion resistance. CONSIL-N is available in sheets and die-cut or molded gaskets. Special cross sections for custom applications are available.

APPLICATION INFORMATION

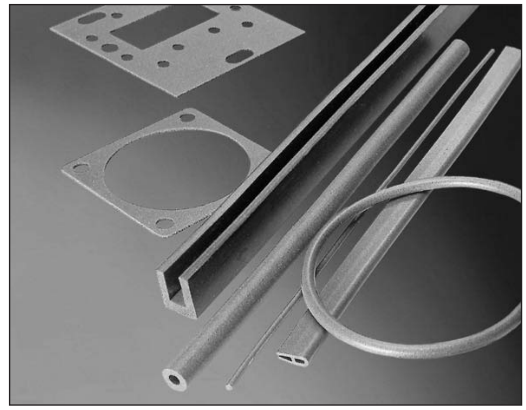
CONSIL-N is an excellent conductive elastomer for use in applications requiring EMI/EMP shielding and environmental sealing. Recommended design compression is 7%-15% of original height for rectangular cross sections and 12%-30% for solid round and solid "D" shapes. Over compression may lead to compression set and degradation of electrical conductivity.

TECKNIT CON/RTV-Ni (Part Number 72-00035) is a two component, electrically conductive, nickel silicone adhesive sealant of medium viscosity. It is recommended for splicing, joining, and bonding CONSIL-N gaskets to enclosures. The material provides a flexible bond and resilient seal.

EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-N Shielding Effectiveness has been tested in accordance with TECKNIT Test Method MIL-G-83528, Paragraph 4.6.12. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
891	75	120	110	100



SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-N Compound No.	831
Elastomer binder	Silicone
Conductive Filler	Silver plated nickel particles
Color	Gray
Form available	Molded Sheets & Strips

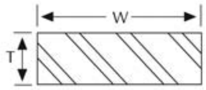
PERFORMANCE CHARACTERISTICS

Specific Gravity ASTM D-792	4.0 ± 13%
Volume Res. (Max.)	0.005 ohm-cm
Hardness (Shore A) ASTM D-2240	75 ± 7
Tensile Strength (Min.) ASTM D-412	200 psi [1.35 MPa]
Elongation To Break (Min./Max.) ASTM D-624	100% to 300%
Tear Strength (Min.) ASTM D-624	30 ppi [5.25 kN/m]
Temperature Range	-67°F to 257°F [-55°C to 125°C]

STANDARD SHEETS

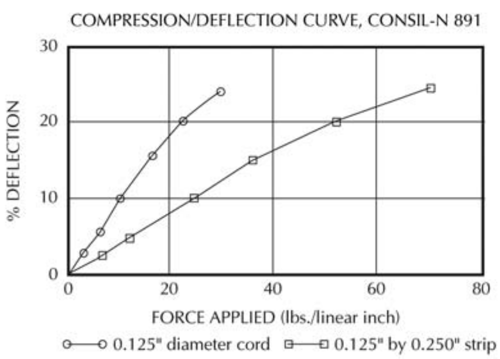
Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.020 [0.51]	831	83-30190	-
.032 [0.76]	831	83-30170	83-30180
.040 [1.02]	831	83-30171	83-30181
.062 [1.52]	831	83-30172	83-30182
.093 [2.36]	831	83-30173	83-30183
.125 [3.18]	831	83-30174	83-30184

STANDARD RECTANGULAR



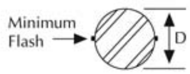
Thickness T	Com-pound	Width W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
.032 [0.76]	831	83-30100	83-30101	83-30102	83-30103	83-30104
.062 [1.52]	831	83-30110	83-30111	83-30112	83-30113	83-30114
.093 [2.36]	831	83-30120	83-30121	83-30122	83-30123	83-30124
.125 [3.18]	831	83-30130	83-30131	83-30132	83-30133	83-30134
.188 [4.78]	831	-	83-30141	83-30142	83-30143	83-30144
.250 [6.35]	831	-	-	83-30152	83-30153	83-30154

COMPRESSION AND DEFLECTION DATA



STANDARD ROUND

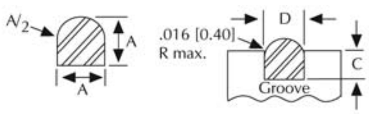
STANDARD LENGTH = 24 in. [610 mm]



Dia.	Com-pound	Part Number	Dia.	Com-pound	Part Number
.062 [1.57]	831	83-30020	.125 [3.18]	831	83-30022
.070 [1.78]	831	83-30021	.139 [3.53]	831	83-30025
.093 [2.36]	831	83-30023	.188 [4.78]	831	83-30026
.103 [2.62]	831	83-30024	.250 [6.35]	831	83-30027

STANDARD "D" SHAPES

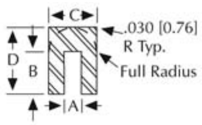
STANDARD LENGTH = 24 in. [610 mm]



A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
.062 [1.59]	831	83-30070	.046 [1.17]	.103 [2.65]
.093 [2.38]	831	83-30072	.071 [1.80]	1.37 [3.50]
.125 [3.18]	831	83-30074	.096 [2.44]	.188 [4.75]
.188 [4.78]	831	83-30076	.146 [3.71]	.256 [6.50]
.250 [6.35]	831	83-30078	.199 [5.05]	.336 [8.55]

STANDARD "U" SHAPES

STANDARD LENGTH = 24 in. [610 mm]



A	B	C	D	Com-pound	Part Number
.062 [1.57]	.188 [4.78] .	250 [6.35]	.250 [6.35]	831	83-30010
.125 [3.18]	.375 [9.53]	.312 [7.92]	.500 [12.70]	831	83-30012
.188 [4.78]	.375 [9.53]	.312 [7.92]	.500 [12.70]	831	83-30014
.093 [2.63]	.312 [7.92]	.218 [5.54]	.421 [10.69]	831	83-30016*

ORDERING INFORMATION

For cross-sections not listed above, custom design applications, and molded parts, contact your nearest TECKNIT area representative or factory location.

Consil®-A

SILVER-ALUMINUM FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

CONSIL-A is a silicone or fluorosilicone elastomer filled with silver-plated aluminum particles designed to achieve maximum electrical conductivity. CONSIL-A provides high shielding effectiveness with minimal galvanic corrosion. Lighter in weight than other high performance conductive elastomers,

CONSIL-A provides an excellent moisture seal for enclosure joints and seams. CONSIL-A is available in sheets, die-cut or molded gaskets, and continuously extruded strips.

APPLICATION INFORMATION

The MILG-83528 certified compounds meet the demanding requirements of many military and aerospace systems, high frequency microwave environments and wave guide connector gaskets. EMP and TEMPEST requirements are ideal applications for CONSIL-A.

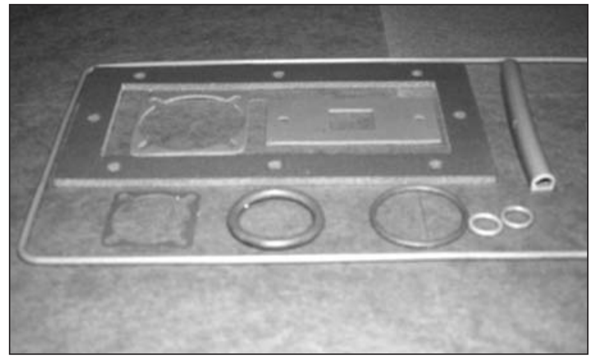
Recommended compression of CONSIL-A is 100 psi with deflection of 6% of original gasket height.

Tecknit Teckbond-A is a two part silicone adhesive recommended for splicing, joining and bonding of Consil-A gaskets to enclosures. The adhesive provides a flexible bond and resilient seal. See 72-00236.

EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-A Shielding Effectiveness has been tested in accordance with MIL-G-83528, Paragraph 4.6.12. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
895	75	120+	110	100
897	55	110	100	90



SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-A Compound	895	897
Elastomer Binder	Silicone	Fluorosilicone
Conductive Filler	Silver Plated Aluminum Particles	
Type	B (MIL-DTL-83528)	D
Color	Blue	Blue
Form Available	Molded & Extruded	

PERFORMANCE CHARACTERISTICS

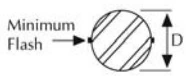
Specific Gravity	2.0 ± 13%	2.0 ± 13%
Volume Resistivity	0.008 ohm-cm	0.012 ohm-cm
Hardness (Shore A) ASTM D-2240	65 ± 7	70 ± 7
Tensile Strength Min.) ASTM D-412	200 psi	180 psi
Elongation to Break (Min./Max.)	100%/ 300%	60% 260%
Tear Strength (Min.) ASTM D-624	30 ppi [5.25 kN/m]	35 ppi [6.13 kN/m]
Operating Temperature Range	-67°F to 350°F [-55°C to 160°C]	-67°F to 350°F [-55°C to 160°C]

STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.020	895	89-50190	89-50179
[0.51]	897	-	-
.032	895	89-50170	89-50180
[0.76]	897	-	-
.040	895	89-50171	89-50181
[1.02]	897	89-70171	89-70181
.062	895	89-50172	89-50182
[1.52]	897	89-70172	89-70182
.093	895	89-50173	89-50183
[2.36]	897	89-70173	89-70183
.125	895	89-50174	89-50184
[3.18]	897	89-70174	89-70184

STANDARD ROUND

STANDARD LENGTH = 24 in. [610 mm]

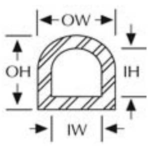


Dia.	Com-pound	Part Number	Dia.	Com-pound	Part Number
.062	895	89-50020	.125	895	89-50022
[1.57]	897	89-70020	[3.18]	897	89-70022
.070	895	89-50021	.139	895	89-50025
[1.78]	897	89-70021	[3.53]	897	89-70025
.093	895	89-50023	.188	895	89-50026
[2.36]	897	89-70023	[4.78]	897	89-70026
.103	895	89-50024	.250	895	89-50027
[2.62]	897	89-70024	[6.35]	897	89-70027

STANDARD TUBING

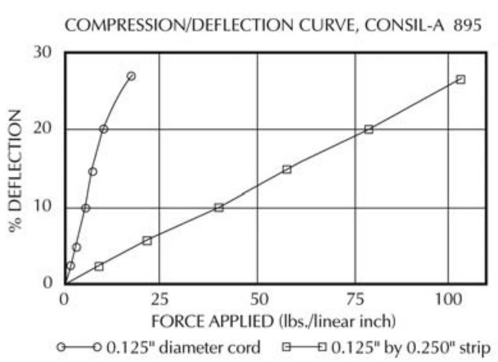
OD	ID	Compound	Part Number
0.103 [2.62]	0.040 [1.02]	895	89-0180B
0.125 [3.18]	0.045 [1.14]	895	89-0141B
0.156 [3.96]	0.050 [1.27]	895	89-0142B
0.250 [6.35]	0.125 [3.18]	895	89-0143B

HOLLOW "D" SHAPE

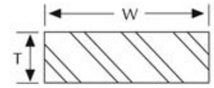


OH	IH	OW	IW	Compound	Part Number
0.187 [4.75]	0.087 [2.21]	0.187 [4.75]	0.087 [2.21]	895	89-50370
0.312 [7.92]	0.188 [4.78]	0.312 [7.92]	0.188 [4.78]	895	89-0111B

COMPRESSION AND DEFLECTION DATA

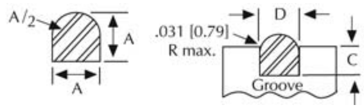


STANDARD RECTANGULAR



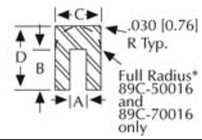
Thickness T	Com-pound	Width W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
.032 [0.76]	895	89-50100	89-50101	89-50102	89-50103	89-50104
	897	89-70100	89-70101	89-70102	89-70103	89-70104
.062 [1.52]	895	89-50110	89-50111	89-50112	89-50113	89-50114
	897	89-70110	89-70111	89-70112	89-70113	89-70114
.093 [2.36]	895	89-50120	89-50121	89-50122	89-50123	89-50124
	897	89-70120	89-70121	89-70122	89-70123	89-70124
.125 [3.18]	895	89-50130	89-50131	89-50132	89-50133	89-50134
	897	89-70130	89-70131	89-70132	89-70133	89-70134
.188 [4.78]	895	-	89-50141	89-50142	89-50143	89-50144
	897	-	89-70141	89-70142	89-70143	89-70144
.250 [6.35]	895	-	-	89-50152	89-50153	89-50154
	897	-	-	89-70152	89-70153	89-70154

STANDARD "D" SHAPES



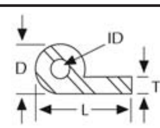
A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
0.62	895	89-50070	.046	.103
[1.57]	897	89-70070	[1.17]	[2.65]
.093	895	89-50072	.071	.137
[2.36]	897	89-70072	[1.80]	[3.50]
.125	895	89-50074	.096	.186
[3.18]	897	89-70074	[2.44]	[4.75]
.188	895	89-50076	.146	.256
[4.78]	897	89-70076	[3.71]	[6.50]
.250	895	89-50078	.199	.336
[6.35]	897	89-70078	[5.05]	[8.55]

STANDARD "U" SHAPES



A	B	C	D	Com-pound	Part Number
.062	.188	.250 .	250	895	89-50010
[1.57]	[4.78]	[6.35]	[6.35]	897	89-70010
.125	.375	.312	.500	895	89-50012
[3.18]	[9.53]	[7.92] [	12.70]	897	89-70012
.188	.375	.375	.500	895	89-50014
[4.78]	[9.53]	[9.53]	[12.70]	897	89-70014
.093	.312	.218	.421	895	89-50016*
[2.63]	[7.92]	[5.54]	[10.69]	897	89-70016*

STANDARD "P" SHAPES



D	ID	L	T	Com-pound	Part Number
0.200 [5.08]	0.080 [2.03]	0.437 [11.1]	0.062 [1.57]	895	89-01053
0.200 [5.08]	0.080 [2.03]	0.475 [12.1]	0.062 [1.57]	895	89-0120B
0.250 [6.35]	0.150 [3.81]	0.625[1.59]	0.062 [1.57]	895	89-01054

ORDERING INFORMATION

For cross-sections not listed above, custom design applications, and molded parts, contact your nearest TECKNIT area representative or factory location.

Consil®-V

EXTRUDED SILVER-FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

Consil-V is an extruded silicone elastomer filled with silver-plated inert particles. The V-shape cross section is ideally suited for applications requiring low closure force gasketing.

FEATURES

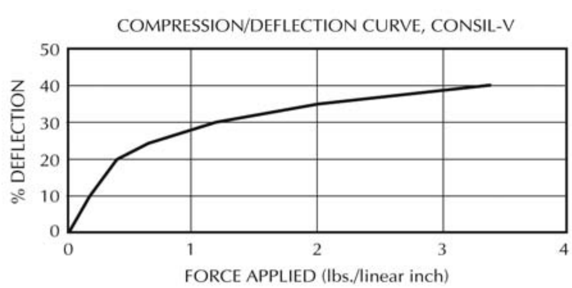
- Ideally suited for Telecom & Medical applications.
- Provides environmental sealing.
- Offers low closure force.
- Low compression set.
- Available with pressure sensitive adhesive or push rivets or both.

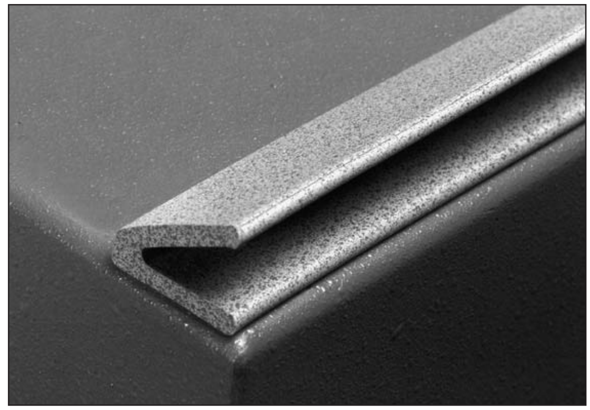
EMI SHIELDING PERFORMANCE

TECKNIT CONSIL-V shielding effectiveness has been tested in accordance with TECKNIT test method TSETS-01, based upon modified MIL-STD-285. Typical values are given below.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz
751	80 dB	75 dB	70 dB

COMPRESSION AND DEFLECTION DATA





SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-V Compound No.	751
Elastomer Binder	Modified Silicone
Conductive Filler	Silver-plated glass
Color	Tan
Form Available	Extruded Strips

PERFORMANCE CHARACTERISTICS

Specific Gravity ASTM D-792	1.7 ±13%
Volume Res. Max.	.05 ohm-cm
Hardness (Shore A) ASTM D-2240	50 ±10
Tensile Strength (Min.) ASTM D-412	100 psi [690 kPa]
Elongation to Break (Min.) ASTM D-624	100%
Temperature Range	-60°F to 350°F [-51°C to 160°C]

METHODS OF ATTACHMENT

CONSIL-V is attached via three different methods: pressure sensitive adhesive, push rivets, or a combination of both. Rivets will be spaced on 1 inch centers or in increments of 1 inch.

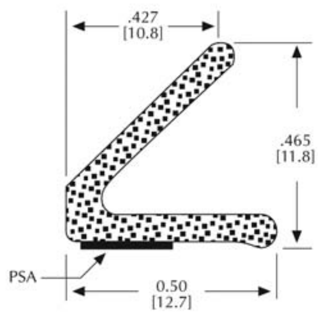


Figure 1. V-Shape Cross Section

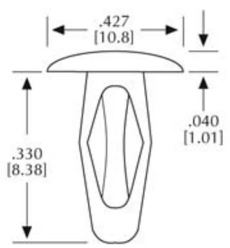


Figure 2. Canoe Clip
NOTE: Requires 0.125" [3.18] hole diameter for installation.

PART NUMBER

75-00000	plain
75-00001	pressure sensitive adhesive
75-00002	push rivets
75-00003	pressure sensitive adhesive and push rivets

Tolerance on width/height: ± .015" [.38]

ORDERING INFORMATION

CONSIL-V is available in continuous lengths up to 25 ft. [7.5m] long or in shorter custom lengths. Contact your nearest TECKNIT area representative or factory location.

NC-Consil®

NICKEL COATED GRAPHITE FILLED SILICONE ELASTOMER

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

NC-Consil is a silicone elastomer filled with Nickel coated graphite carbon particles. It provides high electrical conductivity, broadband shielding and environmental sealing. NC-Consil is designed to provide reliable cost effective shielding for a wide range of EMI applications ideal for the commercial market. NC-Consil is manufactured in sheets, molded shapes, extruded profiles and die-cut gaskets. Flame retardant UL94 V-0 rated compounds for both extruded and molded parts are available.

APPLICATION INFORMATION

NC-Consil should be used where there is a need for high broadband shielding combined with excellent environmental sealing properties. To assure electrical conductivity and sealing reliability, the recommended design compression for sheets and rectangular strips is 7% - 15% of original height. 12% - 30% for round and "D" shapes and 20% - 60% for tubing and "P" shapes. The hollow shapes are designed for low closure force applications. Over compression is not recommended since it can result in compression set and degradation of electrical conductivity.

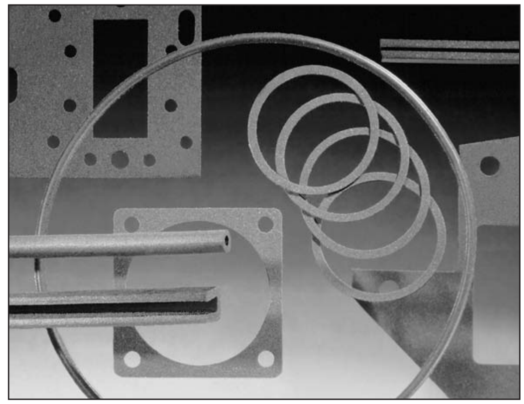
BONDING AND SPLICING

Tecknit Teckbond-NC is a one part RTV conductive silicone adhesive with nickel coated graphite filler recommended for splicing, joining and bonding of NC-Consil gaskets to enclosures. The adhesive provides a flexible bond and resilient seal. See 72-00350.

EMI SHIELDING PERFORMANCE

Tecknit NC-Consil shielding effectiveness has been tested in accordance with the test method described in paragraph 4.6.12 of MIL-G-83528. Typical values are shown.

COMPOUND	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
	dB	dB	dB	dB
750	100	100	100	85
751	100	100	100	85
770	100	100	100	85
FR750	100	100	90	89
FR751	100	100	93	90



SPECIFICATIONS

MATERIAL DESCRIPTION

NC-Consil	750	751	770	FR750	FR751
Compound No.					
Elastomer Binder	- Silicone -				
Conductive Filler	- Nickel Coated Graphite -				
Color	- Dark Gray -				
Form Available	Molded	Extruded	Extruded	Molded Sheets & Strips	Extruded Strips

PERFORMANCE CHARACTERISTICS

	750	751	770	FR750	FR751
Flamability: Rating	--	--	--	UL 94V-0**	
Specific Gravity ASTM D-792	2.0 ± 13%	2.0 ± 13%	2.0 ± 13%	2.1 ± 13%	2.0 ± 13%
Volume Res. (Max.)	0.1 ohm-cm				
Hardness (Shore A) ASTM D-2240	55 ± 10	55 ±10	70 ±10	60 ± 10	60 ± 10
Tensile Strength(Min) ASTM D-624	150 psi [1.02 MPa]				
Elongation To Break (Min/Max) ASTM D-412	100%				
Tear Strength (Min) ASTM D-624	50 ppi [8.76 kN/m]	40 ppi [7 kN/m]	50 ppi [7 kN/m]	50 ppi [8.76 kN/m]	50 ppi [8.76 kN/m]
Temperature Range	-67°F to 350°F [-55°C to 160°C]				

** UL Yellow Card No. E191466

To order catalog parts made from UL Rated compounds FR750 or FR753, change the 3rd digit of the part number to -5. eg: 79-10511 changes to 79-50511.

To order extruded catalog parts made form compound 770, change the 3rd digit of the part number to a 7. eg: 79-

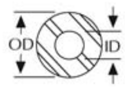
STANDARD SHEETS

Thickness	Compound	Length x Width 12 x 12 [305 x 305]	12 x 18 [305 x 457]
.020 [0.51]	750	79-10001	-
.032 [0.76]	750	79-10002	79-10008
.047 [1.19]	750	79-10003	79-10009
.062 [1.57]	750	79-10004	79-10010
.093 [2.36]	750	79-10005	79-10011
.125 [3.18]	750	79-10006	79-10012

STANDARD ROUND

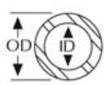
Dia.	Com-pound	Part Number	Dia.	Com-pound	Part Number
.047 [1.19]	751	79-10510	.125 [3.18]	751	79-10515
.062 [1.52]	751	79-10511	.139 [3.53]	751	79-10516
.070 [1.78]	751	79-10512	.188 [4.78]	751	79-10517
.093 [2.36]	751	79-10513	.250 [6.35]	751	79-10518
.103 [2.62]	751	79-10514	-	-	-

STANDARD TUBING



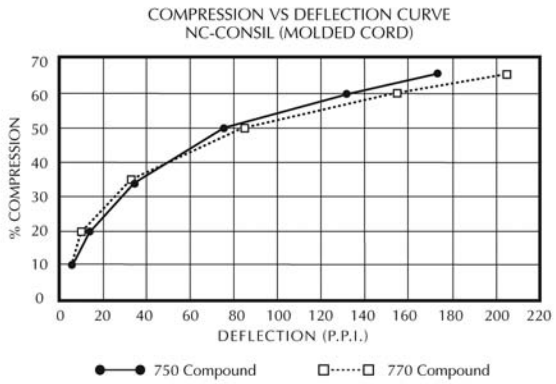
OD	ID	Com-pound	Part #	Com-pound	Part #
.250 [6.35]	.125 [3.18]	751	79-10080	770	79-70080
.375 [9.53]	.250 [6.35]	751	79-10081	770	79-70081
.500 [12.70]	.375 [9.53]	751	79-10082	770	79-70082

STANDARD THIN WALL TUBING



OD	ID	Compound	Part Number
.062 [1.52]	.020 [0.51]	751	79-10135
.075 [1.91]	.030 [0.76]	751	79-10136
.093 [2.29]	.040 [1.02]	751	79-10137
.125 [3.18]	.060 [1.52]	751	79-10138
.188 [4.78]	.125 [3.18]	751	79-10139
.250 [6.35]	.188 [4.78]	751	79-10140

COMPRESSION AND DEFLECTION DATA

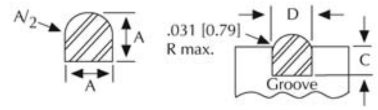


STANDARD RECTANGULAR

Thickness T	Com-pound	Width W .125 [3.18]	.188 [4.78]	.250 [6.35]	.375 [9.53]	.500 [12.70]
.032 [0.76]	750	79-10200*	79-10201*	79-10202*	79-10203*	79-10204*
.062 [1.52]	751	79-10205	79-10206	79-10207	79-10208	79-10209
.093 [2.36]	751	79-10210	79-10211	79-10212	79-10213	79-10214
.125 [3.18]	751	79-10215	79-10216	79-10217	79-10218	79-10219
.188 [4.78]	751	79-10216	79-10220	79-10221	79-10222	79-10223
.250 [6.35]	751	79-10217	79-10221	79-10224	79-10225	79-10226

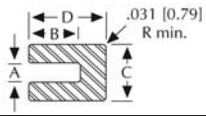
STANDARD LENGTH = 18 in. [457 mm]

STANDARD "D" SHAPES



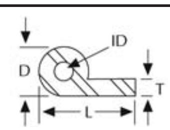
A	Com-pound	Part Number	Groove Dimensions C +.006 [0.15]-0	D ±.006 [0.15]
.062 [1.59]	751	79-10090	.046 [1.17]	.103 [2.65]
.093 [2.38]	751	79-10091	.071 [1.80]	.137 [3.50]
.125 [3.18]	751	79-10092	.096 [2.44]	.188 [4.75]
.188 [4.78]	751	79-10093	.146 [3.71]	.256 [6.50]
.250 [6.35]	751	79-10094	.199 [5.05]	.336 [8.55]

STANDARD "U" SHAPES



A	B	C	D	Com-pound	Part Number
.032 [0.76]	.125 [3.18]	.156 [3.96]	.156 [3.96]	751	79-10142
.062 [1.57]	.125 [3.18]	.188 [4.78]	.188 [4.78]	751	79-10143
.062 [1.57]	.188 [4.78]	.250 [6.35]	.250 [6.35]	751	79-10144
.093 [2.36]	.312 [7.92]	.218 [5.54]	.421 [10.69]	751	79-10146
.125 [3.18]	.375 [9.53]	.312 [7.92]	.500 [12.70]	751	79-10147
.188 [4.78]	.375 [9.53]	.375 [9.53]	.500 [12.70]	751	79-10148

STANDARD "P" SHAPES



D	ID	L	T	Com-pound	Part Number
.188 [4.78]	.125 [3.18]	.500 [12.70]	.062 [1.57]	751	79-10192
.250 [6.35]	.188 [4.78]	.750 [19.05]	.062 [1.57]	751	79-10193
.375 [9.53]	.250 [6.35]	1.00 [25.40]	.075 [1.91]	751	79-10194

Note: Change third digit of part number from 1 to 7 to specify 770 compound.

ORDERING INFORMATION

All sheet thicknesses are available in continuous strip form up to 3 in. [76 mm] wide. NC-CONSIL extruded materials are available in continuous lengths. For cross sections not listed above or custom specification requirements, contact your nearest TECKNIT area representative or factory location. To order catalog parts made from compounds FR750, FR751 or FR752, change the third digit of the part number to -5.

Section E: Windows

U.S. Customary
[SI Metric]

PRODUCT **PAGE**

Design Guidelines to EMI Shielding Windows

U.S. Customary
[SI Metric]

INTRODUCTION

The DESIGN GUIDELINES TO SHIELDING WINDOWS is intended to aid designers in understanding the trade-offs associated with the selection of specific materials against anticipated performance.

One of the many requirements, which compromise the shielding integrity of equipment enclosures, is the need for large-area openings for access to electronics, ventilation, and displays. The displays may be panel meters, digital displays, oscilloscopes, status monitors, mechanical indicators or other read-outs. The most critical displays to shield against electronic noise are the large area, high resolution monitors (CRT). Shielding of these large apertures is generally more difficult than those encountered for cover plates, doors, ventilation panels and small apertures, such as connectors, switches and other controls in which the majority of the opening is covered by a continuous homogeneous conductive (metal) plate. Therefore, when working with window designs, which do not have a continuous conductive cover, consideration must be given to shielding as related to relative apertures and screens and supporting substrates. These two factors are inter-related and need to be treated as a combined problem.

Shielding windows are presently manufactured in one of three ways: (1) laminating a conductive screen between optically clear plastic and glass sheets; (2) Casting a screen within a plastic sheet; (3) applying an optically clear conductive layer to a transparent substrate. Until recently, the typical conductive screen was a knitted wire mesh made from Monel, tin-plated copper-clad iron core (Sn/Cu/Fe or Monel wire).

Knitted densities range from 30 openings per inch for the 0.001-inch diameter tungsten wire (94% open area) to 10 openings per inch for the 0.0045-inch diameter wire (90% open area). These high open area meshes provide high optical transmission with average shielding effectiveness (greater than 60 dB) below 10 MHz when wire crossovers are adequately bonded.

Optically clear conductive coatings are produced by depositing an electrically conductive transparent coating (ECTC) directly onto the surface of various optical substrates. Typically, these coatings can provide better than 50 dB shielding effectiveness below 100 MHz with an optical transmission of better than 70% over the visible light spectrum. Increased shielding effectiveness may be achieved by increasing the thickness of the deposited coating material (decreasing resistance) at the expense of loss in optical transmission and increase in optical reflection.

High-density woven wire screens have been employed which have extended the useful high-frequency response beyond 10GHz. These screens have made use of silver-plated, stainless steel wires; copper-plated, stainless steel wires; and copper wires. In all cases these screens make direct contact to a peripheral wire mesh gasket, window frame or enclosure structure. Woven meshes have ranged from 80 mesh (wires to the inch) to 150 mesh and wire diameters from 0.001 inch diameter to 0.0045 inch diameter. Typical performance for a 100 mesh screen will provide almost 60% open area with shielding effectiveness of up to 60 dB beyond 1 GHz. Higher mesh densities and large wire diameters usually result in higher shielding effectiveness with lower optical performance.

In the following sections, various aspects of shielding window design will be reviewed as related to shielding performance, optical performance, optical designs and methods for mounting windows to enclosures.

SHIELDING PERFORMANCE

A great deal of information has been written and published on total shielding effectiveness (SE) as an aid in reducing electromagnetic interference (electrical noise). Electromagnetic compatibility (EMC) may be achieved by reducing the electromagnetic interference (EMI) below the threshold level that disrupts the normal operation of an electronic system. An electronic system can be both an emitter and a susceptor. An EMI emitter generates unwanted noise; a susceptor responds to unwanted noise. Military and governmental specifications stipulate the allowable levels of radiated and conducted emissions and the necessary circuit immunity to these emissions to achieve electromagnetic compatibility (EMC).

Shielding requirements for shielding windows can vary from moderate to severe. Any barrier placed between an emitter and a susceptor that diminishes the field strength of the interference is an EMI shield. The attenuation of the electromagnetic field is referred to as its shielding effective (SE). The standard unit of measurement for shielding effectiveness is the decibel (dB). The decibel is expressed as the ratio of electromagnetic field strength on one side of a shielding barrier to the field strength on the opposite side.

The losses in field strength (absorption and reflection) from a shield are functions of the barrier material properties: permeability, conductivity, and thickness, as well as the distance from the emitter to the shield. Figure 2-1 depicts the relationship between decibels, attenuation ratio, and percent attenuation.

In most shielding applications, shielding effectiveness below 20 dB (10:1 reduction in EMI) is considered marginal due to long-term environmental effects on the mating surfaces of enclosures and shielding gaskets and barriers. Normally, acceptable shielding performance covers the range from 30 dB to 80 dB. Above average shielding ranges from 80d dB to 120 dB. Above 120 dB, shielding effectiveness is difficult to achieve and difficult to confirm by measurement.

Figure 2-2 shows the range of shielding effectiveness for the three primary barrier materials used in shielding window: knitted wire mesh screens (Band I), transparent conductive coatings (Band II), and woven mesh screens (Band III). Shielding performance is the primary consideration in the design process and is, therefore, considered first.

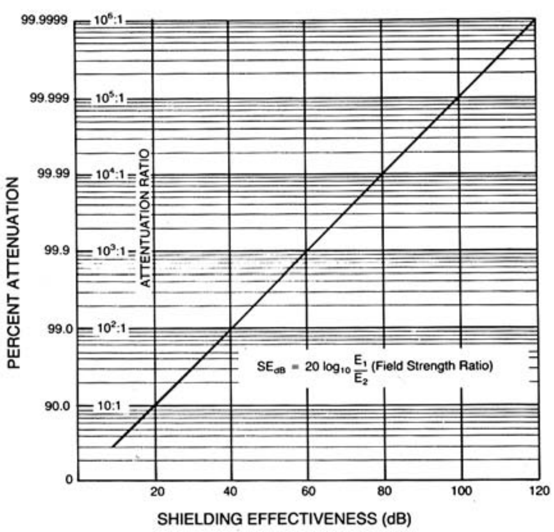


Figure 2. Shielding Effectiveness as a Function of Attenuation.

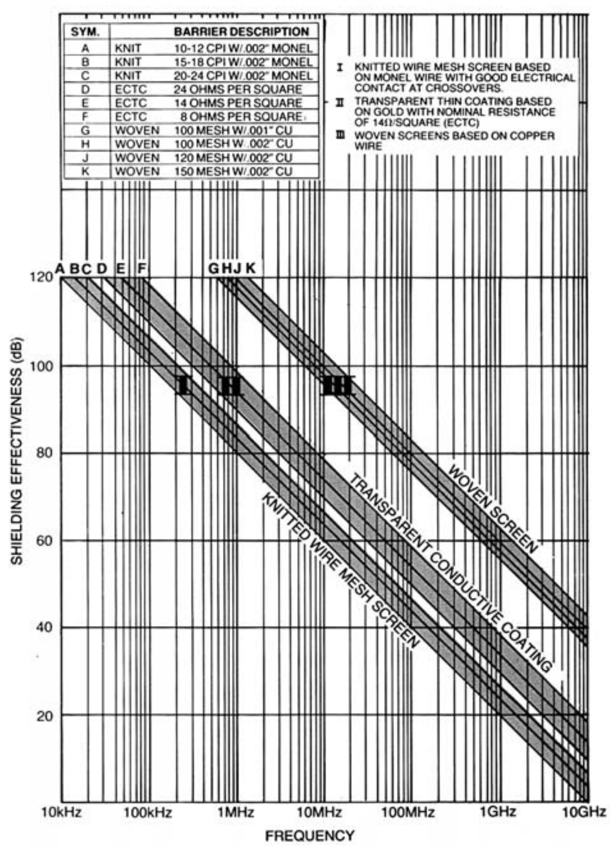


Figure 2-2. Barrier Shielding Performance for Shielding Windows.

Design Guidelines to EMI Shielding Windows cont.

U.S. Customary
[SI Metric]

The shielding values presented in Figure 2-2 are considered to be conservative based on measurements in shielded room tests, which generally show from 10 dB to 20 dB higher shielding effectiveness. The origin of the data is based on the theoretical relationship given by:

$$SE_{dB} = 195\text{-}20 \log_{10} (df)$$

Where d is the mesh wire spacing in inches and f is the threat frequency in Hertz.

Since most EMI problems are broadband (cover a broad frequency range), the frequency of most concern is generally the highest frequency within that bandwidth envelope to which the equipment is responsive and which may be a threat to electromagnetic compatibility. Therefore, the highest threat frequency and the shielding requirements at that frequency are both needed to determine the type or types of windows, which are suitable for that application.

For example, assume the highest threat frequency is 10 MHz with a maximum required shielding of 60 dB at that frequency. Figure 2-2 shows that any of the three families of shielding materials would be suitable to provide of shielding materials would be suitable to provide adequate shielding.

On the other hand, changing the maximum threat frequency from 10 MHz to 100 MHz would eliminate the knitted wire mesh screens and the transparent conductive coatings, leaving only the high-performance woven screens as a suitable solution.

Knowing which types of windows are available, the next selection should be made on the basis of the optical transmission that is attainable from the screen materials or conductive coatings, plus the optical substrate. Standard optical substrates should cause only a minor reduction in optical transmission should be less than 1% to up to 10%, depending upon the reflection and absorption from coated and uncoated surfaces of the substrates. The following section will deal with the evaluation of the windows from an optical aspect of the specific materials to be referred to as percent open area. This characteristic is important in determining optical contrast which can affect operator fatigue in using devices such as video display monitors.

Table 2-1 summarizes the general shielding effectiveness ranges at specific frequencies for the three shielding materials shown in Figure 2-2. The three frequencies are 1 MHz (magnetic field), 10MHz (electric field), and 1 GHz (plane wave).

SUMMARY

Figure 2-1. Shielding Performance

Shielding Screen Material	Shielding Range (dB)		
	Magnetic 1 MHz	Electric 10MHz	Plane 1GHz
I Knitted Wire Mesh (Monel-Cross over Bond) 10-30 CPI	30-40	60-70	20-25
II Transparent Conductive Coating 8 to 24 OHM/Square	40-50	70-80	30-40
III Woven WireMesh (Copper Wire) 80-200 mesh	65-75	95-110	60-70

OPTICAL PERFORMANCE

To deal with the material selection process an understanding of optical properties of shielding windows is imperative. These properties concern the optical transmission of the finished window, including optical substrate, shielding screen, laminating material, coatings, and characteristics of transmission color filters. This section discusses the optical performance of the shielding screens.

Knitted mesh screens are produced on industrial knitting machines that were originally developed for the commercial, knitted fabric materials industry. The machines have been adapted to handle wire instead of yarn. In this process they produce a continuous tube of material called a “stocking.” The diameter of the stockings varies from 3/8 inch to 30 inches. Various sizes are used to make electrically conductive metal gaskets and the conductive mesh screens for shielding windows. The irregular shapes formed in the knitting process (see Figure 3-1) aid in minimizing any obscuration of regular shapes as might be formed in typed or printed information. The density of the mesh is determined by the courses per inch along the length of the stocking, the wire material and the wire diameter. To maintain a square pattern of openings in both directions, it is necessary to call out the number of openings per inch around the stocking as well. This effectively determines the complete description of the knitted mesh screen. Knitted screens are generally limited to about 30 openings per inch when used as a screen for shielding windows.

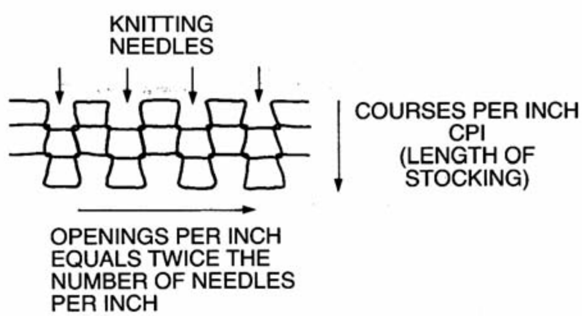


Figure 3. Knitted Mesh Screens.

Woven mesh using fine wires, generally much smaller than 0.005 inch diameter, provide a significant improvement in shielding effectiveness over other shielding widow materials, even at higher frequencies. These woven screens have 80 or more wires to the inch in both directions (Figure 3-2). Typical mesh density is 100 mesh (100 by 100 wires per inch), 120 mesh (120 by 120 wires per inch) and 150 mesh (150 by 150 wires per inch). Typical wire diameters vary from 0.001 inch to 0.0025 inch depending upon plating and blackening. Blackening of the screen reduces reflections and improves image contrast.

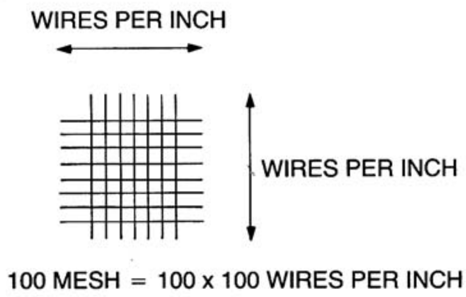


Figure 3-2. Woven Mesh Screens.

A third shielding material is the transparent conductive coating. This material exhibits good shielding properties at moderate optical transparency (reference Table 2-1 on shielding performance for knitted, woven and transparent conductive coatings). Since the shielding effectiveness is a function of the resistivity of the transparent coating which, in turn, is a function of the optical transmission, there are tradeoffs in performance (see Figure 3-3 and Table 3-1). An optimum relationship for this type of coating occurs at approximately 10 to 14 ohms per surface resistivity to obtain approximately 70% transmission and greater than 50 dB shielding at 100 MHz.

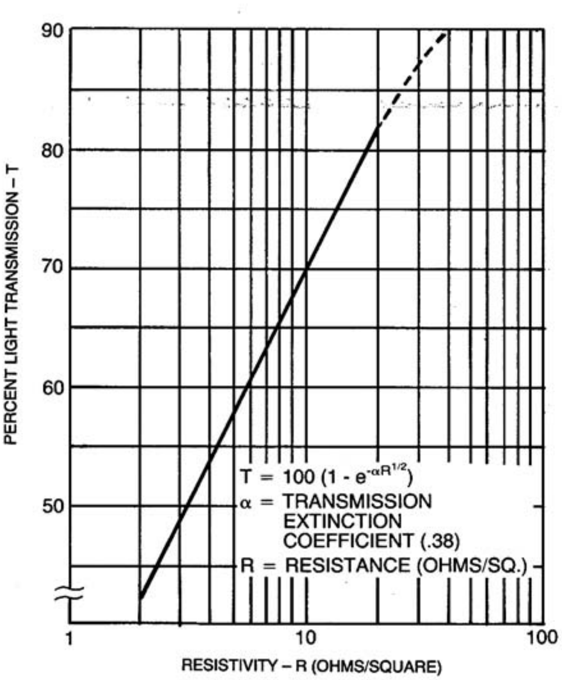


Figure 3-3. Light Transmission-Resistivity Relationship (Thin Gold Coating).

Design Guidelines to EMI Shielding Windows cont.

U.S. Customary
[SI Metric]

Figure 3-4 provides a ready reference for the optical Transmission (percent open area) of the three types of shielding materials for windows covering the most commonly used knitted mesh screens, woven mesh screens and transparent conductive coatings. The commonly used materials are annotated by circle (O) on the figure.

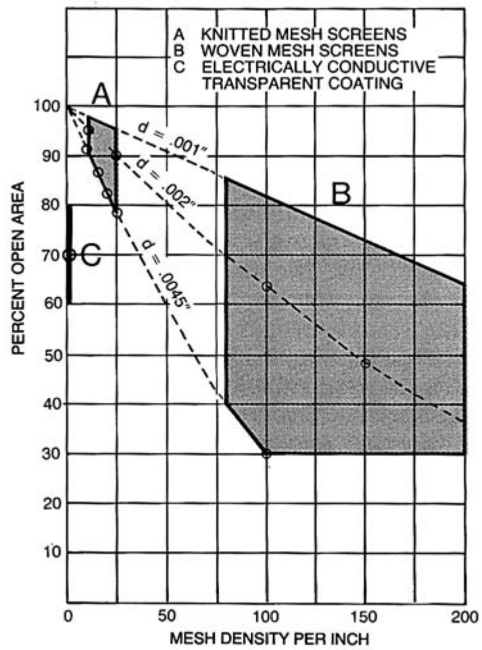


Figure 3-4. Percent Open Area of Mesh Screen.

Section A of Figure 3-4 encompasses the useful range of knitted materials. Wire diameters from 0.001 inch to 0.0045 inch bound the upper and lower limits while 10 to 25 CPI provide the limits of mesh densities. These boundaries provide the highest optical open area ranging from about 80% to greater than 95%. Bonding of wire crossovers has been assumed in all performance data shown in this guideline.

Section B of Figure 3-4 depicts the useful range of woven screen materials ranging from wire diameters of 0.001 inch to 0.0045 inch and mesh densities from 80 to 200 mesh. The circles indicate commonly used mesh materials that are generally readily available. Performance for 100 mesh screen with 0.0045 inch diameter copper wire provides approximately 30% optical transparency and 70 dB shielding, while 100 mesh with 0.002 inch Diameter copper wire provides about twice the open area (64%) while reducing the shielding effectiveness by only 10 to 12 dB.

Section C of Figure 3-4 (vertical coordinate) shows the normal range of transparency for the transparent conductive coating. These electrically conductive transparent coatings (ECTC) have a distinct advantage over screen materials when used with three color CRT's employing a color mask on the faceplate. The color mask is used to delineate the specific phosphor color to be displayed. The masks have a color repetition pattern or pitch that varies from an equivalent mesh density of about 60 mesh for broadcast monitors to 130 mesh for the very high-resolution monitors. Whenever a repetitive pattern, such as a shielding mesh screen, is placed in front of a color CRT, patterns of dark and light bars are known as moiré patterns. They occur as a result of the mesh screen having nearly the same pitch as the pattern of the CRT color mask. Rotating the mesh will vary the number of bars. Changing the number of wires per inch (mesh density) will also alter the number of bars. Often there is an optimum mesh density, wire size and angular relationship to the fixed CRT color mask pattern that will minimize or even eliminate the interference pattern.

These light and dark bars are the result of the patterns of two objects, either aligning up exactly with each other to produce light areas or misaligning completely and blocking all transmitted light to produce dark bars. Sometimes, it is difficult to attain a perfect match between the CRT mask and the screen mesh. ECTC windows on the other hand do not have a repetitive structure similar to the shielding mesh screens. They are, therefore, ideal in some applications as an EMI shield for color monitors. The main limitations with the ECTC windows are high

Figure 3-1.

Shielding Screen Material	Shielding Range (dB)			Optical Open Area (%)		
	Magnetic 1 MHz	Electric 10MHz	Plane 1GHz	0.001" DIA.	0.002' DIA.	0.0045" DIA.
I Knitted Wire Mesh (Monel-Cross over Bond) 10-30 CPI	30-40	60-70	20-25	95-98%	90-96%	79-91%
II Transparent Conductive Coating (Molecular 8 to 24 OHM/Square Structure)	40-50	70-80	30-40	60-80%	NA	NA
III Woven WireMesh (Copper Wire) 80-200 mesh	65-75	95-110	60-70	64-86%	36-70%	30-41%

cost, their tendency to be easily scratched, a noticeable color tint for some coatings and a lower shielding effectiveness than the woven mesh screens.

The TECKNIT EMI Shielding Design Guide is an excellent reference in determining the required shielding for specific specifications (MIL-STD-461, FCC, VDE and others) against equipment circuits and EMI generators. Tables 3-1 summarize the performance capabilities of shielding windows from both shielding and optical aspects.

OPTICALLY CLEAR WINDOW SUBSTRATES

Glass and clear plastic optical substrate materials are the most common for covering large area apertures for viewing windows. This section discusses the basic properties of these materials for shielding applications requiring both flat and curved windows.

GLASS SUBSTRATES

Glass substrate materials provide the hardest surface for resistance to scratches and marring. Once fully laminated, these windows closely match the properties of safety glass, with the added protection of an embedded screen mesh.

Properties of the glass conform to ASTM-C-1036 and mirror to mirror select quality. Edges are cut and trimmed to remove any sharp surfaces. Edges may be ground, ground and polished, beveled, or mitered on special order as specified by customer drawings or specifications. Standard glass window thickness is 0.205 inch with a tolerance of plus or minus 0.020 inch. Other thickness may be furnished in the ranges and tolerances shown in Table 4-1. Maximum outside dimensions (length by width) are 18 inches by 14 inches with a standard tolerance of plus or minus 0.031 inch. Major defects such as gaseous inclusions, which are permitted by Federal Specifications, are culled before laminating. Glass, in effect, when specified for shielding windows will exceed the requirements as stipulated in federal Specifications. Plate glass is specified to assure virtually parallel and flat surfaces. See **TECKSHIELD-F Data Sheet** for laminated glass windows.

PLASTIC SUBSTRATES

Not all-clear plastics are of use in the manufacture of shielding windows. Plastics are divided into two general classes: thermoplastic and thermosetting resins.

A **thermoplastic** material softens when heated and hardens on cooling. Since this action is reversible it is possible for the material to be molded and remolded without appreciable change in the material properties. The significant difference in **thermosetting** materials is the irreversible heating action. These latter materials, once softened by heating, remain in the shape formed during the original heating cycle. Hence, the desired or final shape of the windows to be made must be incorporated into the mold of the part. Furthermore, with thermosetting plastics, the desired color) other than clear) depends on the thorough blending of the proper mixture of the coloring agent with the plastic material before molding.

THERMOPLASTICS-Cellulose Derivatives: The principal cellulose derivatives are the nitrate, acetate, acetate butyrate, and ethyl cellulose. The cellulose plastics have a comparatively poor surface hardness and poor abrasive resistance. They are readily hygroscopic (absorb water) with a resultant change in dimensions. Most do not possess the high optical qualities of glass or some of the other plastic substrate materials. Softening occurs at about 60*C for these thermoplastic materials and, therefore must be used in applications which will not exceed their softening temperature. **Cellulose acetate butyrate** (CAB) is probably the best of the cellulose family of plastics. It is especially suited to molding and possesses lower water absorption than other cellulose derivates and therefore, betters dimensional stability than cellulose acetate.

THERMOPLASTICS-Synthetic Resins: The principal thermoplastic resin materials consist of polycarbonates, polystyrenes and methyl methacrylates (acrylic). In general these resins are characterized by higher resistance to chemicals and lower water absorption than the cellulose derivatives. They generally have optical characteristics very close to glass with a much lower tendency toward scratching, but are still very much softer than glass. Polycarbonate is about 10 times easier to scratch or mar than the methyl methacrylates (acrylic).

Polycarbonate material is virtually unbreakable and can withstand impacts greater than 200 ft.-lbs. for a one eighth inch thick sheet. Softening temperature is about 125*C. The poorer than desirable scratch performance makes polycarbonate a poor candidate for viewing windows that require periodic cleaning, such as may be needed with cathode ray tubes (CRT). Some aromatic solvents (hydrocarbon) cause surface stress cracking in this material.

Polystyrene material is relatively hard and rigid, naturally colorless and quite transparent. The softening range is about 20*C higher than the cellulose plastics, but lower than that for acrylic resins. Most other properties for this material are excellent except for poor resistance to most organic solvents.

Methyl methacrylate (acrylic) material has high luster, high transparency, and good surface hardness, is comparatively inert chemically and is not toxic. Essentially, acrylic possesses almost all the desirable qualities of glass except for scratch resistance. Compared to other plastics, methyl methacrylate is harder than most but still readily scratched by dust particles.

Methyl methacrylate is a very stable compound and retains to a high degree its mechanical properties under adverse environmental conditions. Impact resistance when compared to some plastics is poor, although when compared to glass it is much superior.

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THERMOSETTING RESINS – ACP, CR-39 (PPG industries): ACP (Allyl Cast Plastic) is known as Columbia Resin (CR-39). It is a transparent solid, cured from the clear, colorless, water-insoluble liquid monomer through the aid of a catalyst. It is strong, relatively insoluble and inert. It is normally free of internal haze, has a low water absorption and moderate coefficient of thermal conductivity. Refractive index is almost identical to that of crown glass, and yet, the density is about one-half. The resin material is Superior to acrylic and other plastics with respect to softening under heat, crazing, resistance to abrasion and attach by chemicals. The continuous use temperature is 100*C.

In summary, the three most likely candidates for optical substrate materials in shielding window application are glass, acrylic and CR-39, in that order. Table 4-2 summarizes the performance characteristics of these materials.

TABLE 4-1
STANDARD SIZES AND TOLERANCES

MATERIAL	MAXIMUM SIZE	TOLERANCE	THICKNESS (Overall)	REMARKS
Plate Glass (woven mesh)	**Standard** 32" x 56" 32" x 32" **Special** 14" x 14"	±0.031"	Standard[1] 0.270 ± 0.020 inch 0.205 ± 0.020 inch **Special** 0.145 ± 0.020 inch	Glass per ASTM-C-1036
Plastic (woven mesh)	**Standard** 24" x 24" **Special** 32" x 32" 32" x 56"	±0.031"	**Standard** (acrylic) 0.145 ± 0.020 inch **Special** (acrylic) 0.205 ± 0.020 inch 0.270 ± 0.020 inch	Acrylic per L-P-391
Plastic (knitted mesh & ECTC)[4]	18" x 22"	±0.031"	**Standard** (cast)[2] 0.125±0.010 inch **Standard** (edge laminated)[3] 0.135±0.015 inch **Special** (Cast) 0.060±0.010 inch	Smooth or matte finish, Polycarbonate CR-39, Acrylics

[1]**TECKSHIELD-F** Specification Reference, Appendix A-1
[2]**EMC-CAST** Specification Reference, Appendix A-2
[3]**EMC-LAMINATED** Specification Reference, Appendix A-3
[4]**EMC-ECTC** Specification Reference, Appendix A-4
[5]Contact factory for larger edge bonded windows.

TABLE 4-2
PROPERTIES OF WINDOW SUBSTRATES (TYPICAL VALUES FOR CLEAR COLORLESS MATERIAL)

PROPERTY	UNITS	PLATE GLASS	METHYL METHACRYLATE (ACRYLIC)[1]	POLYCARBONATE[1]	CR-39
OPTICAL					
Index of refraction	–	1.529	1.48-1.51	1.59	1.50-1.57
Transmission	%	90	21-23	85-89	89-91
Haze	%	0.9	0.6	0.5-2.0	0.4
MECHANICAL					
Flexure Strength	psi		12-14,000	12-13,000	5,000
Impact Strength (Izod Notch)	ft-lb./in.		0.4	12-16	0.2-0.4
Hardness	Rockwell		M80-M90	M68-M74	M95-M100
Specific Gravity	–	2.52	1.20	1.20	1.32
ELECTRICAL					
Dielectric Strength	volt/mil		450-530	380-425	290
Dielectric Constnat	@1MHz		2.7-3.2	3.0-3.1	3.5-3.8
Volume Resistivity	ohm-cm		10^{15}	$8x10^{16}$	$4x10^{14}$
THERMAL					
Thermal Conductivity	Btu-in/hr•ft^2•°F		1.44	1.35-1.41	1.45
Specific Heat	Btu/lb°F		0.35	0.3	0.3
Coeff. Therm. Expan.	in/in/°F	$4.7X10^{-6}$	$45x10^{-6}$	$37.5x10^{-6}$	$60x10^{-6}$
Continuous Use Temp.	°C/F	110/230	80/175	100/212	100/212
CHEMICAL/PHYSICAL					
Water Absorbtion	% (24hrs.)	—	0.3-0.4	0.15	0.2
Abrasion Resistance	ASTM 1044	0	14	100	—

[1]Connectors & Interconnections Handbook Volume 4, Materials, 1983.

CONTRAST ENHANCEMENT

The optical performance of substrate materials may be substantially improved by increasing the optical contrast of the displayed image through glare reduction and optical filtering. Additionally, special surface treatments for some plastics may increase the scratch and mar resistance of surfaces subject to frequent cleaning. Here special coatings can significantly reduce the harsh effects of dust and dirt scratches from cleaning materials, which cause unwanted light scattering and image distortion or obscuration.

Wherever high ambient lighting conditions are present, loss in display contrast may occur from window reflections unless these reflections are controlled by means of antireflection coatings, matte finishes, optical color transmission filters, or special laminates such as polarizers.

Antiglare or glare reduction techniques consist of either an antireflection coating for glass windows or a matte finish for glass or plastic windows. Antireflection coatings utilize optical interference filters, while matte finishes are imprinted into the surface of the substrate and scatter incident light to reduce specular reflection (See Figure 5-1).

Color transmission filters transmit only specific color hues within a comparatively narrow spectral band reducing the amount of optical energy, which does not contribute to the display image. Polarizers selectively block the passage of unwanted wide band spectral energy such as is reflected from the internal surface of a display.

ANTIREFLECTION COATINGS

Antireflection interference coatings are applied to optical elements of shielding windows to reduce reflections. These coatings are applied by several deposition methods, such as high vacuum evaporation, sputtering thin film coating techniques. The techniques to reduce surface reflection from glass optical elements have been well known in the optical industry for many years. Virtually all lenses in modern cameras have a single or multilayer antireflection coating. The amount and the rate of material applied to the surface are controlled to obtain the required film thickness. These specialized coatings consist of several thin film layers of different materials to obtain a particular optical effect.

The basic laws of optics determine the reflection that occurs at a boundary between two transparent media of different index of refraction (n). The index of refraction is a measure of the speed of light in a medium. For vacuum, the index is 1.00 and for all practical purposes, it is 1.00 for air. Higher indices indicate a slower propagation speed for light in that media. The index for plate glass, such as used in shielding windows, is 1.525. This higher index means that the speed of light in plate glass is approximately two-thirds the speed of light in air. These indices are used to determine the percentage of incident light, which will be reflected at the boundary.

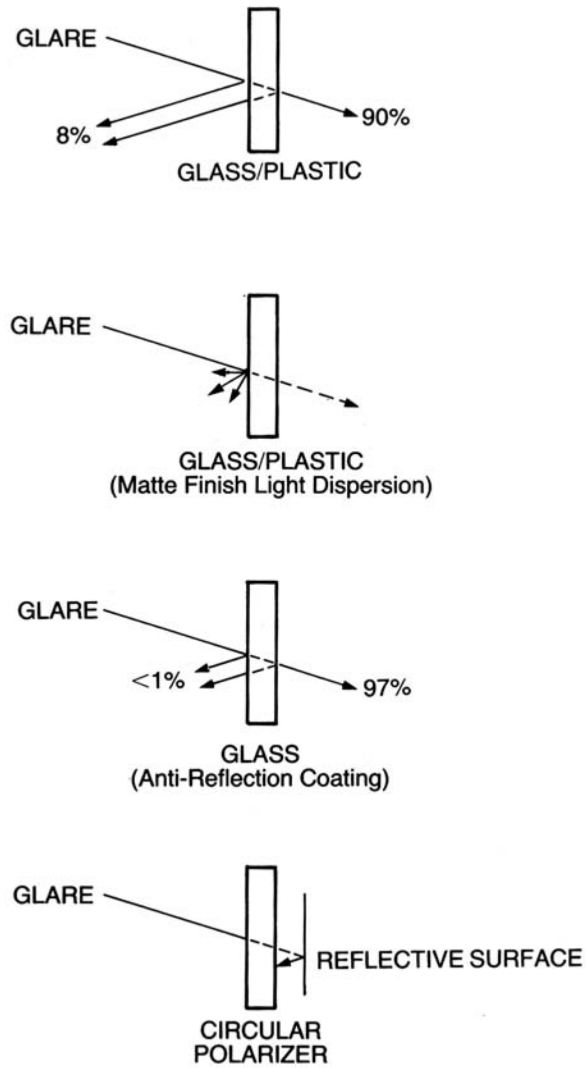

Figure 5-1. Glare Reduction Techniques.

The reflection (R) occurs at the boundary of interface between two different indices and can be calculated from the equation:

$$R=\frac{(n_g - n_a)^2}{(n_g - n_a)^2}$$

For ng: the index for glass is 1.52
For na: the index for air, 1.00

For the indices given above, the ratio of reflected to incident light is 0.04 or 4%. A similar reflection will occur wherever a boundary between two different indices exists, such as the boundary between glass and air at the second surface. The front and back surface reflections then may amount to a total of 8%

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of the incident light being reflected back to the viewer for plate glass with an index of 1.52. Figure 5-2 shows the relationship of reflection to indices from 1.0 to 2.0.

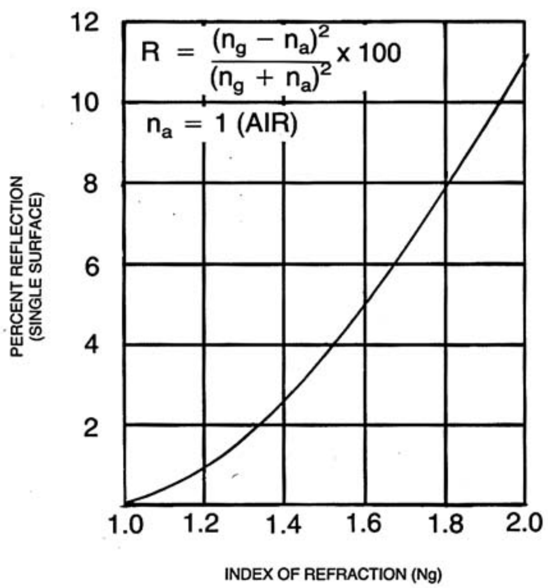

Figure 5-2. Percent Reflection Against Index of Refraction.

Figure 5-3 represents schematically an air/antireflection-coating glass interface. The light wavefront represented by two electromagnetic rays (A & B) impinge onto the front surface of the antireflection coating. Small portions (4%) of rays A & B are reflected while the larger portion of each enters the coating. Ray A reflects another small portion (4%) at the boundary between the antireflection coating and the glass substrate. The thickness of the coating is exactly ? of the wavelength of the reflected light to be absorbed. The reflected Ray A at the boundary between the antireflection coating at Point 2 arrives at Point 3 exactly out of phase with Ray B (out of phase occurs where Ray A is positive, Ray B is negative and of equal amplitude). At point 3 the out of phase condition results in destructive interference between rays A & B with a complete cancellation of the reflected wave fronts. The same cancellation occurs at the back surface when it is also subjected to the antireflection coating.

In reality, the number of materials that are available for antireflection coating are fairly limited, requiring a high index of refraction for the lass substrate and a low index for the coating. Under exact conditions, it was shown in the paragraph that the air-to-coating boundary reflection may

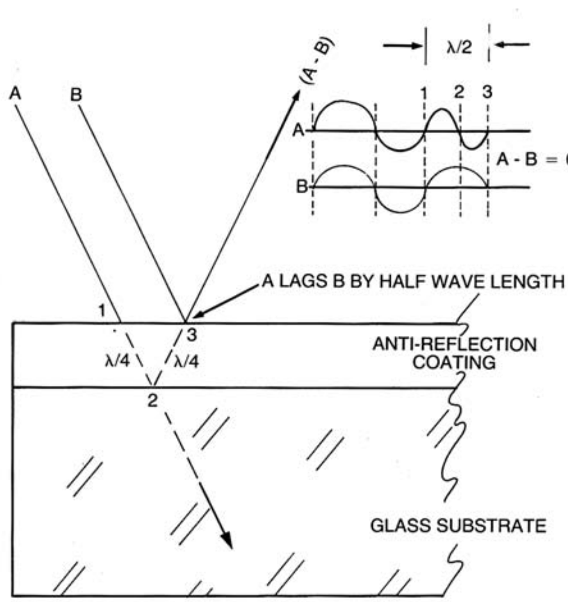

Figure 5-3. Air-Antireflection Coating-Glass interface

result in complete cancellation of the reflection from the coating-to-glass boundary, thus producing a near zero reflection value at some selected optical wave length. Unfortunately, in most applications, exact matching of indices and layer thickness seldom occurs. Even for only slightly mismatched conditions, the human eye is extremely sensitive to low light levels. To the untrained observer, a 1% to 2% reflectivity is still very apparent and often difficult to distinguish from an uncoated glass surface. To be effective for glare reduction application, the coating must reduce a single surface reflection significantly below 0.5% The transmission of TECKNIT high-efficiency optical coating is greater than 99% which is more than 7% higher than that for uncoated plate glass. Uncoated plate glass transmits approximately 90% of the incident light. Surface reflections account for 8% and absorption accounts for approximately 2%. To avoid the reflection of the second (back) glass-to-air boundary, the back surface must be coated with a similar coating.

The eight percent (8%) reflection of incident light from the glass surface may be frequently as intense as the optical energy generated by many displays. Cathode ray tubes (CRT) monitors, radar scopes for traffic controllers, digital LED and LCD and electroluminescence are examples of fairly low brightness displays. In some applications where the ambient light is very high (outdoors), the intensity of the reflected light may exceed the light energy from most data displays.

Under these conditions, it is often easier to see the reflected image of the scene behind the viewer than the display itself that has been completely of almost completely washed-out (zero contrast) by ambient light. In these cases, the use of light dispersion (scattering surfaces as are provided by matte finishes. Circular polarizers are useful for eliminating reflections internal within the display that can be reflected back toward the viewer reducing image contrast.

MATTE FINISH

Matte finishes are used as an antireflection surface treatment to effect a dispersion of specular reflectance. These finishes for either glass (an etch finish) or plastic (mold or cast finish) are available as an alternate to thee antireflection coating (HEOC for glass). Matte front surface finishes are used in applications where the shielding windows may be used in close proximity to the display, such as flat (or nearly flat) CRT, plasma display, LED, LCD, and electroluminescent and monochrome or multicolor displays.

At or near normal incidence where ambient light strikes the window straight on, light reflected is a function of the indices as discussed earlier. As the angle of incidence increases s measured from the normal (perpendicular) to the window surface, an abrupt increase in reflection occurs bout 45∞ incident angle. These near grazing angles are often coincident with the positioning of overhead lighting. Reflections under these conditions are best treated with a shading hood or by using matte finish which dispense the reflected energy (reference Figure 5-1).

POLARIZERS

Polarizers provide a third method of discrimination between optical signals and optical noise. There are two basic types of polarizers, linear and circular.

Electromagnetic radiation is generally conceived of on the basis of field theory. An electric and magnetic field are said to exist at right angles to each other. In any random waveform, the orientation of either field would be random in relation to some fixed axis. Therefore, in a bundle of optical waveforms or rays, there would be (statistically) a complete random orientation of the fields (the electric field, for example) as shown in Figure 5-4b. These waveforms would be unpolarized; that is, there would be no preferential orientation of either field. A polarized wave, then, is one in which the fields are specially oriented in one direction, Figure 5-4A.

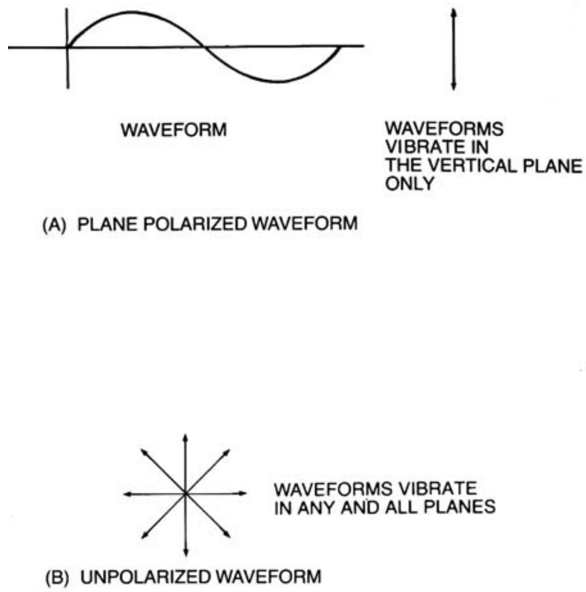

Figure 5-4. Polarized and Unpolarized Waveforms

A linear polarizer selectively transmits an unpolarized waveform by resolving the field components that are aligned with the polarizing axis of the polarizer. In this manner, the polarized waveform consists of a single orientation of the electric field. When viewed through another linear polarizer (called an analyzer) with its polarization axis at right angles (90º) to the polarized waveform, the light will be completely blocked. When the axis is aligned at other than a right angle to the polarized waveform, the wave is transmitted as a function of the angle (COSINE$^2\Theta$) between the axes of the polarizer and the analyzer. For example, where the axes are aligned at 45º, about 50% of the polarized light will pass through the analyzer.

Linear polarizers are used to control light output. These polarizers attenuate reflected light glare form smooth objects where the reflected light has been polarized in a known plane, such as horizontally. To minimize the reflected light, the linear polarizer acting as an analyzer is oriented with its polarizing axis perpendicular to the reflecting surface.

Circular polarizers provide an important additional advantage. When viewing objects through a window, the objects on the inside of the enclosure are generally oriented at various angles to the window surface, such that the light that reflects from those objects may be polarized in several different planes.

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The problem then becomes one of discriminating between light which enters the display from the window side and light generated within the display. Generally, the acceptance angle of the light entering the display will be fairly narrow (Figure 5-5). The farther away the display is located in relation to the window, the narrower the acceptance angle of the interfering light and, therefore, less chance that light will be retro-reflected back to the viewer. Light, which originates outside the acceptance angle will not contribute to the loss in contrast with the image being emitted at the display (CRT, LED, annunciators - those displays that generate their own illumination). Additionally, orientation of the reflecting object within the display plays an important part in determining what light from the window will be reflected back out the window toward the viewer.

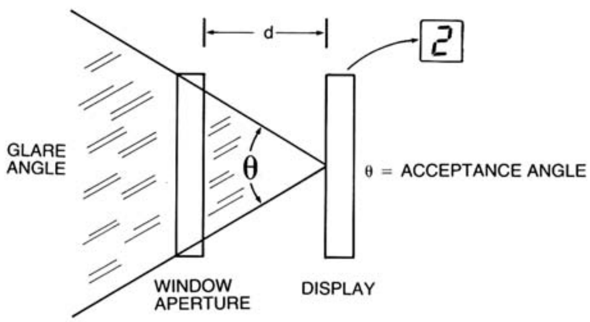

Figure 5-5. Glare Acceptance Angle.

CIRCULAR POLARIZER – HOW IT WORKS

A circular polarizer consists of linear polarizer in series with a 1/4 wave-retarding element. It is important that the linear polarizer precedes and is oriented (aligned) correctly to the ? wave-retarding element.

With reference to Figure 5-6, light passing through the linear polarizer is polarized along its polarizing axis and enters the 1/4 wave retarder. The 1/4 wave retarder separates the polarized rays into two equal rays that pass through the retarder at different speeds (by virtue of two different indices of refraction). The thickness of the retarder determines the phase relationship of the two light rays and is selected to produce a 90º phase shift (1/4 wavelength). After passing through the 1/4 wavelength retarder, the phase relationship of the rays remains constant. Upon striking a highly reflective surface (specular), the phase orientation of the two rays reverses with the phase lagging ray preceding the previously phase leading ray by 1/4 wavelength.

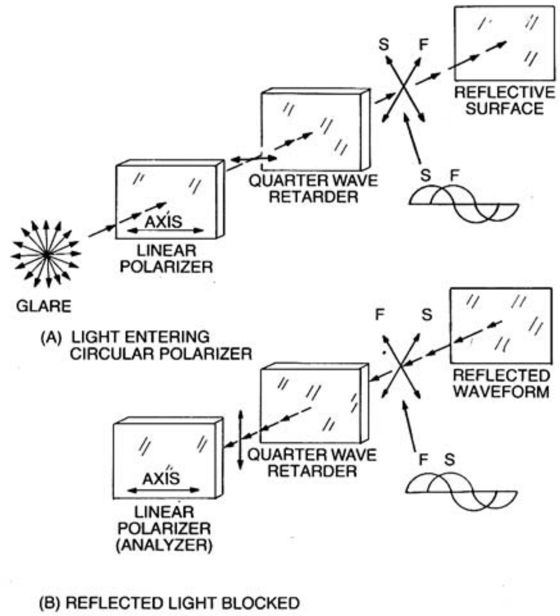

Figure 5-6. Circular Polarizer.

On reentry through the 1/4 wave element, the retarder phase aligns the two rays and orients the resultant wave at right angles to its original polarization. The 90º rotated polarized wave emerging from the 1/4 wave retarder is then completely blocked by the linear polarizer (the first element of the circular polarizer).

Circular polarizers can not be used with LCD display. LCD displays use linear polarizers in their normal operation to effect selective filtering of the external illumination. This type of display would partially or completely block the incident light from the circular polarizer, effectively defeating the purpose of the various elements of the LCD.

OPTICAL COLOR TRANSMISSION FILTERS

Optical filters generally are classified according to their spectral properties such as short wave cut-off, long wave cut-off, bandpass, rejection, or neutral density.

Short wave cut-off filters are used to block the ultraviolet while long wave cut-off filters may be used to eliminate infrared heating. Bandpass filters are principally used to increase the signal-to-noise ratio (contrast) of displays (or detectors). Rejection filters are usually employed to eliminate specific spectral wavelength(s) or to minimize their intensity, which might be harmful to the operation of equipment, such as laser beam. Neutral density filters reduce the average illumination across the visual spectrum.

In shielding window applications, transmission filters are used to provide various hue and shades of transmitted light. To assist the designer in selecting the proper filter for specific applications, it becomes important to be able to calculate the effect of material thickness and combinations of elements that tend to alter the transmitted light and the overall density of the filter.

Light transmitted through the filter material experiences a first surface reflection, absorption within the bulk of the material and losses due to the second surface reflection. The transmitted light (T) is a fraction of the incident light and the optical density of the filter is given by:

$$D = \log_{10} \frac{1}{T}$$

Where there are several transmission factors involved (multiple values of T), thee factors should be included and multiplied together. For example, if the transmission factor for a color filter at the peak wavelength is Tp and the optical substrate transmission factor is Ts, the density expression would be:

$$D_T = \log_{10} \frac{1}{T_P T_S}$$

Standard colors are available for plastics which broadly cover four hue classes (red, yellow, green, blue) and neutral gray. Table 5-1 tabulates suggested filters, which most nearly match the spectral band for each of the emitters.

Figure 5-7 provides spectral transmission curves for the more commonly used filters.

ABRASION RESISTANT COATINGS

The surfaces of most plastics are relatively soft in comparison to glass. As a result, the front surface of shielding windows are subjected to possible scratching and marring when periodically cleaned to remove dust, dirt and grease in normal handling during operation of the equipment. These soft surfaces can be treated with specially formulated coatings for use on thermoplastic and thermosetting plastics.

Abrasion resistant coating not only provides scratch and mar resistance, but is also resistant to moisture and cleaning solvents. The coatings re clear and non-yellowing and are resistant to ultraviolet light. They can be applied to methyl methacrylate (acrylic), polycarbonate or CR-39. Polycarbonates are not recommended for normal shielding window applications unless protected with an abrasion resistant coating.

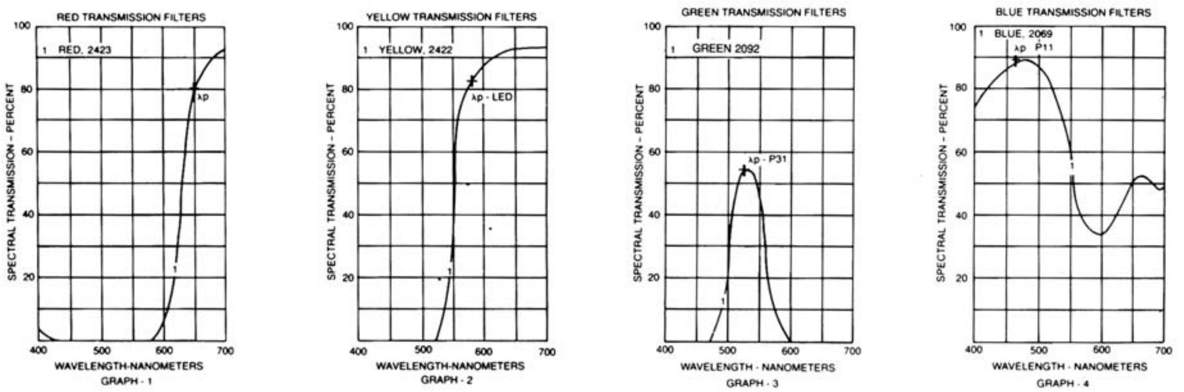

Figure 5-7. Standard Spectral Transmision Filters.

TABLE 5-1
RECOMMENDED TRANSMITTING FILTERS FOR TYPICAL LED EMITTERS

EMITTER	FILTER NUMBER	PEAK WAVELINGTH (λp in nm)	PERCENT TRANSMISSION at λp	PERCENT TOTAL LUMINOUS TRANSMISSION
LED				
Red	2423	650	80	10
Yellow	2422	580	82	60
Green	2092	530	53	21

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ASSEMBLY AND MOUNTING

The edge of shielding windows is prepared for mounting to the enclosure by applying an interface gasket, which conducts induced currents from the shielding mesh or conductive surfaces to the ground plane of the system.

There are essentially two basic barrier terminations for shielding windows: (1) conductive busbar; (2) conductive gasketing. The conductive busbar I used to contact the shielding screen or conductive coating. The busbar terminates the edge of the window opening by contacting the screen mesh while providing a flat surface on one or both sides of the window (Figure 6-1) to make electrical contact to the enclosure bezel. Conductive gasketing is often used in combination with conductive busbars to provide a resilient interface for aid in absorbing hock and vibration.

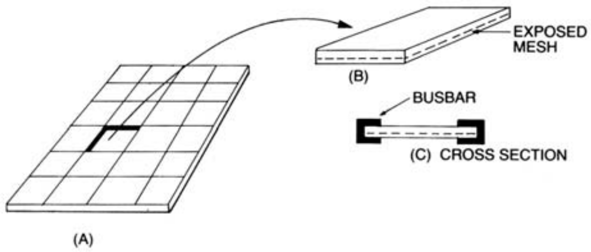

Figure 6-1. Busbar Termination.

CONDUCTIVE BUSBAR

A conductive busbar is an electrical conductor that can be used as a common electrical connection around the perimeter of the shielding window to the conductive shielding barrier of knitted wire mesh screen, transparent conductive coating (ECTC) or woven mesh screen.

Generally, the more economical way to manufacture small shielding windows is to either laminate or cast knitted wire mesh screen or woven mesh screen into large area sheets and/or to dissect the sheets into several smaller area windows. The windows that are cut to size from the larger sheets have the mesh screen emerging at the four edges of the window as shown in Figure 6-1. Contact is made to the screen by means of a conductive busbar of either a highly conductive coating such as an organic-type paint which is highly filled with conductive silver particles or a deposited metal film.

Silver is the preferred filler for paint to attain maximum conductivity. The liquid carrier for the paint is an acrylic base, which produces a hard, firm busbar and is compatible with most optical substrate materials. The busbar then provides a comparatively large contact area to which an electrochemically compatible, conductive, resilient gasket may be attached for shock mount and moisture barrier.

An alternate mounting method for these types of windows, employing a peripheral busbar, is to bond the window directly to the enclosure using a conductive RTV (room temperature vulcanization) adhesive or a conductive epoxy. This latter mounting technique provides a comparatively rigid mounting and should be backed up by several mounting clips or fasteners to ensure proper bonding and to reduce possible seam flexure.

CONDUCTIVE GASKETING

The termination of the shielding mesh screen to attain maximum performance from the shielding window is as important in the material and methods selection as in the shielding screen itself. Improper screen termination may severely reduce the shielding effectiveness of a high performance shielding window as may be required for performance shielding window as may be required for NASCIM 5100A (Tempest) applications. There are three recommended edge terminations for woven mesh screens in applications requiring the maximum performance over any extended period. The three methods are listed in order of performance.

1. Bond, Direct Contact, Self Gasketing: Shielding effectiveness tests have shown that the most consistent results and highest performance are

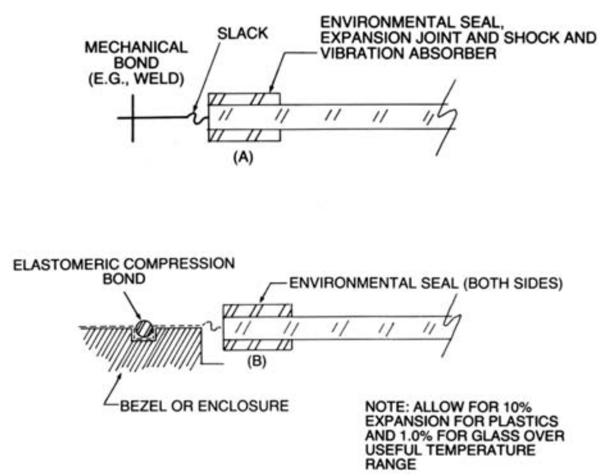

Figure 6-2. Bond Direct Contact.

attained when the shielding screen is bonded permanently to the enclosure by spot welding, brazing or soldering, depending upon the material used for the screen. Generally, this method is not cost effective. A nearly identical assembly may be attained by a mechanical clamping of the screen as shown in Figure 6-2. For both glass and plastic windows, the use of elastomer gaskets (neoprene or silicone) as moisture barriers and for shock mounting is recommended.

2. Wrap-Around, Direct Contact, Self Gasketing: The mesh screen is wrapped over a sponge or hollow core elastomer gasket and secured to the underside of the window (Figure 6-3). The use of elastomer moisture barrier and shock mounts to protect the window and screen from possible adverse environment is recommended.

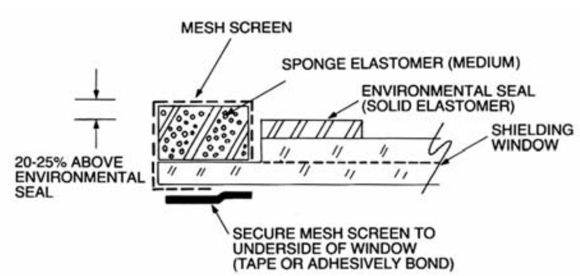

Figure 6-3. Wrap Around Screen, Direct Contact (Most Commonoly Used Configuration).

3. Interfacial Gasket, Indirect Contact, Conductive Gasketing: the mesh screen is extended along the flat of the step formed in the lamination process and secured to the underside of the window (Figure 6-4). A conductive metallic or elastomer gasket I mounted and bonded to the surface of the step. The gasket should be resilient and compatible with the screen and enclosure materials. Contact resistance must be kept low by means of a low impedance bond, such as a conductive RTV or conductive epoxy. A recommended gasket for this type of application, providing both EMC and moisture barrier, is a knitted mesh bonded to a silicone sponge (see Tecknit DUOGASKET). The knitted mesh strip should utilize tin-plated phosphor bronze (TPPB). TPPB provides highest shielding and environmental compatibility between the shielding screen and the enclosure surface.

Many combinations of gaskets are possible. The three methods described have been successful in specific applications. The greatest number of interfacing surfaces which must make low impedance contact between each interface, the greater will be induced electromagnetic noise current and the lower the shielding effectiveness of the system. As a rule of thumb, provide a 10:1 signal to noise ratio margin (about 20 dB more shielding) than may be actually required when all the mating surfaces are freshly cleaned and properly protected.

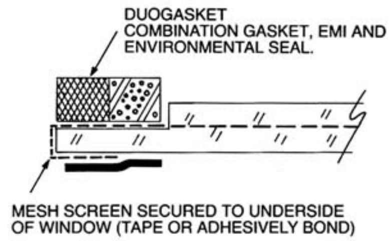

Figure 6-4. Interfacial Gasket, Indirect Contact with Mesh Screens (Most Economical)

SURFACE PREPARATION

The primary function of an EMC gasket is to provide impedance that matches or exceeds the conductivity the enclosure and minimizes the coupling efficiency of the seam itself from becoming a re-radiator. Normally, the reflection and absorption functions of a conductive shielding gasket are to a large extent masked by metal cover has been replaced by a quasi-continuous open mesh which at best is equivalent to a very thin barrier. At high frequencies (about 100MHz) the screen does not respond as a solid barrier. Special attention must be paid to the method by which the induced EMI currents in the mesh screen are returned to the system ground. Any significant difference in seam impedance, including that introduced by the gasket materials, may produce nonuniform current flow resulting in the generation of EMI voltages. Such induced voltages can then become sources of EMI radiated energy. To minimize these effects, the seam design and preparation is important and the following features should be incorporated into any new design:

1. Mating surfaces should be as flat and parallel as practically possible.
2. Mating surfaces must be conductive and protected from oxidation by plating with a hard conductive finish that is galvanically compatible with each other and with interfacial gaskets (tin, nickel, cadmium).
3. Protective coatings having less than half the conductivity of the mating surfaces should be avoided.

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4. Flange width should allow at least five times the maximum expected separation between mating conductive surfaces.
5. Mating surfaces should be cleaned to remove dirt and oxide films just prior to assembly of the shielding window to the enclosure and bezel.
6. Bonded surfaces should be held under pressure during adhesive curing to minimize surface oxidation and to maximize conductivity after cure.

CORROSION

Corrosion is one of the major factors, which influences specific design considerations. Generally, the lightweight structural materials, aluminum and magnesium, are most highly active electrochemically when in contact with the more conductive materials used for shielding. Selecting suitable shielding materials and finishes, which inhibit oxidation and corrosion and are compatible with enclosure materials, becomes a major tradeoff in the designing of shielding windows.

Corrosion occurs between dissimilar metals in the presence of an electrolyte. Dissimilar metals in contact in the presence of an electrolyte cause galvanic corrosion. A single metal under stress in the presence of an electrolyte may result in stress corrosion due to impurities embedded within the conductor. Table 6-1, electrochemical compatibility grouping, lists groups of common materials used as structural, barrier and gasketing materials. The rate of corrosion (erosion of the less noble metal, anodic) depends upon the electrochemical potential difference between the dissimilar metals and the strength of the electrolyte.

Table 6-1. Grouping of Metals by Electrochemical Compatibility.

(ANODIC)

Group I	Group II	Group III	Group IV
Magnesium	Aluminum	Cadmium Plating	Brass
Magnesium	Aluminum Alloys	Carbon Steel	Stainless Steel
Alloys	Beryllium	Iron	Copper & Copper
Aluminum	Zinc & Zinc Plsling	Nickel & Nickel Plating	Alloys
Aluminum	Chromium Plating	Tin & Tin Plating	Nickel / Copper
Alloys	Cadmium Plating	Tin / Lead Solder	Alloys
Beryllium	Carbon Steel	Lead	Monel
Zinc & Zinc	Iron	Brass	Silver
Plating	Nickel & Nickel Plating	Stainless Steel	Graphite
Chromium	Tin & Tin Plating	Copper & Copper Alloys	Rhodium
Plating	Tin / Lead Solder	Nickel/Copper Alloys	Palladium
	Lead	Monel	Titanium
			Platinum
			Gold

(CATHODIC)

Selection of materials from a common group provides the least chance for corrosion due to galvanic action when materials are in contact for extended periods of time in a normal office environment. The materials are arranged in their decreasing order of galvanic activity within each group and from left to right. Materials at the top of a group or in groups to the left erode under galvanic action. Dissimilar metals, which are in different groups, may be accommodated by plating one or both with a material that is common to both the enclosure and the mating surface. For example, aluminum and copper are not compatible in most environmental situations since they are not contained within one single group (aluminum is in groups I and II, while copper is in groups III and IV. To make these materials compatible, either one or both, preferable the latter, would have to be tin plated.

MOUNTING WINDOWS

Twist drills that are commonly used for metals may normally be used on most plastics. Since, when machining plastics, a scraping action produces better results than a cutting action; drills may be repointed to provide zero rake angle. Moderate speed and light pressures produce best results and minimize temperature changes at the cutting edge, which may result in galling or seizing.

Plastic windows may be provided with holes, which are often used for mounting and access holes for screwdriver adjustments for “zeroing” or “scaling” digital readouts. These holes should be drilled prior to the application of surface coating or finishes whenever possible to prevent scratching or marring the surfaces of the window. Holes or notches are not recommended for glass windows.

Common mounting methods include pressure-clips to secure windows under pressure during curing and clamping bars for larger plastic or glass windows. Bolt spacing © for windows, especially those with resilient gasketing, should follow the basic equation as given by:

$$C = \left[\frac{480\ (a/b)\ E\ t3\ \Delta H}{13\ P\ min + 2\ P\ max} \right]^{1/4} \text{inches}$$

Where: a=width of clamping bar
b=width of resilent gasket
E=modulus of elasticity of cover plate
t=thickness of clamping bar
$\Delta H = H1 - H2$ (difference between max/min gasket deflection)
P min=minimum pressure (at minimum deflection)
P max=maximum pressure (at maximum deflection)

The bolt spacing equation can be simplified by making some assumptions:

1. The bar width (a) will always be equal or greater than the gasket width (b); therefore, the ratio a/b will usually be greater than one (1). The worst case, which requires the minimum bolt spacing (C), occurs when a/b equals one. Should the bar be twice the width of the gasket, the bolt spacing could be increased by about 20%.
2. The maximum closing pressure, as a rule of thumb, should not exceed the minimum pressure by more than a 3:1 ratio.
3. The minimum closing pressure with a solid elastomer moisture seal should not be less than 50 PSI (P min.).
4. Modulus of elasticity for most metals (clamping bar) is greater than 10 PSI.
5. Assume a maximum deflection of 0.010 inch (ΔH).

Then, maximum bolt spacing, C, becomes:

$$C = 15(t)^{3/4}$$

Example: Aluminum clamping bar 1/8 inch thick (t) would require a center-to-center bolt spacing of 3-1/8 or less.

SPECIFYING SHIELDING WINDOWS

Sections 1 through 6 have provided methods by which the designer can establish minimum system need from shielding and optical clarity requirements.

Table 3-1 summarizes the shielding range in dB and open area in percent (%) of three types of shielding screen materials.

Table 4-1 tabulates maximum sizes, thickness and tolerances for standard glass and plastic optical substrates.

Table 4-2 tabulates optical, mechanical, electrical, thermal and chemical/physical properties of standard optical substrate materials: plate glass, methyl methacrylate (acrylic), polycarbonate, and CR-39.

Table 5-1 tabulates standard color transmission filters for plastic substrates.

Table 7-1 summarizes standard features of the **TECKNIT TECKSHIELD-F, and EMC-ECTC** windows.

Table 7-1 provides a suggested work sheet, which will aid **TECKNIT** Application Engineers in handling request for designing or ordering flat shielding windows. For curved shielding windows fully laminated or edges bonded, contact factory. Usually by consulting with the factory before the design stage can result in cost savings and performance enhancement for curved shielding windows.

Table 7-1

	TECKSHIELD-F (Fully Laminated)	**EMC-ECTC**
Maximum Size	32″ x 54″ (813mm x 1372mm)	
Shielding Material	Woven Mesh or Knitted Mesh	Transparent Conductive Coating
Shielding Effectiveness (1GHz)	>60 dB	>30 dB
Anti-Glare Finish (On Request)	Yes	Yes
Anti-Reflection Coating (On Request)	Yes (HEOC)	Yes (One Side Only) (HEOC)
Color Transmission Filters (On Request)	Yes (Ref. Table 5-1)	Yes (Ref. Table 5-1)
Abrasive Resistant Coating	Yes (On Acrylic and Polycarbonate)	Yes
Circular Polarizers	Yes (Fully Laminated)	Yes (Edge Bond)

Design Guidelines to EMI Shielding Windows cont.

U.S. Customary
[SI Metric]

ENGINEERING SPECIFICATIONS ES-71-01, TECKSHIELD WINDOWS – FLAT GLASS

I OPTICAL QUALITY

The finished window will meet the optical quality criteria with respect to any imperfections and defects as detailed below:

A. Minor Imperfections

1. Definition – Any one of the following conditions, exceeding 0.0001 square inches but not exceeding 0.0025 square inch area per defect and not exceeding 0.2 inch in its longest dimension, in the viewing area:
a. embedded Particles
b. air bubbles
c. scratches
d. wire screen defects

2. Accept/Reject Criteria
The window shall not have more than one such "imperfection" per 40 sq. in. of viewing area.

B. Major Defects

3. Definition – Any condition as described in Section A, but exceeding 0.0025 square inch in area or exceeding 0.2 inch in its longest dimension per defect in the viewing area.

4. Accept/Reject Criteria
Any "Major Defect" shall be cause for rejection.

II ANTI REFLECTION COATING (HEOC)

The multi-layer low-reflection coating will meet the minimum acceptable requirements for optical contrast enhancement when used for TECKNIT EMI shielding windows.

A. Coated Area: Unless otherwise specified, glass elements shall be coated over their entire effective aperture, except for an allowable uncoated area with a maximum width of 0.060 inch around edges.

B. Specular Reflectance: When applied to substrate materials having indices of refraction of 1.5 ± 0.04, the specular reflectance from a coated surface shall average less than 0.85% for an angle of incidence of 10º over the wavelength range of 450 to 650 nanometers.

C. Coating Quality: The coating shall be uniform in quality and condition, clean, smooth, and free from foreign materials, and from physical imperfections and optical imperfections as follows:

1. The coating shall show no evidence of flaking, peeling or blistering.

2. The coating shall not contain blemishes, such as discoloration, stains, smears and streaks or show evidence of a cloudy or hazy appearance.

3. The coating shall show no evidence of scratches, digs, or pinholes within a central area, which covers 60% of the overall viewing area.

D. Abrasion Resistance: There shall be no visible damage to the coated surface when rubbed 15 times with a standard rubber-pumice eraser under a force of 2 to 2-1/2 pounds.

E. Humidity: Continuous exposure to 100% relative humidity at a temperature of 80º C.

F. Operating and Storage Temperature Range: -55º to + 80ºC continuous.

ECTC™ Windows

ELECTRICALLY CONDUCTIVE TRANSPARENT COATING

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

ECTC WINDOWS are custom designed optical display panels produced by depositing a very thin electrically conductive transparent coating directly onto the surface of various optical substrate materials to provide high EMI shielding performance coupled with good light transmission properties.

APPLICATION INFORMATION

Applications of ECTC WINDOWS are found in equipment requiring visual displays where the viewing panel must also serve to reduce the radiated electromagnetic energy entering or leaving the device.

SUBSTRATE MATERIALS

Most transparent plastic and glass sheet material are suitable for ECTC coating. However, even those optical substrate materials with high quality surfaces, have minute surface imperfections which become more apparent after coating. In most applications these blemishes will not degrade the appearance of the finished window or the shielding performance.

CONDUCTIVE COATING

Standard ECTC coating has a nominal resistivity of 14.0 ohms per square and a light transmission of about 70 percent in the visible spectrum. Applying ECTC coatings to both surfaces of the optical substrate, increases shielding effectiveness by 6 to 10 dB, while reducing the optical transmission from 70 percent to about 50 percent.

ECTC coatings are easily damaged by abrasion since “finger printing” from oils present in normal skin moisture are difficult to remove. In normal usage, the coating is applied to the inner surface of the window substrate which permits cleaning of the front surface with a commercial window cleaner. NOTE: Inspection, handling and installation personnel should use clean, lint-free cotton gloves when handling ECTC Windows.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Optical Substrate**
  Acrylic: Acrylic sheet per Federal Specification L-P-391, Type 1, Grade C, clear (ASTM-D-4802).
  Glass: Glass sheet per Specification ASTM-C-1036, clear.
  Commercial Grade Polycarbonate
- **Conductive Coating:**
  TECKNIT ECTC vacuum deposited thin metal film.
  Indium Tin Oxide coatings available upon request.
- **Busbar Termination:** TECKNIT Silver Acrylic conductive coating.
- **Mounting Frame (when specified):** Aluminum alloy

PERFORMANCE CHARACTERISTICS

- **Coating**
  Surface Resistivity: 14 ohms/square nominal (±4 ohms/square).
- **Temperature Range**
  Acrylic: -67°F to 150°F [-55°C to 65°C].
  Glass: -67°F to 167°F [-55°C to 85°C].

MATERIAL	H-FIELD	E-FIELD	PLANE WAVE
ECTC	100 kHz	10 MHz	1 GHz
	20 dB	90 dB	30 dB

Tested in accordance with TECKNIT Test Method TSETS-01, which is based upon modified MIL-STD- 285. Typical values are based on a 5" square window.

BUSBAR TERMINATION AND INTERFACE GASKETING

The edges of ECTC WINDOWS are terminated with a border of highly conductive, silver busbar material. This conductive band serves two purposes:

1. Provides a uniform current distribution. The busbar material has a very low surface resistivity when compared to the ECTC coating.

2. Provides a more durable low impedance bearing surface than the ECTC coating alone. An interface gasket joins the ECTC window coating to the enclosure panel.

The most widely used interface gasket is TECKNIT CONSIL, silver-filled silicone rubber gaskets. These gaskets provide both environmental and electromagnetic sealing without damage to the busbar or coating.

FRAMING AND MOUNTING

Standard ECTC Windows can be mounted directly to the equipment panel or enclosure without an interface gasket using TECKNIT conductive epoxy. When using standard interface gasketing, TECKNIT standard framing is available.

STANDARD OPTICAL SUBSTRATE MATERIAL

Table 1. STANDARD THICKNESS (T)

MATERIALS	THICKNESS (T) in. [mm]	TOLERANCE in. [mm]
Acrylic	.062 [1.52]	±.016 [0.41]
	.125 [3.18]	±.020 [0.51]
Glass	.090 [2.29]	±.020 [0.51]
	.125 [3.18]	±.020 [0.51]

STANDARD WINDOW CONFIGURATION

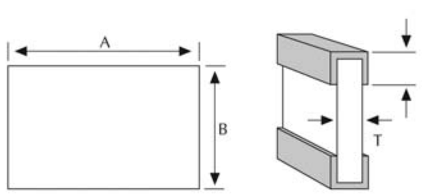


Figure 1. Window Dimensioning.

*Continuous Busbar around periphery (TECKNIT Silver Acrylic Conductive Coating).

STANDARD FRAME STYLES

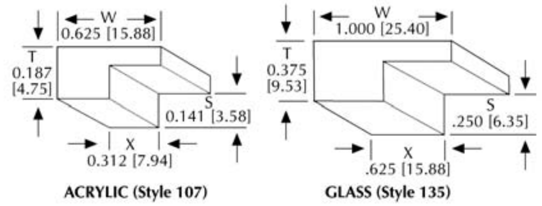


Figure 2. Frame Cross Section

STANDARD FRAME DIMENSIONING

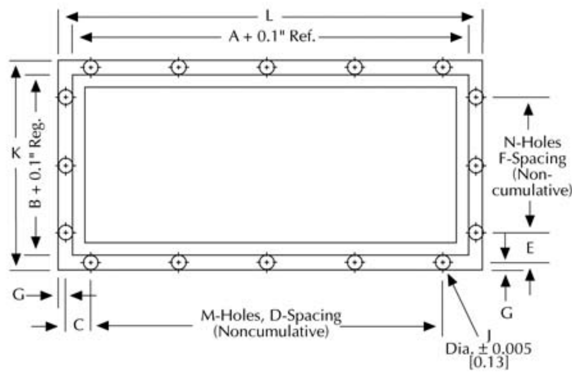


Figure 3. Overall Frame Style

STANDARD TOLERANCES

Table 2. SYMBOL	WINDOW DIMENSION	TOLERANCE
A,B	18 in. [up to 457 mm]	±.031 [0.79]
	FRAME	
C,D,E,F,G	12 in. [up to 305 mm]	±.015 [0.38]
	12-18 in. [305 to 457 mm]	±.020 [0.50]
K,L	12 in. [up to 102 mm]	±.015 [0.38]
	4-24 in. [102.1 to 610 mm]	±.031 [0.79]
	FRAME CROSS SECTION	
W,X	0-.750 in. [up to 19 mm]	±.010 [0.25]
	.750 -1.250 in. [19.1 to 31.8 mm]	±.012 [0.30]
S,T	.750 in. [up to 19 mm]	±.006 [0.15]

ORDERING INFORMATION

ECTC Windows are custom designed to customer specifications and drawings. Customer drawings should provide dimensional data as suggested in Figure 3 such as overall size, viewing area, window size and thickness (dimensions AxB), type of edge termination and interface gasket, type frame by style number and special options. For assistance, contact your TECKNIT representative or factory engineer.

Teckfilm™

TRANSPARENT CONDUCTIVE COATING ON POLYESTER FILM

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKFILM is a highly conductive coating deposited on a transparent polyester film. It is available in rolls 30" wide. Usable width is 28". The conductive coating is overcoated with a ceramic type film which serves to increase visible light transmission and to provide a protective barrier that exhibits electrical conductivity through the layer.

CONSIL®-II silver filled silicone elastomer material is recommended between the TECKFILM and conductive mating surface as an interface gasket and an environmental seal between the enclosure and TECKFILM window panel assembly.

APPLICATION INFORMATION

TECKFILM is designed for electric and planewave shielding, grounding and static discharge applications. TECKFILM is used as a transparent, shielding panel for visual displays in instrumentation equipment, control panels, computer processing, printers, peripheral equipment and large electrode displays as a grounding shield.

MOUNTING TECHNIQUES

Various methods of mounting are as follows:

1. Affixed to conductive mating surface with clamps or bonded with TECKNIT Two-Part RTV Silver Silicone Adhesive Sealant (Part No. 72-00036).

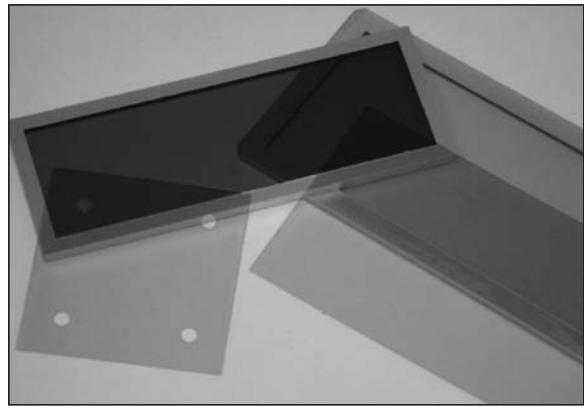
2. Mounted between a substrate and conductive mounting surface with or without the aid of edge bonding to the substrate.

NOTE: TECKFILM conductive surface can be marred if handled excessively.

EMI SHIELDING PERFORMANCE

TECKNIT TECKFILM Shielding Effectiveness has been tested in accordane with TECKNIT Test Method TSETS-01 which is based upon modified MIL-STD- 285. Typical shielding effectiveness values are based on a 5" square window.

MATERIAL	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz
TECKFILM	20 dB	90 dB	30 dB



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Substrate:** Polyester film .005 in. [0.13mm] thick, clear and colorless.
- **Conductive Coating:** Vacuum deposited thin metal film with protective ceramic coating.
- **Standard Bulk Material Part Number:** 70-00117

PERFORMANCE CHARACTERISTICS

- **Substrate and Coating**
  Surface Resistivity: 14 ohms/square (nominal) (±4 ohms/square).
  Visible Light Transmission: 70 to 80%.
  Temperature Range: -76°F to 300°F [-60°C to 150°C].

ORDERING INFORMATION

Fabricated and rule die cut window shapes up to 28" wide can be supplied. Contact your TECKNIT area representative or factory engineer for assistance.

Teckshield®-F

HIGH PERFORMANCE EMC WINDOWS

GENERAL DESCRIPTION

TECKSHIELD-F high-performance fully laminated flat windows are specially designed to provide optimum optical transmission and EMI shielding in severe interference environments. TECKSHIELD-F windows have proven to be effective in TEMPEST qualified Visual Display Units, as well as in printers and enclosures requiring large viewing apertures. A special low-resistance mesh is laminated between two layers of glass or acrylic. The edge termination between the window mesh and the enclosure is designed to provide uniform mesh-to-enclosure continuity around the entire perimeter of the shielding aperture.

FEATURES

- Full lamination provides rugged construction, prevents moisture intrusion or entrapment between optical layers, enhances optical contrast by elimination of two optical media-to- air interfaces.
- High shielding performance of large viewing apertures at a broad range of frequencies.
- Minimum optical distortion of viewed display.
- Design options include color filters and polarizers for contrast enhancement, which permit flexibility in matching optical and shielding requirements to specific applications.

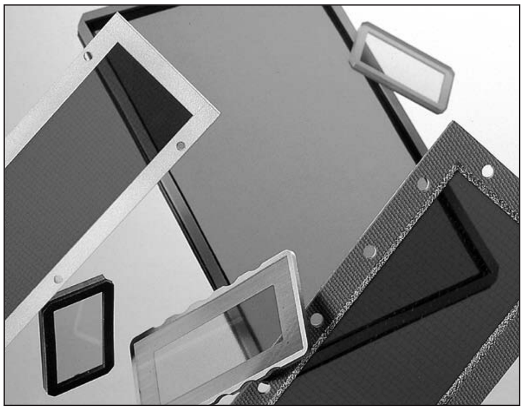
APPLICATION INFORMATION

TECKSHIELD-F high-performance flat windows are designed for enclosures requiring superior shielding against EMI radiation or susceptibility. They provide maximum EMI protection and high optical clarity for teleprinters, digital, graphic, and other flat displays. TECKSHIELD-F windows can also be economically matched to most visual display units to minimize image distortion and to maximize shielding effectiveness.

EMI SHIELDING PERFORMANCE

MESH SCREEN	H-FIELD 100 KHZ	E-FIELD 10 MHZ	PLANE WAVE 1 GHZ	PLANE WAVE 10 GHZ
100 OPI	55 dB	120 dB	60 dB	40 dB
145 OPI	55 dB	120 dB	80 dB	45 dB

Tested in accordance with TECKNIT Test Method TSETS-01, which is based upon modified MIL-STD-285. Typical Shielding Effectiveness values are based on a 5" square window.



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Standard Optical Media**
  Glass: Per Specification ASTM-C-1036, Type 1, Class 1.
  Acrylic: Per Federal Specification L-P-391, Type 1, Grade C (ASTM-D-4802).
- **Optical Media Options**
  Acrylic Colors: See Table 2.
  Anti-Reflection Coatings:
  Non-Glare Coating (Matte Finish).
  High Efficiency Anti-Reflection Coating (Less than 0.6% Reflection).
- **Mesh Screen**
  100 OPI: Blackened Copper Mesh 0.0022" Wire Diameter, 60% Open Area.
  145 OPI: Blackened Copper Mesh 0.0022" Wire Diameter, 45% Open Area.
  Interface Gasket: Copper Mesh Wrap-Around Termination. See Figure 2.
  Duogasket: See Figure 3.
  Busbar Termination: Tecknit Silver Acrylic Conductive Coating (Fig. 5)

PERFORMANCE CHARACTERISTICS

- **Operating & Storage Temperature**
  Glass: -67°F to 176°F [-55°C to 80°C]
  Acrylic: -67°F to 140°F [-55°C to 60°C]

U.S. Customary
[SI Metric]

STANDARD WINDOW CONSTRUCTION

Standard TECKSHIELD-F fully laminated window construction consists of: (a) Standard mesh screen, blackened and laminated between (b) two layers of standard optical medium (clear and colorless see Fig. 1), and with (c) an interfacial gasket (copper mesh wrap around or Duogasket) to provide electrical continuity between the window mesh and equipment enclosure. The Duogasket consists of an environmental seal and an EMI gasket seal.

Standard window thicknesses are 0.205 in. [5.2 mm] for glass substrates and 0.145 in. [3.68 mm] for acrylic substrates.

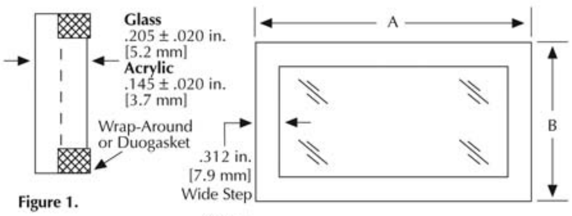


Figure 1.

Figure 2.

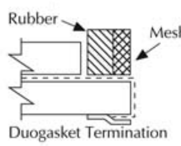


Figure 3.

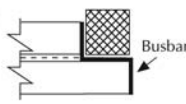


Figure 4.

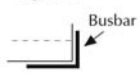


Figure 5.

FRAMING AND MOUNTING

Standard TECKSHIELD-F windows may be mounted directly to the equipment enclosure utilizing the recommended interface gasket termination shown in Figs. 2, 3, 4 and 5. When specifying a finished mounting frame for the standard window thickness shown in Fig. 1, provide a drawing of the frame as shown in Fig. 6 using the TECKNIT styles shown in Fig. 2-5.

In some instances, standard TECKSHIELD-F windows may be mounted directly to the equipment enclosure without an interface Duogasket by

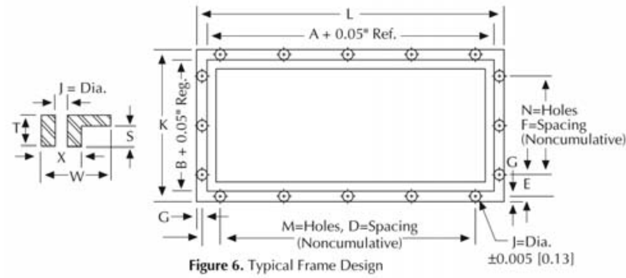


Figure 6. Typical Frame Design

using TECKNIT conductive epoxy to establish an electrical bond to the enclosure. Additional mechanical clips may be required to locate and mechanically secure the window to the enclosure.

STANDARD TOLERANCES

Table 1.

SYMBOL	WINDOW DIMENSION	TOLERANCE
A,B	18 in. [up to 457 mm]	±0.031 [0.79]
	FRAME DIMENSION	
C,D,E,F,G	up to 12 in. [305 mm] 12 to 18 in. [305-457 mm]	±0.015 [0.38] ±0.020 [0.50]
K,L	up to 4 in. [102 mm] 4 to 24 in. [102.1-610 mm]	±0.015 [0.38] ±0.031 [0.79]
	FRAME CROSS SECTION	
W,X	up to 0 - .750 in. [19 mm] .750 to1.250 in. [19.1-31.8 mm]	±0.010 [0.25] ±0.012 [0.30]
S,T	up to 0.750 in. [19 mm]	±0.006 [0.15]

ACRYLIC COLOR TRANSMISSION FILTERS

Table 2.

Red	Amber	Yellow	Green	Blue	Gray
2423	2422	2208	2092	2069	2514

ORDERING INFORMATION

TECKSHIELD-F high-performance windows are custom designed to customer specifications. Drawings should be provided that show dimensional data such as overall dimensions, mounting hole dimensions, desired viewing area, window and frame thickness (when required), type of edge terminations and interface gasket, type of frame or bezel and special options. For assistance contact your nearest TECKNIT area representative or factory location.

Teckshield®-F Polycarbonate Windows

FEATURES

- 80% open area-best light transmission of all Tecknit woven window meshes.
- Available as thin as .053" [1.35].
- -60°F to 158°F [-55°C to 70°C] operating temperature.
- All standard Tecknit EMI terminations available.

EMI SHIELDING PERFORMANCE

	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
80 OPI SS	35 dB	85dB	42 dB	30 dB
100 OPI SS	40 dB	105 dB	52 dB	35 dB

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Mesh Screen:** Blackened 304 stainless steel, .001" dia., 80 or 100 openings per inch.
- **Standard Substrate:** Polycarbonate, clear & colorless.
- **Available Upon Request**
  UL-94VO-rated polycarbonate
  Abrasion resistant & anti-glare coatings

Teckshield®-F Allycarbonate Windows

ALLYCARBONATE EMI SHIELDED WINDOWS

PHYSICAL & OPTICAL PROPERTIES OF MONOMER CASTING MEDIUM

Temperature Range:
-60ºCto 100ºC
-60ºC to 130ºC (1 Hour Duration)

Rockwell Hardness (M):
97 ASTM Test Method (D 785)

Visible Transmission %:
93.3 ASTM Test Method (D1003)

Tecknit Allylcarbonate shielded windows are manufactured by casting a woven EMI shield mesh into a material that has optical properties similar to that of glass. The window offers a lightweight, cost effective alternative to traditional glass laminated shielded windows and is a more flexible material to machine, making it more suited to meet the changing design demands that are part of modern electronics.

Available Standard Shielding Mesh Types

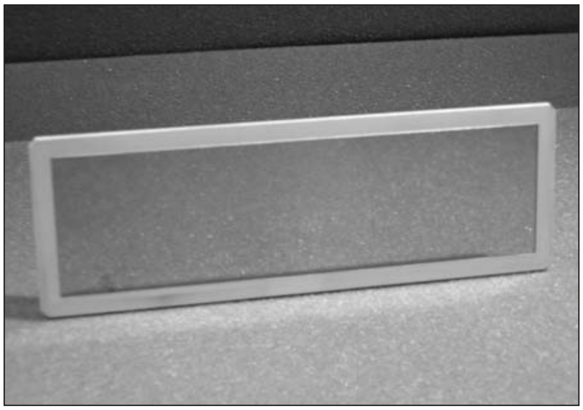
50 OPI - Blackened stainless steel woven screen 0.001 inch diameter wire
100 OPI - Blackened stainless steel woven screen 0.001 inch diameter wire
100 OPI - Blackened copper woven screen 0.002 inch diameter wire

Shielding Performance of Mesh Screens

	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	10 GHz
50 OPI	16db	45db	56db	36db
100 OPI	40db	105db	52db	35db
100 OPI	55db	120db	60db	40db

Note: (OPI Number of openings per inch of woven screen)

Some examples of shielding screens also available as a non-standard are, 80 OPI and 150 OPI woven materials, however lead times for these products may vary. Please contact our Sales Office.



Allylcarbonace windows are ideally suited to applications where there is a requirement to shield displays or visual apertures. Windows are machined using computerised programming technology This offers a facility to accurately engrave data or drill mounting holes into the window itself.

The windows operate in a very broad temperature range and have a high resistance to abrasion and most acids and solvents. The window product is ideally suited to many applications and is now supplied throughout a broad range of companies in military and Commercial Industries.

FEATURES

- 80% open area-best light transmission of all Tecknit woven window meshes.
- Available as thin as .053" [1.35].
- -60°F to 158°F [-55°C to 70°C] operating temperature.
- All standard Tecknit EMI terminations available.
- Cast Material Supplied as a Standard .079” [2mm] to .236” [6mm] thick Clear or medium-grade matte finish

Section F:
Air Vent Panels

U.S. Customary
[SI Metric]

Teckcell™-A & Paracell

ALUMINUM HONEYCOMB AIR VENT PANELS

U.S. Customary
[SI Metric]

TECKNIT

GENERAL DESCRIPTION

Standard TECKCELL air vent panels are constructed of aluminum honeycomb installed in an extruded aluminum frame. The "waveguide" style construction of the honeycomb provides high EMI shielding effectiveness combined with the highest airflow of any vent medium. Standard honeycomb cell size is 0.125 in.[3.2mm] wide by 0.50 in. [12.7mm] deep. Tin or electroless nickel plating may be used to improve shielding and environmental effectiveness.

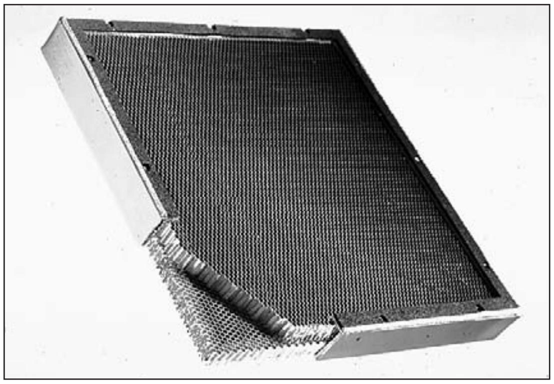
PARACELL shielding air vent panels are constructed of two parallel aluminum honeycomb medium layers installed in an extruded aluminum frame. Each layer of honeycomb is oriented 90° to each other (Fig. 1). This eliminates the polarization characteristics of straight honeycomb by greatly improving shielding effectiveness (with some compromise in air flow). Standard honeycomb cell size for each layer is .125 in. [3.2 mm] wide by .25 in. [6.4 mm] deep, yielding a total thickness of .500 in. [12.7 mm]. The panels may be plated with a chromate conversion coating for environmental protection. The PARACELL construction does not require tin or nickel plating for improved shielding effectiveness.

APPLICATION INFORMATION

TECKCELL-A and PARACELL air vent panels are furnished ready to install with standard framing and EMI shielding gaskets. For surface mounted applications use frame style 21 (Fig. 4) with a DUOGASKET. For recessed applications use frame style 23 (Fig. 5) with a TECKNIT STRIP GASKET. The DUOGASKET is made of neoprene sponge and knitted copper clad steel. The STRIP GASKET consists of knitted copper clad steel mesh. Panels with a length or width exceeding 24in. [610mm] need cross braces.

For special applications round TECKCELL-A vent panels are available (Fig. 6). The frames are made of spun aluminum. Where the construction must be drip proof, aluminum honeycomb is available slanted downward at 30°, 45° and 60° (Figs. 7, 8).

Flexible .125 in. [3.2 mm] thick polyurethane filter foam is available for TECKCELL-A and PARACELL panels to filter out dust particles (frame style 21 only). Based on specifications from the



Air Filter Institute filter foam provides an average arrestance of 50%. In designs requiring special framing, supply a sketch and/or contact your representative or the factory.

If greater structural support is required or severe environmental conditions exist, steel honeycomb or brass honeycomb is recommeded.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Frame**
  Aluminum alloy: 6063-T1 per QQ-A-200/9 (ASTM-B-221).
- **Honeycomb**
  Aluminum alloy: 5052 Grade B, per MIL-C-7438.
- **EMI Gasket**(1)
  Wire Mesh: Sn/Cu/Fe/ (tin coated, copper-clad steel) wire per ASTM B-520.
  Elastomer: Neoprene sponge per MIL-R-6130, Type II, Grade A, Condition Medium (ASTM-D-6576)
- **Threaded Inserts**(2)
  Steel alloy, cadmium plated, 6-32 UNC-2B or 8-32 UNC-2B

FINISH DESCRIPTION

- **Chromate:** Trivalent Chromium Coating in compliance with the EU RoHS Directive 2002/95/EC.
- **Options**
  Tin(3)**:** Tin plate per MIL-T-10727, Type 1 (ASTM-D-545).
  Nickel: Electroless Nickel plate per MIL-C-26074A, Class 1, Grade B (SAE-AMS-C-26074).
  Chromate: Chromate conversion coating per MIL-C-5541, Class 1 A or 3A.

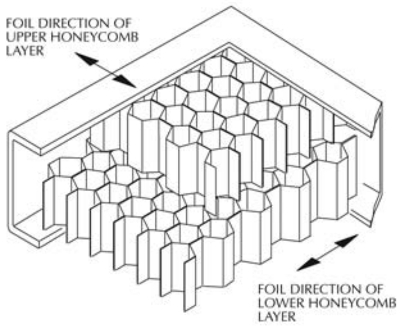
(1) Reference DUOGASKET Data or Tecknit Strips Data. (2) Threaded inserts available on request. (3) Frame requires drain holes for plating.

EMI SHIELDING PERFORMANCE

TECKNIT TECKCELL-A and PARACELL shielding effectiveness has been tested in accordance with Tecknit Test Method TSETS-01 and is based on modified MIL-STD-285. Typical values for a 5 in. square panel are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
PLATING	dB	dB	dB	dB
Chromate	40	80	60	40
Tin	70	125	105	85
Nickel	80	135	115	95
PARACELL	**H-FIELD 100 kHz**	**E-FIELD 10 MHz**	**PLANE WAVE 1 GHz**	**PLANE WAVE 10 GHz**
PLATING	dB	dB	dB	dB
Chromate	65	110	95	85

Figure 1. 90º Oriented Paracell Panel

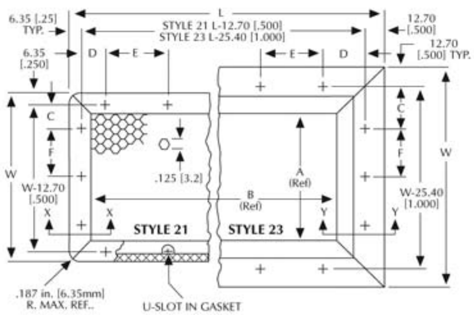


DIMENSIONAL TOLERANCES FOR TECKCELL-A AND PARACELL PANELS

Ref. Figures 1 and 2

FEATURE	FRAME DIMENSION	TOLERANCE
LW	0-8 in. [0-200mm] 8-24 in. [201-610mm] >24 in. [Over 610mm]	±.015 in. [±0.38mm] ±.031 in. [±0.76mm] ±.062 in. [±1.57mm]
Hole/Fastener Locations	C,D,E,F	±.015 in. [± 0.38 mm]
Hole Diameter	All	±.005 in. [± 0.13 mm]
Frame Cross Section	All	±.010 in. [± 0.25 mm]
	EMI GASKET*	
Mesh: Height & Width	up to 187 in. [4.75 mm]	+ .016, - 0 in. [+ 0.41, - 0 mm]
Elastomer: Height	up to .100 in. [2.54 mm]	±.016 in. [0.41 mm]
Width	up to .500 in. [12.7 mm]	± .031 in. [0.79mm

Figure 2. Vent Panel Frame Dimensions (Ref.Table 1.)



TECKCELL-A PANEL FRAME STYLE 21 DIMENSIONS

Table I. (Ref. Figure 2)

OPENING AREA in.2 [cm2] (Ref)	AxB (Ref) in. [mm]	FRAME DIMENSION WxL in. [mm]	C in. [mm]	D in. [mm]	E in. [mm]	F in. [mm]	NUMBER OF FASTENERS W Side	L Side	TECKNIT** PART NO. Std. 8.32 Fasteners	Std. .204 Dia. Holes	No Holes or Fasteners
4 [25.81]	2x2 [50.8x50.8]	3x3 [76.2x76.2]	1.250 [31.75]	1.250 [31.75]	-	-	1	1	60-70929	60-02052	60-02002
9 [58.06]	3x3 [76.2x76.2]	4x4 [101.6x101.6]	1.750 [44.45]	1.750 [44.45]	-	-	1	1	60-70200	60-02053	60-02003
15 [96.77]	3x5 [76.2x127.0]	4x6 [101.6x152.4]	1.750 [44.45]	1.000 [25.40]	3.500 [88.90]	-	1	2	60-70201	60-02054	60-02004
16 [103.23]	4x4 [101.6x101.6]	5x5 [127.0x127.0]	2.250 [57.15]	.750 [19.05]	3.000 [76.20]	-	1	2	60-70204	60-02055	60-02005
21 [135.48]	3x7 [76.2x177.8]	4x8 [101.6x203.2	1.750 [44.45]	.750 [19.05]	3.000 [76.20]	-	1	3	60-70202	60-02056	60-02006
24 [154.84]	4x6 [101.6x152.4]	5x7 [127.0x177.8]	2.250 [57.15]	1.500 [38.10]	3.500 [88.90]	-	1	2	60-70205	60-02057	60-02007
25 [161.29]	5x5 [127.0x127.0]	6x6 [152.4x152.4]	1.000 [25.40]	1.000 [25.40]	3.500 [88.90]	3.500 [88.90]	2	2	60-70207	60-02058	60-02008
33 [212.91]	3x11 [76.2x279.4]	4x12 [101.6x304.8]	1.750 [44.45]	1.250 [31.75]	3.000 [76.20]	-	1	4	60-70203	60-02059	60-02009
35 [225.81]	5x7 [127.0x177.8]	6x8 [152.4x203.2]	1.250 [31.75]	.750 [19.05]	3.000 [76.20]	3.000 [76.20]	2	3	60-70208	60-02060	60-02010
36 [232.26]	6x6 [152.4x152.4]	7x7 [177.8x177.8]	1.500 [38.10]	1.500 [38.10]	3.500 [88.90]	3.500 [88.90]	2	2	60-70211	60-02061	60-02011
36 [232.26]	4x9 [101.6x228.6]	5x10 [127.0x254.0]	2.250 [57.15]	1.250 [31.75]	3.500 [88.90]	-	1	3	60-70206	60-02062	60-02012
42 [270.97]	3x14 [76.2x355.6]	4x15 [101.6x381.0	1.750 [44.45]	1.250 [31.75]	3.000 [76.20]	-	1	5	60-71042	60-02063	60-02013
48 [309.68]	3x16 [76.2x406.4]	4x17 [101.6x431.8]	1.750 [44.45]	1.250 [31.75]	3.500 [88.90]	-	1	5	60-71043	60-02064	60-02014
49 [316.13]	7x7 [177.8x177.8]	8x8 [203.2x203.2]	2.000 [50.80]	.750 [19.05]	3.000 [76.20]	3.500 [88.90]	2	3	60-70214	60-02065	60-02015
54 [348.39]	6x9 [152.4x228.6]	7x10 [177.8x254.0]	1.500 [38.10]	1.250 [31.75]	3.500 [88.90]	3.500 [88.90]	2	3	60-70212	60-02066	60-02016
55 [354.84]	5x11 [127.0x279.4]	6x12 [152.4x304.8]	1.000 [25.40]	1.250 [31.75]	3.000 [76.20]	3.500 [88.90]	2	4	60-70209	60-02067	60-02017
63 [406.45]	7x9 [177.8x225.6]	8x10 [203.2x254.0]	2.000 [50.80]	1.250 [31.75]	3.500 [88.90]	3.500 [88.90]	2	3	60-71044	60-02068	60-02018
70 [451.61]	5x14 [127.0x355.6]	6x15 [152.4x381.0]	1.000 [25.40]	1.250 [31.75]	3.000 [76.20]	3.500 [88.90]	2	5	60-71045	60-02069	60-02019
77 [496.77]	7x11 [177.8x279.4]	8x12 [203.2x304.8]	.750 [19.05]	1.250 [31.75]	3.000 [76.20]	3.000 [76.20]	3	4	60-70215	60-02070	60-02020
78 [503.22]	6x13 [152.4x330.0]	7x14 [177.8x355.6]	1.500 [38.10]	1.500 [38.01]	3.500 [88.90]	3.500 [88.90]	2	4	60-70213	60-02071	60-02021
81 [522.58]	9x9 [228.6x228.6]	10x10 [254.0x254.0]	1.250 [31.75]	1.250 [31.75]	3.500 [88.90]	3.500 [88.90]	3	3	60-70217	60-02072	60-02022
85 [548.39]	5x17 [127.0x431.8]	6x18 [152.4x457.2]	1.000 [25.40]	1.250 [31.75]	3.750 [95.25]	3.500 [88.90]	2	5	60-70210	60-02073	60-02023
91 [587.10]	7x13 [177.8x330.2]	8x14 [203.2x355.6]	.750 [19.05]	1.500 [38.10]	3.500 [88.90]	3.000 [76.20]	3	4	60-71046	60-02074	60-02024
105 [677.42]	7x15 [177.8x381.0]	8x16 [203.2x406.4]	.750 [19.05]	1.250 [31.75]	3.250 [82.55]	3.000 [76.20]	3	5	60-70216	60-02075	60-02025
117 [754.84]	9x13 [228.6x330.2]	10x14 [254.0x355.6]	1.250 [31.75]	1.500 [38.10]	3.500 [88.90]	3.500 [88.90]	3	4	60-70218	60-02076	60-02026
121 [780.64]	11x11 [274.4x279.4]	12x12 [304.8x304.8]	1.250 [31.75]	1.250 [31.75]	3.000 [76.20]	3.000 [76.20]	4	4	60-70220	60-02077	60-02027
153 [987.09]	9x17 [228.6x431.8]	10x18 [254.0x457.2]	1.250 [31.75]	1.250 [31.75]	3.750 [95.25]	3.500 [88.90]	3	5	60-70219	60-02078	60-02028
165 [1,064.51]	11x15 [279.4x381.0]	12x16 [304.8x406.4]	1.250 [31.75]	1.250 [31.75]	3.250 [82.55]	3.000 [76.20]	4	5	60-70221	60-02079	60-02029
196 [1.264.51]	14x14 [355.6x355.6]	15x15 [381.0x381.0]	1.250 [31.75]	1.250 [31.75]	3.000 [76.20]	3.000 [76.20]	5	5	60-71047	60-02080	60-02030
209 [1,348.38]	11x19 [279.4x482.6]	12x20 [304.8x508.0]	1.250 [31.75]	1.000 [25.40]	3.500 [88.90]	3.000 [76.20]	4	6	60-70222	60-02081	60-02031
253 [1,632.25]	11x23 [279.4x584.2]	12x24 [304.8x609.6]	1.250 [31.75]	1.250 [31.75]	3.500 [88.90]	3.000 [76.20]	4	7	60-70223	60-02082	60-02032
324 [2,090.32]	18x18 [457.2x457.2]	19x19 [482.6x482.6]	1.750 [44.45]	1.750 [44.45]	3.000 [76.20]	3.000 [76.20]	6	6	60-71048	60-02083	60-02033

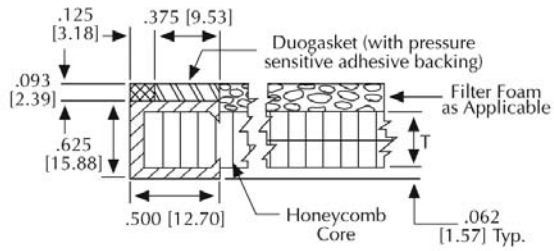
**To order standard TECKCELL-A Panels with Filter Foam, change third digit to a 3 (60-3XXXX)

Teckcell™-A & Paracell cont.

U.S. Customary
[SI Metric]

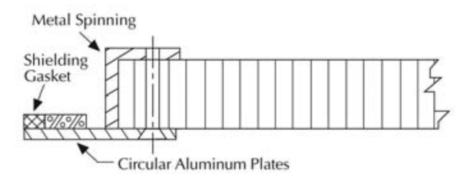
FRAME STYLE 21

Figure 4.



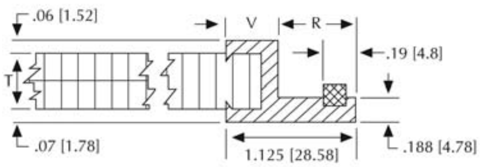
CIRCULAR PANELS

Figure 6.



FRAME STYLE 23

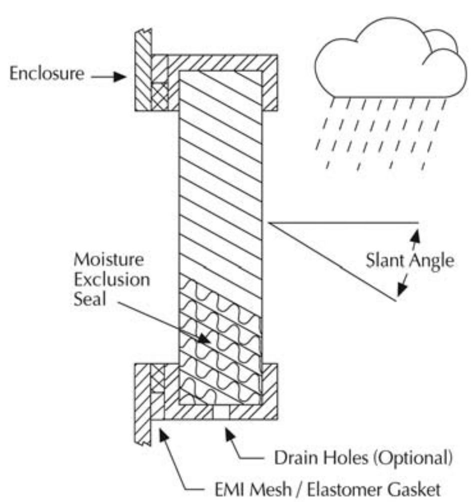
Figure 5.



FRAME STYLE 23: For T=.500in., V=10.03 [.395], R=18.54 [.73]
For T=.750in. and 1.00in., V=9.53 [.375], R=19.05 [.75]

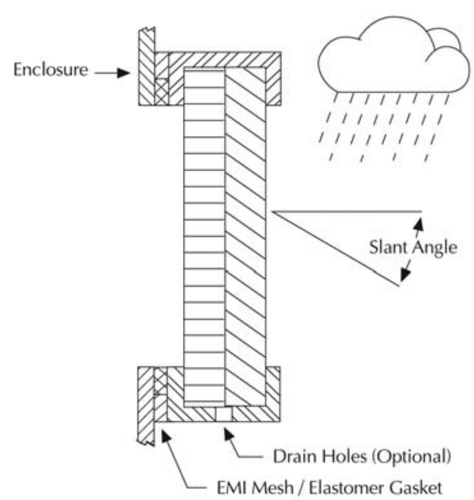
TECKCELL-A RAINSHIELD

Figure 7.



PARACELL RAINSHIELD

Figure 8.



HONEYCOMB CORE SELECTOR

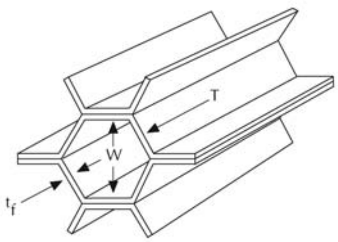


Table 2.

Code Cell No.	Width Cell (W) in. [mm]	Depth (T) in.[mm]	Foil Thickness (tf)
CS 1	.125 [3.18]	.500 [12.70]	.0015 [0.04]
CS 2	.125 [3.18]	.750 [19.05]	.0015 [0.04]
CS 3	.125 [3.18]	1.000 [25.40]	.0015 [0.04]
CS 8	.250 [6.35]	1.000 [25.40]	.003 [0.08]
CS 9	.125 [3.18]	*.500 [12.70] 30° slant	.0015 [0.04]
CS 10	.125 [3.18]	*.500 [12.70] 45° slant	.0015 [0.04]
CS 11	.125 [3.18]	*.500 [12.70] 60° slant	.0015 [0.04]

*Cell depth is variable depending on angle. Honeycomb thickness is .500 in. [12.7 mm]

For filter foam use suffix "F" at the end of the honeycomb core selector code number (see Table 2). Standard foam color is charcoal gray. (Example call-out: CS1F)

FINISH SELECTOR

Table 3.

Code No.	Finish
FS1	No Finish
FS2	Chromate Conversion Coating
FS5	Tin Plate
FS6	Electroless Nickel Plate

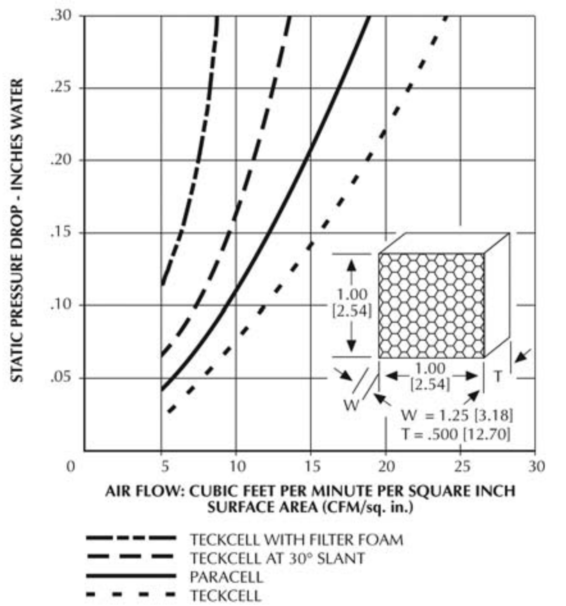
PANEL HOLE OR FASTENER SELECTOR

Table 4.

Code No.	Hole and Fastener Information
HF1	No holes or fasteners in frame
HF2	Panel with .204 in. [5.18 mm] dia. through holes.
HF3	Panel with 8-32 blind fasteners
HF4	Panel with 6-32 blind fasteners

TECKCELL-A AND PARACELL AIR FLOW CHARACTERISTICS

Figure 9.



NOTE: To determine AIR FLOW, divide total air flow (CMF) delivered by the number of square inches (AxB) of the vent panel to find CFM/ sq. in. From this value, determine the static pressure drop across the vent panel. The reverse operation can be used to limit the static pressure drop to a given value by selecting the proper size vent panel (dimensions A & B) and limiting the CFM/sq. in.

ORDERING INFORMATION

To order Tecknit aluminum honeycomb air vent panels, the following information should be provided: Teckcell-A or Paracell type panels, overall dimensions, frame style, honeycomb core, finish and mounting provisions (see Tables 2, 3, 4).

Teckcell™-S/B

STEEL AND BRASS HONEYCOMB AIR VENT PANELS HIGH PERFORMANCE VENT PANELS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKCELL-S/B high-performance vent panels are made of a framed honeycomb medium to ensure optimum shielding and ventilation. The panels are framed and gasketed to provide ready-to-install honeycomb panel assemblies. TECKCELL-S/B panels are available in two honeycomb media, steel or brass, and two standard framing styles. Standard honeycomb cell size is 0.125 in. [3.2 mm] wide by 0.500 in. [12.7 mm] deep. The panels can be plated with tin, cadmium or nickel for environmental protection. Optional framing styles and media sizes are available on special order.

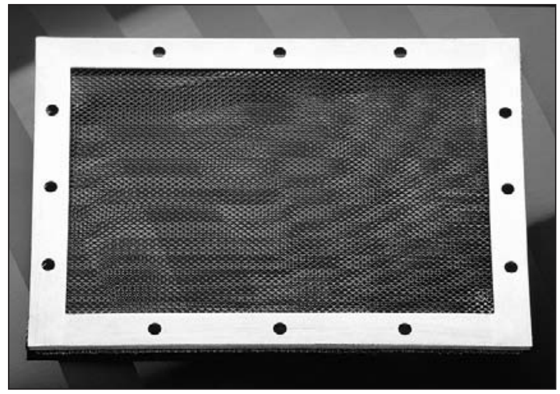
APPLICATION INFORMATION

TECKCELL-S/B steel and brass panels are used on electronic equipment enclosures that require highest EMI shielding effectiveness for the most demanding requirements. These panels are used in military shelters and equipment where EMP shielding or TEMPEST requirements are specified. For extreme environmental conditions such as harsh fumes and salt spray, use brass honeycomb air vent panels.

EMI SHIELDING PERFORMANCE

TECKNIT TECKCELL-S/B PANELS Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD-285. Typical values for a 5" square panel are given below.

	H-FIELD	E-FIELD	PLANE WAVE	
TECKCELL S/B	100 kHz	10 MHz	1 GHz	10 GHz
PLATING	dB	dB	dB	dB
Tin	85	135+	115	110



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Frame**
  Teckcell-Steel: SAE 1010
  Teckcell-Brass: Alloy 260
- **Honeycomb**
  Teckcell-Steel: Per QQ-S-698, Alloy C-1010
  Teckcell-Brass: Per QQ-B-613 (ASTM-B-36), Alloy 260
- **EMI Gasket**(1)
  Wire Mesh: Sn/Cu/Fe (tin coated, copper-clad steel) wire per ASTM B-520.
  Elastomer: Neoprene sponge per MIL-R-6130, Type II, Grade A, Cond. Med.

FINISH DESCRIPTION

Tin(2)**:** Tin plate per MIL-T-10727, Type 1. (ASTM-B-545)

Nickel: Electroless Nickel plate per MIL-C-26074A, Class 1, Grade B. (SAE-AMS-C-26074)

PERFORMANCE

- **Temperature Range:**
  Teckcell-Steel: -80°F to 400°F [-63°C to 204°C]
  Teckcell-Brass: -80°F to 400°F [-63°C to 204°C]

(1) Reference Duogasket Data Sheet. Optional mesh material available.
(2) Requires drain holes for plating.

STANDARD FRAMES-STEEL (Style 41, 43)
STANDARD FRAMES-BRASS (Style 51, 53)

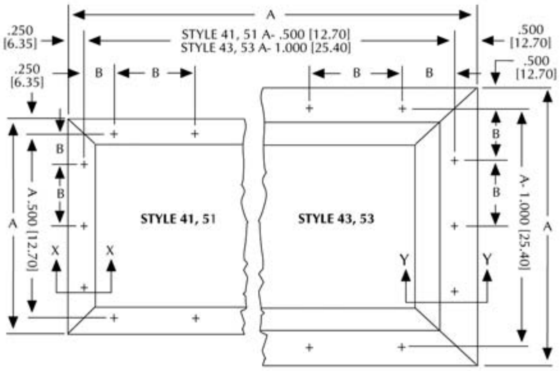
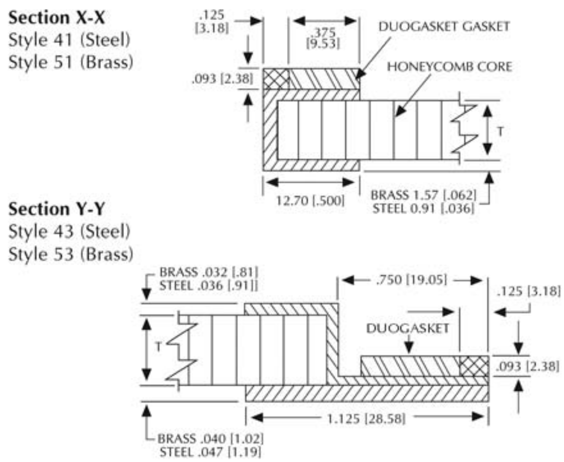


Figure 1. Frame Dimensions.
Note (1): Duogaskets have U slots at fastener or hole locations.
Note (2): Drain holes are standard on plated panels.



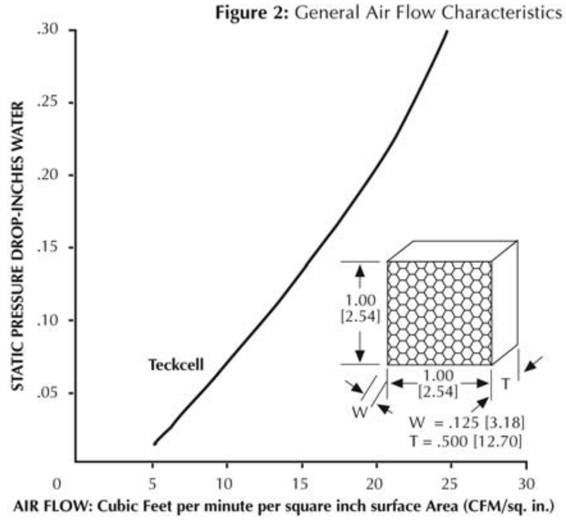
DIMENSIONAL TOLERANCES FOR TECKCELL-S/B PANELS

FRAME		
FEATURE	**DIMENSION**	**TOLERANCE**
A	0-8 in.[0-203 mm] 8-24 in.[203-610 mm] >24 in.[over 610 mm]	±.015 in.[0.38 mm] ±.032 in.[0.76 mm] ±.062 in.[1.57 mm]
Hole/Fastener Locations	B	±.015 in.[0.38 mm]
Hole Diameter	All	±.005 in.[0.13 mm]
Frame Cross Section	All	±.010 in.[0.25 mm]

EMI GASKET*		
FEATURE	**DIMENSION**	**TOLERANCE**
Mesh Height & Width	up to .188 in. [4.78 mm]	+.016, -0 in. [+0.41, -0 mm]

TECKCELL-S/B AIR FLOW CHARACTERISTICS

Figure 2: General Air Flow Characteristics



Note: To determine AIR FLOW divide total air flow (CFM) delivered by the number of square inches (AxB) of the vent panel to find CFM/ sq. in. From this value, determine the static pressure drop across the vent panel. The reverse operation can be used to limit the static pressure drop to a given value by selecting the proper size vent panel (dimensions A & B) and limiting the CFM/sq. in.

CUSTOM OPTIONS

Framing - For panels requiring alternate frame designs supply a drawing for part number assignment.

Honeycomb Media - Standard cell size is 0.125" x 0.500" [3.17 mm wide by 12.7 mm deep]. Cell sizes other than standard, such as 0.250 in. [6.34 mm] wide by 1.00 in. [25.4 mm] deep, are also available to provide improved shielding and/or air flow.

Mounting holes - Panels can be provided with hole patterns to customer specifications.

ORDERING INFORMATION

TECKCELL-S/B air vent panels specifications should include: frame style and dimensions, core material, frame and core finish, and mounting provisions. Customer panels using materials and finishes, other than those called out on this data sheet, should include appropriate material specifications and detailed dimensional data. For assistance contact your nearest TECKNIT representative or factory location.

Teckcell™-A (LP)

LOW PROFILE, ALUMINUM, SHIELDING AIR VENT PANELS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKCELL-A (LP) panels have been developed by Tecknit to satisfy the need for a thin, low cost, EMI shielding vent panel that does not compromise shielding performance.

These new vents utilize .250" [6.35 mm] thick honeycomb (.125" [3.2 mm] cell width) and dispel the belief that honeycomb shielding panels are an expensive solution, limited to military grade shielding problems. They provide excellent air flow and EMI shielding performance for commercial and low profile applications. These cost effective panels are available with the following gasket materials.

- Beryllium copper fingers for EMI protection.
- Oriented wires in silicone for EMI protection and environmental sealing.

EMI SHIELDING PERFORMANCE

Shielding effectiveness has been tested in accordance with TECKNIT test method TSETS-01, based upon modified MIL-STD-285. Typical values are given below.

TECKCELL A	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB
Be/Cu Gasket	70	50	30
Elastomet	60	40	25

SPECIFICATIONS

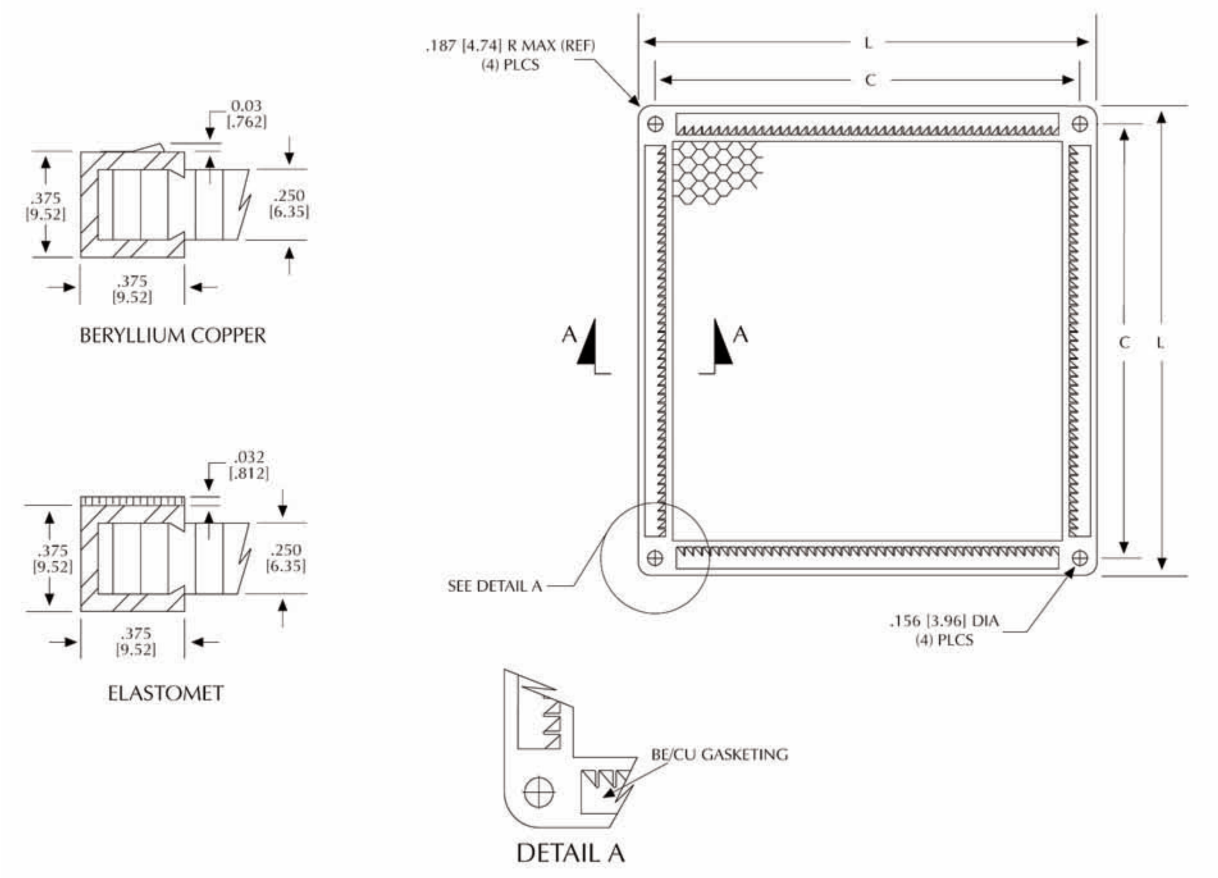
MATERIAL DESCRIPTION

- **Frame:** Aluminum alloy 6063-T1 per QQ-A-200/9 (ASTM-B-221).
- **Honeycomb:** Aluminum alloy 5052 Grade B, Class 2 per MIL-C-7438.
- **EMI Gaskets**
  Beryllium Copper Fingerstock: 55-45000
  Elastomet: Monel wires in solid silicone rubber.

FINISH DESCRIPTION

- **Standard:** Trivalent Chromium Coating in compliance with the EU RoHS Directive 2002/95/EC.
- **Optional:** Tin plate per MIL-T-10727 Type 1 (ASTM)-B-545). Electroless nickel-plate per MIL-C-26074A, Class 1, Grade B (SAE-AMS-C-26074).
  Chromate conversion coating per MIL-C-5541, Class 1A or 3A.

DIMENSIONS FOR LOW PROFILE TECKCELL-A VENT PANELS



PART NUMBERS

DIMENSIONS		GASKETING	
L	**C**	**Be/Cu**	**Elastomet**
± .015" [0.38 mm]	± .010" [0.25 mm]		
2.36 [59.94]	1.97 [50.03]	60-40001	60-40011
3.14 [79.75]	2.81 [71.37]	60-40002	60-40012
3.62 [91.94]	3.25 [82.55]	60-40003	60-40013
4.69 [119.12]	4.13 [104.90]	60-40004	60-40014

ORDERING INFORMATION

To order TECKCELL-A (LP) air vent panels, simply specify the standard items by the part numbers listed on this page. For custom sizes or any special air vent requirements, please contact the factory.

Teckscreen™

DUST ARRESTING EMI SHIELDING AIR VENT PANELS

U.S. Customary
[SI Metric]

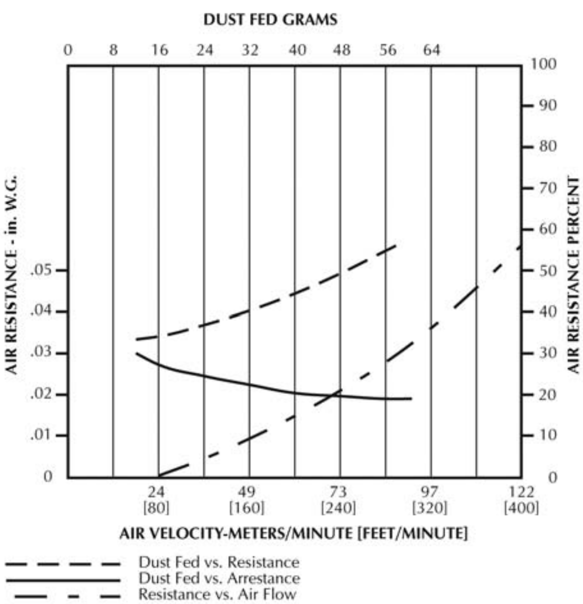
GENERAL DESCRIPTION

TECKSCREEN Panels consist of three layers of aluminum wire screen sandwiched between rigid expanded metal and installed within a frame. Standard TECKSCREEN panels are available with an EMI gasket on the panel frame to provide a superior shielding interface. TECKSCREEN Panels are an alternative to panels with honeycomb constructions.

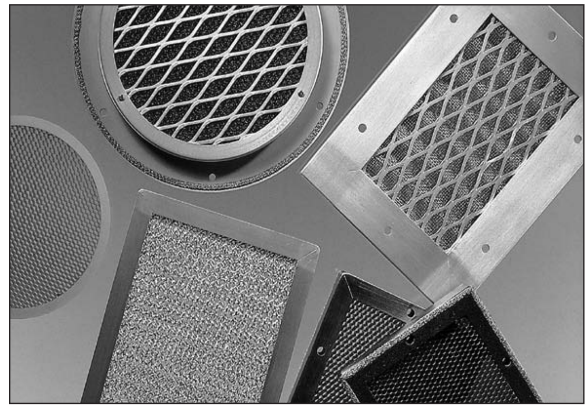
APPLICATION INFORMATION

TECKSCREEN Panels are used in applications requiring both EMI shielding and an air filter medium for ventilation or inlet cooling. Typical applications include electronic equipment enclosures, mobile military control stations, and shielding rooms. Most standard air fans or blower packages can be mounted behind TECKSCREEN Panels. TECKSCREEN Panels have been evaluated for their air flow characteristics. Results of these tests for a filter face area of 1.0 ft.2 [0.09 m2] are shown below in Figure 1.

Figure 1. Air Filtration



Note: Rated Capacity, 320 ft.3/min. [9m3/min.]. Dust holding capacity 12.1 grams. Average Arrestance 20.2%.



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Frame:** Aluminum alloy 6063-T1 per QQ-A-200/9 (ASTM-B-221).
- **Expanded Metal Screen:** Aluminum alloy 3003-H14 per ASTM B-209
- **Wire Screen:** Aluminum 5154 alloy wire fabric.
- **EMI Gasket**(1)

  Wire Mesh: Sn/Cu/Fe (tin coated, copper clad steel) wire per ASTM B-520.

  Elastomer: Neoprene sponge per MIL-R-6130, Type II, Grade A, Condition Medium. (ASTM-D-6576)
- **Blind Fastener**(2)**:** Steel alloy, cadmium plated 6-32 UNC-2B or 8-32 UNC-2B

FINISH DESCRIPTION

- **Chromate**(3)**:** Trivalent Chromium conversion coating in compliance with EU RoHS Directive 2002/95/EC.

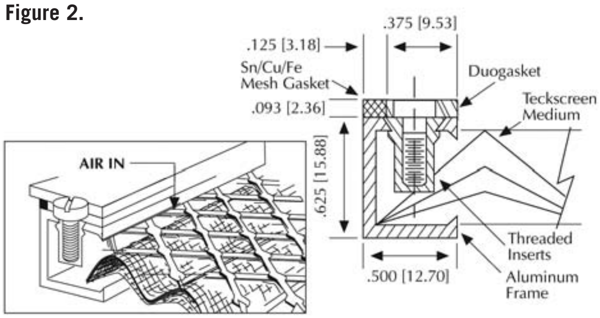
(1) Reference Duogasket or Tecknit Strip Data Sheet
(2) Threaded inserts are available on request
(3) For other finishes contact Tecknit.

STANDARD FRAMING AND MOUNTING DESIGNS

Specially designed aluminum extrusions can be manufactured into frames to provide convenient mounting assemblies. TECKSCREEN panels may be mounted over or through openings in equipment enclosures. Panels with standard extrusions are supplied with a TECKNIT EMI gasket already installed. Requirements for holes, studs or threaded inserts should be included when specifying panels.

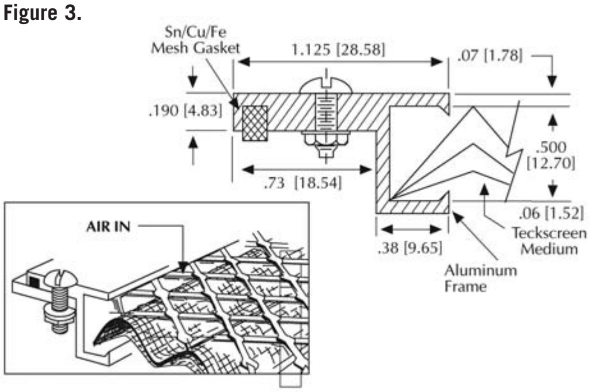
FRAME STYLE 93

Figure 2.



FRAME STYLE 104

Figure 3.



EMI SHIELDING PERFORMANCE

TECKNIT TECKSCREEN Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MILSTD-285. Typical values for a 5" square panel are given below.

TECKSCREEN	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
PLATING	dB	dB	dB	dB
Chromate	70	120	80	60

TECKSCREEN PANELS DIMENSIONAL TOLERANCE

FEATURE	DIMENSION	TOLERANCE
FRAME		
Length & Width	up to 8 in. [203 mm]	±.015 in. [0.4 mm]
	8-24 in. [203-610 mm]	±.031 in. [0.8 mm]
	Over 24 in. [611 mm]	±.060 in. [1.6 mm]
Hole Locations	ALL	±.015 in.[0.4 mm]
Hole Diameters	ALL	±.005 in. [0.13 mm]
Frame Cross Sections	ALL	±.010 in. [0.25 mm]
EMI GASKETS		
FEATURE	**DIMENSION**	**TOLERANCE**
Mesh:		
Height & Width	Up to .125 in. [3.18 mm]	+ .016, - 0 in. [0.41, 0 mm]
Elastomer:		
Height	Up to .100 in. [2.54 mm]	±.016 in. [0.41 mm]
Width	Up to .500 in. [12.7 mm]	±.031 in. [0.79 mm]

ORDERING INFORMATION

When ordering TECKSCREEN Air Vent Panels, specifications should include: frame style number, overall frame and opening dimensions, air flow direction, hole locations and fastener requirements. For specifications assistance, contact your nearest TECKNIT area representative or factory location.

Teckaire®

LOW PROFILE DUST AND EMI FILTERING AIR VENT PANELS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

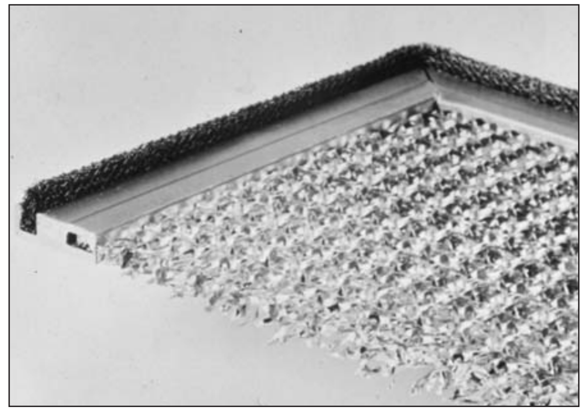
TECKAIRE panels are made of a viscous impingement filter medium framed within an aluminum extrusion. They are extremely low profile vents and require only .2 in. [5 mm] of inside enclosure depth. TECKAIRE panels combine excellent dust arrestance and shielding properties with minimal restriction of air flow. They are available with an EMI gasket on the panel frame to provide a superior shielding interface. Maximum overall size of TECKAIRE panels is 12x25 in. [305x610 mm] requiring cross braces to reinforce the frame.

APPLICATION INFORMATION

TECKAIRE panels are used on electronic equipment enclosures and shielded rooms. They are especially suited for applications requiring a shielding vent panel of minimum depth. TECKAIRE panels will perform under harsh environmental conditions and meet MIL-E-5272C, Section 4.6, salt spray test.

AIR FLOW CHARACTERISTICS (WITH VISCOUS FILTER COATING)

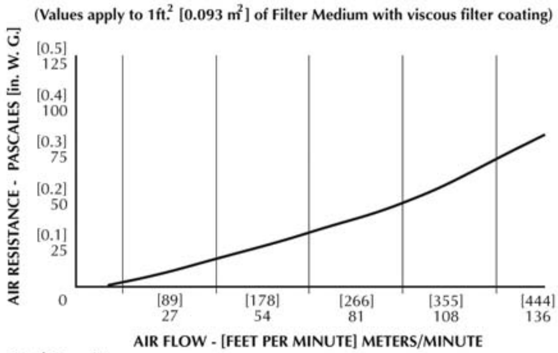
At the rated air velocity of 355 feet per minute, the pressure drop through TECKAIRE with viscous filter coating is less than .22 in W.G. [55 Pascals]. At this velocity, average dust arrestance is 45% with about 12 grams of dust retained for each 1 ft.2[0.093 m2] of filter area. Standard TECKAIRE Filters are supplied without a viscous impingement coating. When specified, TECKAIRE Filters will be furnished with a viscous impingement coating consisting of a water soluble film of hydrocarbon oil. Dust saturated filters may be washed in water, recoated, and returned to service.



TECKAIRE AIRFLOW AND FILTRATION CHARACTERISTICS

Figure 1.

(Values apply to 1ft.^{2} [0.093 m^2] of Filter Medium with viscous filter coating)



Rated Capacity
Air Flow, 355 ft.^{3}/min. [10 m^3/min.]. Dust holding capacity, 12 grams.
Average Arrestance, 45%.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Frame:** Aluminum alloy 6063-T1 per QQ-A-200/9 (ASTM-B-221).
- **Filter Medium:** Aluminum alloy 1145-H-19, with interlayer polyethylene binder.
- **EMI Gasket**

  Wire mesh: Sn/Cu/Fe (tin coated, copper clad steel) wire per ASTM B-520.

  Viscous Filter Coating(1): Water soluable hydrocarbon oil film.

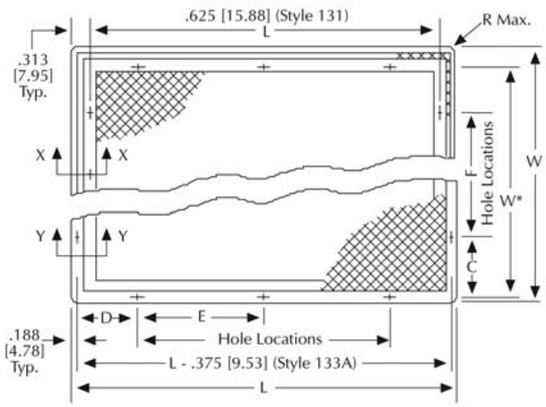
FINISH DESCRIPTION

- **Chromate:** Trivalent Chromium conversion coating in compliance with Eu RoHS Directive 2002/95/EC.

(1) Upon request the panels are coated with a viscous impingement coating.

VENT PANEL FRAME DIMENSIONING

Figure 2.



FEATURE	FRAME DIMENSION	TOLERANCE
Length & Width	up to 8 in. [203 mm]	±.015 in. [0.4 mm]
	8-24 in. [204-610 mm]	±.031 in. [0.8 mm]
	> 24 in. [610 mm]	±.062 in. [1.6 mm]
Hole Locations	C,D,E,F	±.015 in.[0.38 mm]
Hole Diameters	ALL	±.005 in. [0.13 mm]
Frame Cross Sections	ALL	±.010 in. [0.25 mm]

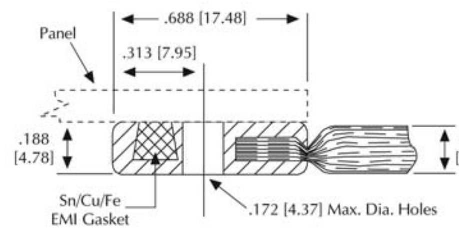
EMI SHIELDING PERFORMANCE

TECKNIT TECKAIRE Shielding Effectiveness has been tested in accordance with TECKNIT Test Method TSETS-01 and based upon modified MIL-STD- 285. Typical Shielding Effectiveness values are based on a 5" square panel.

TECKAIRE	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
PLATING	dB	dB	dB	dB
Chromate	60	125	75	55

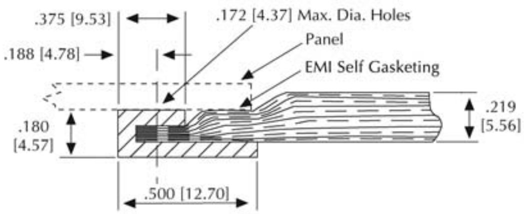
FRAME STYLE 131

Figure 3.



FRAME STYLE 133A

Figure 4.



ORDERING INFORMATION

When ordering TECKAIRE Air Vent Panels, specifications should include: extrusion style number, overall frame and opening dimensions, and hole locations. For specification assistance, contact your nearest TECKNIT area representative or factory location.

Section G: Conductive Systems

U.S. Customary
[SI Metric]

Conductive Adhesives

ONE PART: SILVER-FILLED SILICONE RTV

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT CON/RTV-I system is a pure silver loaded, one component RTV silicone adhesive-sealant. It is ready to use without mixing and cures quickly at room temperature on exposure to moisture in the air to form a flexible, resilient, conductive bond or seal.

APPLICATION INFORMATION

TECKNIT CON/RTV-I can be used in the following applications:

1. Bonding or installing various conductive silicone elastomer EMI gaskets. These include silver filled silicone (CONSIL®), silicone filled with stainless steel fiber. (TECKFELT™), silicone impregnated woven (DUOLASTIC™), expanded (TECKSPAN™), metal aluminum wire or silicone filled oriented wire (ELASTOMET®). It can also be used for attaching porous or wire mesh materials.

2. For joining strips of conductive elastomers to form continuous shield/seal rings or gaskets.

3. To form-in-place conductive gasketing to attach shielding windows to frames or bezels, and in turn, installing the framed window on a shielding enclosure; for in place EMI gasketing of shield penetrating components such as connectors or switches: conductively attaching small screens, honeycomb or metal shielding vents to enclosures.

4. For flow-in-place EMI gasketing for grooves in cast boxes or covers or as a conductive seam sealant. Generally, these are field repair or "fix" applications.

CURING CHARACTERISTICS

CON/RTV-I cures on exposure to moisture in the air. A skin forms on the surface of a .250 in.[6.35 mm] diameter bead in 3-4 minutes at standard room temperature conditions 72°F[23°C] and 50% RH. Lower temperature and humidity slow the cure, while higher temperature and humidity accelerate it. In all adhering and joining operations the adhesive must be spread and parts assembled before the adhesive becomes "tack free." Thin films (less than .005 in. [0.13 mm]) should be avoided as cure is rapid. Early in the cure stage an odor caused by acetic acid will be evident and will disappear after complete cure.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Number of Components:** One
- **Resin:** Silicone
- **Filler:** Ag

AS SUPPLIED

- **Color:** Silver-Tan
- **Consistency:** Thick paste
- **Final Condition:** Flexible
- **Volume:** 1.1 in.^{3}
- **Weight:** 2 oz.
- **Pot Life @ 77°F [25°C]:** 5 minutes
- **Shelf Life, unopened container:** 5-1/2 months
- **Recommended Cure:** 24 hours @ 77°F [25°C] x 50% RH [for 1/8" dia bead]
- **Full Cure:** 72 hours @ 77°F [25°C] x 50% RH

CURED*

- **Volume Resistivity (QA-1038), max.:** 0.01 ohm-cm
- **Shear Strength, min. (ASTM D-1002):** 150 psi
- **Peel Strength, min. (ASTM D-1876) (silicone aluminum):** 2 ppi
- **Temperature Range:** -75°F to 400°F [-59°C to 204°C]

PART NUMBER

- **72-00002**
- **Transportation Class:** Combustable

*72 hours @ 25°C x 50% RH

A preliminary check of the affect of acetic acid on surfaces to be bonded is recommended. Cure is optimum in 24 hours in most cases. Parts may be handled 2 hours after assembly.

SURFACE PREPARATION AND BONDING TECHNIQUES

1. Roughen both surfaces to be bonded with Scotchbrite® or equivalent.

2. Degrease both surfaces with VM&P Naptha or an equivalent and then solvent wipe with acetone or methyl ethyl keytone. Allow to dry before applying adhesive.

3. Apply adhesive from tube directly to bond area in spots or as a bead. CAP TUBE TO KEEP OUT MOISTURE.

4. Spread adhesive to approximately twice the desired final film thickness. Work quickly. Remember assembly must be complete within 3-4 minutes! Large areas must be bonded in stages.

5. Place conductive gasket in position on top of adhesive and work into place with slight circular motion.

6. A hand roller is useful to evenly distribute adhesive if film is not spread to uniform thickness. This technique removes "lumps."

7. Handle only after 2 hours. 24 hours will provide cure. Remember impermeable materials slow the moisture penetration necessary to obtain full cure.

8. Though not required, slight pressure applied during cure will increase bond strength.

9. Vertical bonds must be made with gasket materials held in place during cure.

®Scotchbright is a registered trademark of 3M Co.

GASKET PREPARATION AND JOINING TECHNIQUES

1. Wipe cut ends of elastomer to be joined with clean isopropanol alcohol moistened cloth.

2. Apply adhesive to both faces to be joined.

3. Join ends together and hold in position with pins or other holding devices until cure is completed.

TECKNIT P/N	UNIT DESCRIPTION
72-00002	2.0 oz.[56 g] CON/RTV-I packaged in collapsible aluminum tube, spreading tool, instructions.

ORDERING INFORMATION

When ordering TECKNIT CON/RTV-I, specify number of units and TECKNIT Part Number 72-00002. For assistance, contact your nearest TECKNIT area representative or factory location.

Conductive Adhesives

SILVER AND NICKEL FILLED RTV'S

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

Two RTV silicone adhesive-sealants comprise TECKNIT electrically conductive, medium viscosity adhesive- sealant systems. They are CON/RTV-II (silver- filled) and CON/RTV-Ni (nickel-filled). Each is formulated with a special conductive material producing its own unique advantages. Each system with its conductive material and volume resistivity is shown in Table 2. After full cure, the resultant bond or seal of each system is flexible, resilient and conductive.

APPLICATION INFORMATION

TECKNIT Conductive Adhesive-Sealants are recommended wherever an electrically conductive flexible bond and seal is required. The main consideration for selecting the correct adhesive should be based on the galvanic coupling of metallic (or conductive) materials. Excellent practices and recommendations can be obtained by reviewing MIL-STD- 1250. The Adhesive-Sealants are also used to join and install a variety of conductive elastomers and porous or open wire mesh gaskets. Recommended applications and material combinations are given in Table 3.

PREPARATION OF TWO PART CONDUCTIVE SILICONE ADHESIVES

Mix Part 1 of the adhesive by stirring to disperse any material that has settled out. Stir in Part 2 (catalyst) and thoroughly mix with Part 1 to insure uniform dispersion. The Part 2 supplied is the correct amount to properly catalyze the entire content of the Part 1 container. It is recommended that the full amount of Part 1 be catalyzed. This avoids errors in mixing. However if less is required, use portions as recommended in Table 1, “Small Quantity Mixing Proportions.”

SURFACE PREPARATION

To insure the best adhesive bond and electrical conductivity the following procedure should be used. Remove all grease, oil and dirt. Roughen all surfaces to be bonded with an abrasive material. After surface has been roughened, degrease with VM&P Naptha, then solvent wipe with acetone or methyl ethyl keytone. Allow to dry before applying adhesive.

SMALL QUANTITY MIXING PROPORTIONS

PART 1 oz. [g] Net Wt.	PART 2 (Catalyst) oz. [grams] Nickel	Silver
.5 [14]	.01 [.29]	.01 [.29]
1.0 [28]	.02 [.57]	.02 [.57]
2.0 [57]	.04 [1.16]	.05 [1.16]
4.0 [113]	.08 (2.29)	.08 (2.29)

CURING CHARACTERISTICS

Curing two part conductive adhesives begins with the addition of the catalyst. 70% of maximum peel strength is reached in about 24 hours at room temperature, with maximum strength achieved after 7 days. The cure time can be shortened by exposing the applied adhesive to elevated temperatures in a circulating air oven. Four hours at 50°C will yield approximately 50% of full cure strength.

SAFETY AND USAGE CAUTIONS

Conductive Adhesives contain a flammable solvent and should be used in well ventilated areas. Avoid direct skin contact and inhalation of vapors. Prevent contact with eyes. Do not use near open flame. Industrial use only. Some individuals may observe skin irritation-wash with mild soap and rinse with clean water. Contact physician should irritation occur.

SPECIFICATIONS Table 2.

MATERIAL DESCRIPTION	CON/RTV-II 2 Part	CON/RTV-Ni 2 Part
• **Number of Components:**	Two	Two
• **Resin:**	Silicone	Silicone
• **Filler:**	Ag/Glass	Ni
AS SUPPLIED		
• **Color:**	Beige	Dark gray
• **Consistency:**	Paste	Thin paste
• **Final Condition:**	Flexible	Flexible
• **Mix Ratio:**	49:1	49:1
• **Volume:**	13.6 in.^{3}	7.0 in.^{3}
• **Weight:**	16 oz.	16 oz.
• **Pot Life @ 25°C:**	4 hours	4 hours
• **Shelf Life, unopened container:**	9 months	9 months
• **Recommended Cure/Full Cure:**	168 hours	168 hours
CURED*		
• **Volume Resistivity, QAP-1017, max.**	0.01 ohm-cm	0.1 ohm-cm
• **Shear Strength, min. (ASTM D-1002):**	60 psi	50 psi
• **Peel Strength, min. (ASTM D-1876) (silicone aluminum):**	3 ppi	3 ppi
• **Shrinkage, max.:**	31%	44%
• **Temperature Range:**	-67°F to 302°F [-55°C to 150°C]	-67° to 302°F [-55°C to 150°C]
PART NUMBER	**72-00036**	**72-00035**
• **Transportation Class:**	Part I: Flammable liquid Part II: Non Flammable	Part I: Flammable liquid Part II: Non Flammable

*24 hrs. @ RT followed by 24 hrs @ 212°F [100°C]

BONDING:

1. Keep adhesive covered to minimize solvent evaporation and extend pot life.

2. Apply a uniform film .010 to .015 in. [0.25 to 0.38 mm] thick on both surfaces to be bonded.

3. Press surfaces firmly together avoiding formation of air bubbles in the bond area. For optimum bond strength pressure should be maintained during cure.

4. Allow to cure. Sufficient bond strength for normal handling develops in 24 hours.

5. Because curing relies on evaporation of solvent, surface area to be bonded is a determining factor in actual cure time. Solvent entrapment inhibits curing.

6. For non-permeable adherents, [rubber to rubber (solid) or metal to rubber (solid)], allow for some solvent evaporation before joining surfaces.

RECOMMENDED APPLICATIONS

Table 3:

CONDUCTIVE ADHESIVE-SEALANTS	CONDUCTIVE ELASTOMERS	OTHER METALLIC MATERIALS
CON/RTV-II (Silver)	Consil-E, -II, -R	Silver, Gold
CON/RTV-Ni (Nickel)	SC-Consil	Nickel, Monel, Aluminum, Tin, Copper

CLEAN UP:

Excessive adhesive may be removed by wiping with a clean cloth dampened in a solvent VM&P Naptha. This should be done immediately after bonding and before the adhesive cures.

ORDERING INFORMATION

When ordering TECKNIT 2-part adhesives, specify quantity and part number. For assistance contact your nearest TECKNIT representative or factory.

TeckBond™-C

SILVER-PLATED COPPER-FILLED ADHESIVE

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKBOND-C is a silicone rubber base filled with silver-plated copper particles to produce a highly conductive one-component adhesive sealant. The system is an RTV moisture-cured compound which is ready to use without additional preparation or mixing. The compound cures at room temperature to form a flexible resilient conductive bond or sealant.

APPLICATION INFORMATION

TECKBOND conductive adhesive-sealants are recommended wherever a flexible bond is required in a metal-to-silicone gasket application, such as TECKNIT CONSIL®-C. These adhesives are recommended in applications where the bond thickness is less than 0.016 in. [0.4 mm]. To ensure optimum bond performance, the surface of the metal may require priming.

CURING CHARACTERISTICS

TECKBOND one-part RTV cures on exposure to moisture in the air. The adhesive is tack free in 30 minutes. Parts can be handled after 2 hours and used after 72 hrs. Lower humidity will slow curing while higher humidity accelerates curing. Full cure is achieved in approximately 7 days.

SURFACE PREPARATION

To ensure maximum adhesive bond strength and electrical conductivity, surfaces should be free of grease, oil and dirt. Gaskets should be cleaned using denatured alcohol just prior to bonding and should be held in position under slight pressure to ensure continuous contact with the adhesive. Use of the one-part adhesive on metal surfaces requires the use of a primer supplied with the adhesive. Allow the primer to air dry 1 to 2 hours under normal room temperatures and humidity conditions. Low humidity will require a longer drying time. Surfaces to be bonded should be roughened with Scotchbrite, degreased withVM&P Naptha and wiped with acetone or methyl ethyl keytone. Allow to dry and then apply a thin, even layer of primer by wiping or brushing.

PART NUMBER	WEIGHT	VOLUME
72-00192	3.5 oz	1.6 cu in
72-00193	14 oz	6.4 cu in

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Number of Components:** One + primer
- **Resin:** Silicone
- **Filler:** Ag/Cu

AS SUPPLIED

- **Color:** Gray
- **Consistency:** Thick paste
- **Final Condition:** Flexible
- **Mix Ratio:** N/A
- **Pot Life @ 77°F [25°C]:** N/A
- **Shelf Life, unopened container:** 9 months
- **Recommended Cure:** 72 hrs. @ 77°F [25°C] x 50% RH (1/8" dia. bead)
- **Full Cure:** 168 hours @ 77°F [25°C] x 50% RH

CURED*

- **Volume Resistivity, 77°F [25°C] & 50% RH (QA-1038), max.:** .04 ohm-cm
- **Shear Strength, min. (ASTM D-1002),:** 200 psi
- **Peel Strength, min. (ASTM D-1876) (silicone-aluminum):** 2.5 ppi
- **Shrinkage, max.:** 1.0%
- **Temperature Range:** -85°F to 360°F [-65°C to 182°C]
- **Transportation Class:** Adhesive - Non Flammable
  Primer - Flammable

*168 hrs. @ 25°C x 50% RH

ORDERING INFORMATION

When ordering TECKBOND adhesives specify quantity and part number. For assistance contact your nearest TECKNIT area representative or factory location.

TeckBond™-A

SILVER-PLATED ALUMINUM-FILLED ADHESIVE

GENERAL DESCRIPTION

TECKBOND-A conductive system is a silicone based, two-component RTV, filled with silver-plated aluminum particles. After cure, the resultant bond or seal is flexible, resilient, and conductive.

APPLICATION INFORMATION

TECKBOND-A conductive adhesive is recommended wherever a flexible bond is required in a metal to silicone gasket application, such as TECKNIT® CONSIL®-A. (Reference TECKNIT Data Sheet D-895.)

CURING CHARACTERISTICS

TECKBOND two-part RTV is a two-component adhesive which begins to cure immediately upon addition of the catalyst which is supplied as a separate vial. Full cure at room temperature is achieved after 7 days.

SURFACE PREPARATION

To ensure maximum adhesive bond strength and electrical conductivity, surfaces should be free of grease, oil and dirt. Gaskets should be cleaned using denatured alcohol just prior to bonding and should be held in position under slight pressure to ensure continuous contact with the adhesive. Metal surfaces should be roughened with Scotchbrite, degreased with toluene and then wiped with acetone prior to applying adhesive.

MIXING INSTRUCTIONS

Mix Part 1 of the adhesive by stirring to disperse any filler which has settled out. Stir in Part 2 (catalyst) and thoroughly mix with Part 1 until completely dispersed. The amount of Part 2 supplied is the correct amount to properly catalyze the entire contents of Part 1. The full amount should be catalyzed. This avoids errors in mixing. However, if less is required, a mix ratio by weight of 49:1 should be used.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Number of Components:** Two
- **Resin:** Silicone
- **Filler:** Ag/Al

AS SUPPLIED

- **Color:** Beige
- **Consistency:** Thick paste
- **Final Condition:** Flexible
- **Mix Ratio:** 49:1
- **Volume:** 14 in.^{3}
- **Weight:** 16 oz.
- **Pot Life @ 77°F [25°C]:** N/A
- **Shelf Life, unopened container:** 9 months
- **Recomended Cure:** 24 hrs. @ RT followed by 24hrs. @ 212°F [100°C]

CURED*

- **Volume Resistivity (QAP-1017), max.:** 0.01 ohm cm
- **Shear Strength, min. (ASTM D-1002),:** 100 psi
- **Peel Strength, min. (ASTM D-1876) (silicone-aluminum):** 2 ppi
- **Shrinkage, max.:** 40%
- **Temperature Range:** -67°F to 150°F [-55°C to 302°C]
- **Transportation Class:** Part I - Flammable
  Part II - Non Flammable

*24 hrs. @ 77°F [25°C] followed by 24hrs. @ 212°F [100°C]

PART NUMBER

- **72-00236**

ORDERING INFORMATION

When ordering TECKBOND adhesives specify quantity and part number. For assistance contact your nearest TECKNIT area representative or factory location.

TeckBond™-NC

NICKEL COATED GRAPHITE-FILLED ADHESIVE

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKBOND-NC is a silicone rubber base filled with nickel coated graphite particles to produce a highly conductive one-component adhesive sealant. The system is an RTV moisture-cured compound which is ready to use without additional preparation or mixing. The compound cures at room temperature to form a flexible resilient conductive bond or sealant.

APPLICATION INFORMATION

TECKBOND conductive adhesive-sealants are recommended wherever a flexible bond is required in a metal-to-silicone gasket application, such as TECKNIT NC-CONSIL®.

These adhesives are recommended in applications where the bond thickness is less than 0.016 in. [0.4 mm]. To ensure optimum bond performance, the surface of the metal may require priming.

CURING CHARACTERISTICS

TECKBOND one-part RTV cures on exposure to moisture in the air. The adhesive is tack free in 30 minutes. Parts can be handled after 2 hours and used after 72 hrs. Lower humidity will slow curing while higher humidity accelerates curing. Full cure is achieved in approximately 7 days.

SURFACE PREPARATION

To ensure maximum adhesive bond strength and electrical conductivity, surfaces should be free of grease, oil and dirt. Gaskets should be cleaned using denatured alcohol just prior to bonding and should be held in position under slight pressure to ensure continuous contact with the adhesive. Use of the one-part adhesive on metal surfaces requires the use of a primer supplied with the adhesive. Allow the primer to air dry 1 to 2 hours under normal room temperatures and humidity conditions. Low humidity will require a longer drying time. Surfaces to be bonded should be roughened with Scotchbrite, degreased with VM&P Naptha and wiped with acetone or methyl ethyl keytone. Allow to dry and then apply a thin, even layer of primer by wiping or brushing.

PART NUMBER	WEIGHT	VOLUME
72-00350	2.5 oz tube	1.7 in³
72-00355	10 oz cartridge	6.7 in³

- **Transportation Class:** Adhesive - Combustible
  Primer - Flammable

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Number of Components:** One
- **Resin:** Silicone
- **Filler:** Nickel coated graphite

AS SUPPLIED

- **Color:** Dark gray
- **Consistency:** Thick paste
- **Final Condition:** Flexible
- **Pot Life @ 25°C:** N/A
- **Shelf Life, unopened container:** 9 months
- **Tack Free:** 1.5 hours
- **Recommended Cure:** 72 hrs. @ 77°F [25°C] x 50% RH (1/8 dia. bead)
- **Full Cure:** 168 hours @ 77°F [25°C] x 50% RH

CURED*

- **Volume Resistivity, (QA-1038), max.:** 0.5 ohm-cm
- **Shear Strength, min. (ASTM D-1002),:** 100 psi
- **Peel Strength, min. (ASTM D-1876) (silicone-aluminum):** 3 ppi
- **Shrinkage, max.:** 1.0%
- **Temperature Range:** -67°F to 392°F [-55°C to 200°C]

ORDERING INFORMATION

When ordering TECKBOND adhesives specify quantity and part number. For assistance contact your nearest TECKNIT area representative or factory location.

Conductive Caulking

SILVER-FILLED FLEXIBLE RESIN CAULKING SYSTEM

U.S. Customary
[SI Metric]

TECKNIT

GENERAL DESCRIPTION

TECKNIT standard electrically conductive caulks consist of four one-component resin systems filled with silver plated glass or copper particles. These systems are formulated to provide over 100 dB total shielding effectiveness across the RF spectrum. They may be used to improve joint or seam integrity for all types of electronic enclosures.

An outstanding feature of these one-component systems is the ease with which they may be applied with conventional caulking guns and dispensing equipment, such as small bead orifice syringes. Hand application with spatula or putty knife is also simple.

High yield per pound is another advantage offered in these conductive caulks. Proprietary formulation techniques result in lower density than most current state-of-the-art caulking compounds.

The systems are safe to handle, very easily applied and free of any corrosive binders. They contain silver plated glass or copper particles for electrical conductivity, assuring stable operation over wide temperature ranges not generally possible with carbon- black filled systems.

APPLICATION INFORMATION

72-00005 CAULKING, CONDUCTIVE. THERMOPLASTIC, FLEXIBLE — This thixotropic cream system, which remains permanently flexible after curing, is easy to apply with standard caulking equipment. It is a thermoplastic + solvent type, which dries quickly to a highly conductive seal. Small beads are easily drawn. It is safe to handle, non-exothermic and has excellent adhesion to metal. The system is watertight, ozone resistant, and non-corrosive to applied surfaces. Among the chief uses are caulking EMI tight cabinets and enclosures, fasteners, panels and handles. The system is extremely vibration and thermal shock resistant.

72-00014 CAULKING, CONDUCTIVE, SILICONE, FAST CURING, FLEXIBLE — This system is a conductive, fast room temperature curing silicone-silver caulking compound. Ease of application and high electrical conductivity are outstanding features of this flexible system. It is used to fill gaps in shielded room joints, repair damaged conductive gaskets and shield/seal permanently mounted panels, components and hardware. This system will withstand shock vibration, seam warping and compensate for thermal expansion.

72-00151 CAULKING, CONDUCTIVE, RTV SILICONE FLEXIBLE — This silver plated, highly conductive, moisture curing RTV silicone caulking compound has excellent adhesion to metals and is ideal for permanent EMI shielding and fluid sealing. Primer is supplied in a separate vial. Allow the primer to dry 1 to 2 hours under normal room temperature and humidity conditions. This material is well suited for aerospace and military applications and is an ideal material where good conductivity, flexible and long life expectancy are required.

PREPARATION AND APPLICATION

To ensure the best electrical and mechanical reliability, it is highly recommended that the surfaces to be caulked be thoroughly cleaned of grease, oils, dirt and oxide coatings. Preparation should be in accordance with standard practice for preparing surfaces for adhesive bonding.

APPLICATION OF CAULKING SYSTEMS

72-00005 — Stir well in original container to assure uniformity before using. Apply to surface with caulking or dispensing equipment, putty knife or spatula. Cover unused contents to prevent solvent evaporation.

72-00014 — This caulk is solvent evaporating, air curing and is supplied in a standard 1 lb. can. Thoroughly stir contents of original container before application or loading into dispensing equipment.

72-00151, 72-00152 — 2 oz. tube and 1 lb. tube respectively. No mixing required.

ORDERING INFORMATION

When ordering CONDUCTIVE CAULKING SYSTEMS, specify quantity and TECKNIT Part Number. Special packaging in 5 lb. [2.25 kg] cans is also available for 72-00005 and 72-00014. For assistance, contact your nearest TECKNIT area representative or factory location.

SPECIFICATIONS

MATERIAL DESCRIPTION			
• **Number of Components:**	One	One	One
• **Resin:**	Polyolefin	Silicone	Silicone
• **Filler:**	Ag/Glass	Ag/Glass	Ag/Copper
AS SUPPLIED			
• **Color:**	Tan	Tan	Gray
• **Consistency:**	Liquid	Self-Leveling	Paste
• **Final Condition:**	Flexible	Flexible	Flexible
• **Mix Ratio:**	N/A	N/A	N/A
• **Volume:**	16.0 $in.^3$	13.8 $in.^3$	1.0 $in.^3$ / 7.7 $in.^3$
• **Weight:**	16 oz.	16 oz.	2 oz. / 16 oz.
• **Pot Life @ 25°C:**	N/A	N/A	N/A
• **Shelf Life, unopened container:**	9 months	9 months	9 months
• **Recommended Cure:**	72 hours @ 25°C	24 hours @ 25°C	72 hours @ 25°C x 50% RH
• **Full Cure:**	72 hours @ 25°C	24 hours @ 25°C	168 hours @ 25°C x 50% RH
CURED	**QAP-1017**	**QAP-1017**	**QAP-1038**
• **Volume Resistivity, max.*:**	.005	.01	.01
• **Shear Strength, min.: (ASTM D-1002), silicone-aluminum**	4 psi	25 psi	150 psi
• **Peel Strength, min.(ASTM D-1876):**	N/A	N/A	3.0 ppi
• **Shrinkage, max.:**	46%	26%	1%
• **Temperature Range:**	-65°F to + 200°F [-54°C to + 94°C]	-80°F to + 400°F [-63°C to + 204°C]	-67° to + 257°F [-55°C to + 125°C]
PART NUMBERS	**72-00005**	**72-00014**	**72-00151 72-00152**
• **Transportation Class:**	Nonflammable	Flammable	Flammable (Adhesive & Primer)

Conductive Epoxy

SILVER-FILLED EPOXY SYSTEMS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

72-00008 - EPOXY ADHESIVE, CONDUCTIVE TWOCOMPONENT - This commercial grade, conductive epoxy is designed for use in bonding applications where good conductivity is required. When mixed in a ratio of 1:1.4 by volume or weight, the two components produce a light colored creamy paste which can be easily applied.

72-08116 - EPOXY SOLDER, CONDUCTIVE, HIGH SILVER CONTENT, TWO-COMPONENT - This is a silver filled epoxy system designed for maximum performance and lowest volume resistivity. It is easily mixed 1:1 by volume or weight, from the two one-ounce jars. Its consistency is that of a thick paste, making it easy to dispense and apply.

PREPARATION AND CLEANING

To ensure the best electrical and mechanical reliability, it is highly recommended that the surfaces to be bonded are thoroughly cleaned of grease, oils, dirt and oxide coatings. Preparation should be in accordance with standard practice for preparing surfaces for adhesive bonding.

APPLICATION OF EPOXY SYSTEMS

72-00008 - Epoxy Adhesive, Conductive, Two-Component.

Stir parts 1 and 2 thoroughly, then mix together one unit of part 1 and 1.4 units of part 2. They may be mixed either by volume or weight. Apply with dispensing equipment, syringe or spatula. May be cured at room temperature or elevated temperature. See Table for cure time and temperature.

72-08116 - Epoxy Solder, Conductive, High Silver Content, Two Component.

Stir Part 1 and Part 2 thoroughly, then mix together one unit of Part 1 and one unit of Part 2. They may be mixed either by volume or weight. Since each jar is half filled, there is sufficient room to mix Part 1 and Part 2 together in either jar. May be cured at room temperature or elevated temperature. For solvent cleaning of surface or material cleaning use Xylene.

CAUTIONS

The conductive systems are safe, non-volatile and non-toxic; however, the following precautions must be observed:

Avoid direct skin contact, as the systems may cause irritation to some individuals. If this should occur, wash with mild soap and rinse with clean water. Contact physician should irritation occur ... Avoid inhalation of vapors by working in ventilated area ... Prevent contact with the eyes ... Do not use near open flame ... This material is for industrial use only.

ORDERING INFORMATION

When ordering CONDUCTIVE EPOXY, specify number of kits and TECKNIT Part Number. For assistance, contact your nearest TECKNIT area representative or factory location.

SPECIFICATIONS

MATERIAL DESCRIPTION		
• **Number of Components:**	Two	Two
• **Resin:**	Epoxy	Epoxy
• **Filler:**	Ag/Glass	Ag
AS SUPPLIED		
• **Color:**	Silver gray	Bright silver
• **Consistency:**	Thick paste	Thick paste
• **Final Condition:**	Rigid	Rigid
• **Mix Ratio:**	1:1.4	1:1
• **Volume:**	14.7 in.^{3}	1.5 in.^{3}
• **Weight:**	16 oz.	2 oz.
• **Pot Life @ 25°C:**	45 minutes	45 minutes
• **Shelf Life, unopened container:**	15 months	15 months
• **Recommended Cure:**	30 minutes @ 212°F [100°C]	30 minutes @ 212°F [100°C]
CURED*		
• **Volume Resistivity, QAP-1017 max.:**	0.02 ohm-cm	.001 ohm-cm
• **Shear Strength, min. (ASTM D-1002):**	1000 psi	1400 psi
• **Shrinkage, max.:**	1%	1%
• **Temperature Range:**	-80° to 300°F [-62°C to 149°C]	-80° to 300°F [-62°C to 149°C]
PART NUMBER	**72-00008**	**72-08116**
• **Transportation Class:**	Part I-Nonflammable Part II-Nonflammable	Combustable Combustable

*30 mins. @ 212°F [100°C] followed by 24 hrs @ RT

Conductive Grease

CONDUCTIVE SILVER-FILLED SILICONE GREASE

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT CONDUCTIVE GREASE is a highly conductive silver-filled silicone grease which contains no carbon or graphite. The material will maintain its electrical and lubricating properties over a broad environmental range. These conditions and properties include high and low temperatures, excellent resistance to moisture and humidity, inertness to many chemicals, ozone and radiation. TECKNIT CONDUCTIVE GREASE is a viscous paste which can be applied to vertical or overhead surfaces without dripping or running at elevated operating temperatures.

APPLICATIONS INFORMATION

TECKNIT CONDUCTIVE GREASE is used on power substation switches and in suspension insulators to reduce EMI noise. It also reduces make-break arcing and pitting of the sliding metal contact surfaces of switches and fills in existing pitted areas with silver/ silicone. In addition, normally closed switches are prevented from sticking due to corrosion or icing. The grease is effective in maintaining a continuous electrical path between contact surfaces which connections of power insulators, which if allowed to arc, can give rise to EMI noise. TECKNIT CONDUCTIVE GREASE is designed to maintain low resistance electrical contact and thereby maintain equipment operation over extended harsh environmental conditions, helping to deliver continuous electrical service.

OTHER APPLICATIONS

TECKNIT CONDUCTIVE GREASE is used on the contacting surfaces of circuit breakers and knife blade switches. It reduces localized overheating or "hot spots" in turn maintaining the blade spring properties and current rating of the switch or breaker at original equipment level. Lubricating conductively prevents "freeze up" in operating equipment and permits restoration of marginal or discarded breakers to rated capacity.

METHODS OF APPLICATION

Apply TECKNIT CONDUCTIVE GREASE to both contact surfaces of the switch. To ensure complete coating, apply the grease to the pivoting

blade and operate the switch several times. These switch surfaces may be wiped smooth with your finger to achieve a thin layer. Do not wipe off the grease with a rag. With ball and socket insulators a sufficient quantity of grease must be applied to fill the clearance gap between the ball and socket contact surfaces. TECKNIT CONDUCTIVE GREASE is reapplied as required during scheduled maintenance either by wiping or brushing with stiff-bristled brush.

Before applying to contact surfaces, it is recommended that the desired quantity of grease be kneaded to guarantee proper dispersion of silver. For solvent cleaning, use Toluene.

ORDERING INFORMATION

TECKNIT CONDUCTIVE GREASE is available in standard packages of 1 lb. [0.45 kg] jars (Part Number 72-00015) and 2 oz.[0.06 kg] jars (Part Number 72-00016) and should be ordered by specifying the part number and the total quantity required. Custom packaging and other size containers are available on request by contacting your nearest TECKNIT Area Representative or factory location.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Number of Components:** One
- **Resin:** Silicone
- **Filler:** Ag/Glass

AS SUPPLIED

- **Color:** Silver Gray
- **Consistency:** Light Paste
- **Final Condition:** Non-Setting
- **Pot Life @ 25°C:** Indefinite
- **Shelf Life, unopened container:** Indefinite
- **Volume Resistivity, (QAP-1017), max.:** .20 ohm-cm
- **Temperature Range:** -67°F to +400°F
  [-55°C to +190°C]

PART NUMBER

- **72-00015:** 1lb. Jar - Volume 10.7 cm in
  72-00016: 2 oz. Jar - Volume 1.4 cm in
- **Transportation Class:** Nonflammable

Conductive Coatings

ELECTRICALLY CONDUCTIVE ACRYLIC AND POLYURETHANE PAINTS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT manufactures a highly conductive acrylic and polyurethane paints filled with silver. These coatings provide a cost effective method for shielding and grounding plastic enclosures, which are susceptible to EMI, and other applications requiring a flexible protective shield.

SHELF LIFE AND STORAGE RECOMMENDATIONS

It is recommended the ACRYLIC-1 paint be used within six months of the manufactured date and the POLYURETHANE paints be used within nine months of the manufactured date. All conductive coating containers should be stored in the "upside-down" position and at a temperature between 50°F and 86°F [10°C and 30°C]. **DO NOT FREEZE CONDUCTIVE COATINGS.**

PAINT PREPARATION

Before and during use, CONDUCTIVE COATINGS should be thoroughly stirred. Each component of the two and three part polyurethane coatings should be stirred prior to combining. The components of the two and three part systems are supplied as a premeasured kit.

SAFETY AND USAGE CAUTIONS

TECKNIT CONDUCTIVE ACRYLIC AND POLYURETHANE PAINTS contain a flammable solvent and should be used in a well ventilated area. Avoid direct skin contact and inhalation of vapors. Prevent contact with eyes. Do not use near open flame. Industrial use only. Some individuals may experience skin irritation - wash with mild soap and rinse with clear water. Contact physician should irritation occur.

SURFACE PREPARATION

To ensure the best electrical and mechanical reliability, remove all grease, oils, dirt, mold releases and foreign matter. Preparation should be in accordance with standard practice for one-coat painting. Recommended cleaning agent is alcohol.

RECOMMENDED THINNING

THINNING IS REQUIRED FOR THE ACRYLIC-1 PAINT to achieve the proper consistency when using spray equipment. Thinning increases drying time by two or three fold but assures "wetting out" of the ACRYLIC-1 paint offering optimum electrical properties. Thinner should never exceed 25% by volume. The POLYURETHANE coatings can be used with spray equipment as supplied. It is not recommended to thin the POLYURETHANE COATINGS. Toluene can be used for solvent cleaning the ACRYLIC-1.

ORDERING INFORMATION

Small quantities can be shipped within one week after receipt of order. To order TECKNIT conductive paint, specify quantity and part number. For additional assistance, or for scheduling large quantity shipments, contact your nearest TECKNIT area representative or factory location.

SPECIFICATIONS

MATERIAL DESCRIPTION		
• Number of Components	One	Two
• Resin	Acrylic	Polyurethane
• Filler	Ag/Glass	Ag
AS SUPPLIED		
• Color	Silver Gray	Metalic Gray
• Consistency	Thin Paint	Thin Paint
• Final Condition	Durable Film	Flexible Film
• Mix Ratio	N/A	75.5 : 24.5
• Volume	16.4 in.^{3}/115 in.^{3}	11.4 in.^{3}
• Weight	16 oz./128 oz. (1 gallon)	12 oz.
• Pot Life @ 25°C	30 minutes	30 minutes
• Shelf Life, unopened container	6 months	9 months
• Full Cure	168 hours @ RT	7-21 days @ RT
CURED*		
• Surface Resistivity, (QA-1074), max. OMS	1.0 per square	.06 per square
• Coverage (Approx.) at Recommended 0.002" thick	56 sq. ft./400 sq. ft.	39 sq. ft.
• Temperature Range	-65°F to +298°F [-54°C to +134°C]	-67°F to +347°F [-55°C to +161°C]
PART NUMBERS	**73-00025/73-00081**	**73-00008**
• Transportation Class	Flammable	Flammable

* 7 days @ 25°C

Section H: Shielding Components

U.S. Customary
[SI Metric]

Die Compressed Mesh Contacts

WIRE MESH RESILIENT CONTACT ELEMENT

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

DIE COMPRESSED MESH CONTACTS are resilient, low-impedance, multi-path shielding and grounding elements. Each unit is formed by die compressing a charge of cohesive, fine knitted wire mesh to a desired shape and density, providing low resistance, redundancy of contact and mechanical compliance.

FEATURES INCLUDE:

- Resiliency-high compressibility and recovery characteristic of wire mesh.
- Low Impedance-typically less than 15 milliohms, even at low closure force.
- Durability-conforms to contact surface, remains conductive and resilient even after thousands of cycles.
- Low Cost, Fast Delivery-MESH CONTACTS can be produced in large or small quantities quickly and economically.

APPLICATION INFORMATION

FUZZ BUTTON ELEMENTS are versatile resilient electrically conductive pads with many applications in EMI grounding, and static discharge, as well as heat transfer and vibration or shock dampening. They are particularly useful for low closure force EMIshielding and static discharge in computer enclosures.

DIE COMPRESSED MESH CONTACTS may be retained in metal cup-type inserts or attached to threaded studs for mounting.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Wire Mesh**

  Standard: Phosphor Bronze: .0045 in. [0.114 mm] diameter, per ASTM B-105, Alloy 30 (CDA C 50700), tin-plated per ASTM B-33.
  Optional:
  Monel: .0045 in. [0.114 mm] diameter, per QQN-281 or AMS-4730.

  Ag/Brass: .003 in. [0.076 mm] diameter, per QQW-321 (ASTM-B-134), Silver-plated (3% Silver by weight).

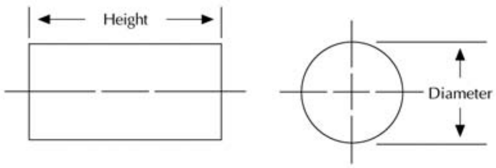


Figure 1.

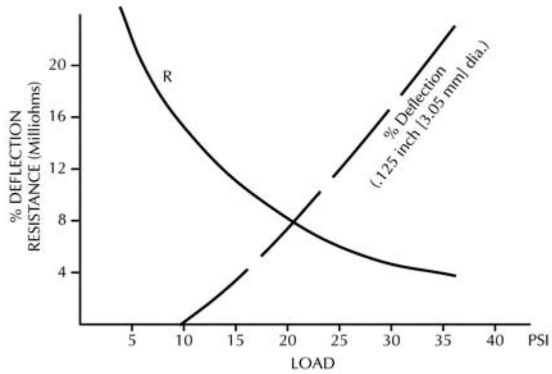


Figure 2. Resistance/Percent Deflection versus Load for a typical .120 inch Diameter Tin Plated Phospher Bronze part (i.e. 30-01751).

STANDARD DIE COMPRESSED MESH CONTACTS (1) — **Table 1.**

DIAMETER(2)	HEIGHT (3) .125	.250	.375	.500
.125	32-01761	32-01762	32-01763	32-01764
.156	32-01765	32-01766	32-01767	32-01768
.188	32-01769	32-01770	32-01771	32-01772
.246	32-01753	32-01754	32-01755	32-01756
.375	32-01773	32-01774	32-01775	32-01776
.484	32-01757	32-01758	32-01759	32-01760

(1) Standard material is Tin-plated Phosphor Bronze.
(2) Other sizes and materials available, please contact factory.
(3) All dimensions given are in a free state under no load.
(4) Height to diameter ratio not recommended above 4:1.

TOLERANCES — **Table 2.**

Dimensional	up to .125 [3.18]	over .125 [3.18]
Diameter	± .010 [0.25]	+ .015 [0.38] - .005 [0.13]
Height	+ .010 [0.25] - .005 [0.13]	+ .015 [0.38] - .005 [0.13]

ORDERING INFORMATION

To order DIE COMPRESSED MESH CONTACTS specify the TECKNIT Part Number and the quantity desired. Contact your nearest TECKNIT area representative or factory location for assistance on designs and mounting techniques.

EMI Connector Gaskets

EMI FLANGE SEALS FOR ELECTRICAL CONNECTORS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

A variety of TECKNIT EMI shielding materials can be manufactured into connector gaskets for military and commercial applications. These materials include TECKNIT CONSIL® materials, TECKFELT™, DUOLASTIC™, TECKSPAN™, and ELASTOMET®. Each TECKNIT material has its own advantages and characteristics. The gaskets can be manufactured to provide shielding only or a combination of shielding and environmental sealing. Tests have shown total shielding effectiveness of 100 dB or greater can be achieved with these TECKNIT materials.

STANDARD FOR DIMENSIONING CONNECTOR GASKETS

Figure 1.

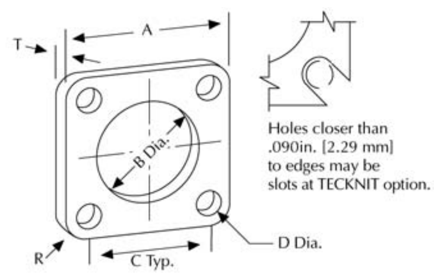
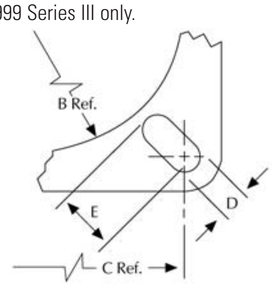
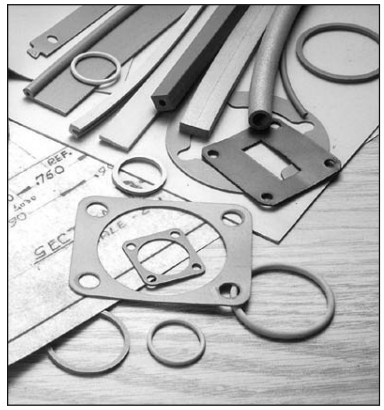


Figure 2. MIL-C-38999 Series III only.



ORDERING INFORMATION

To order TECKNIT connector gaskets, first select the Material Part Number Prefix. Second, locate the required gasket dimension from Table II or III and record the TECKNIT Order Number or Suffix. Third, combine the Material Prefix Number with the Order Number to obtain the complete TECKNIT Part Number which can be used to order gaskets. For assistance, or to determine the availability of connector gaskets not listed here, contact your nearest TECKNIT representative or factory location.



SPECIFICATIONS

STANDARD MATERIALS* (part # prefix)	EMI SEAL	SEALING ELASTOMER	THK. (see Fig. 1) in. [mm]
DUOLASTIC			
(42-6xxxx)	Aluminum	Silicone	.020 [0.51]
(42-8xxxx)	Aluminum	Neoprene	.020 [0.51]
TECKFELT			
(45-6xxxx)	Stainless Steel	Silicone	.030 [0.76]
TECKSPAN			
(48-6xxxx)	Monel	Silicone	.030 [0.76]
(48-8xxxx)	Aluminum	Silicone	.030 [0.76]
ELASTOMET			
(82-6xxxx)	Monel	Silicone	.030 [0.76]
(82-7xxxx)	Phosphor, Bronze	Silicone	.030 [0.76]
(82-8xxxx)	Aluminum	Silicone	.030 [0.76]
CONSIL-II (842)			
(84-6xxxx)	Silver-plated inert particles	Silicone	.030 [0.76]
CONSIL-C (873)			
(87-7xxxx)	Silver-plated copper particles	Silicone	.030 [0.76]
CONSIL-C (875)			
(87-5xxxx)	Silver-plated copper particles	Fluoro-silicone	.030 [0.76]
CONSIL-A (895)			
(89-5xxxx)	Silver-plated aluminum particles	Silicone	.030 [0.76]
CONSIL-A (897)			
(89-7xxxx)	Silver-plated aluminum particles	Fluoro-silicone	.030 [0.76]

*For material specifications and thickness tolerances see applicable material data sheet.

U.S.A.: 908-272-5500 • U.K.: 44-1476-590600 • Spain: 34-91-4810178

STANDARD CONNECTOR GASKETS **Table 1.**

FLANGE, CONNECTOR SHELL SIZE			GASKET DIMENSIONS					
AN,HT & QWL MIL-C-5015 MS-3100 MS-3102	**SP**	**JT,PT & PC MIL-C-26482 MS-3110 MS-3112 MS-3119 MS-3120**	**A ± .015 [0.38]**	**B ± .015 [0.38]**	**C ± .015 [0.38]**	**D ± .015 [0.38]**	**R ± .015 [0.38]**	***TECKNIT ORDER NUMBER**
		#6	0.688 [17.48]	0.375 [9.53]	0.469 [11.91]	.156 [3.96]	.109 [2.77]	XX-X1650
		#8	0.812 [20.62]	0.500 [12.70]	0.594 [15.09]	.156 [3.96]	.109 [2.77]	XX-X1651
#8			0.875 [22.23]	0.500 [12.70]	0.594 [15.09]	.172 [4.37]	.125 [3.18]	XX-X1408
		#10	0.938 [23.83]	0.625 [15.88]	0.719 [18.26]	.156 [3.96]	.109 [2.77]	XX-X1652
	#6		0.953 [24.21]	0.375 [9.53]	0.641 [16.28]	.172 [4.37]	.156 [3.96]	XX-X1653
#10			1.000 [25.40]	0.625 [15.88]	0.719 [18.26]	.172 [4.37]	.125 [3.18]	XX-X1411
		#12	1.031 [26.19]	0.750 [19.05]	0.813 [20.65]	.156 [3.96]	.109 [2.77]	XX-X1654
	#8		1.047 [26.59]	0.500 [12.70]	0.734 [18.64]	.172 [4.37]	.156 [3.96]	XX-X1655
#12			1.094 [27.79]	0.750 [19.05]	0.813 [20.65]	.172 [4.37]	.125 [3.18]	XX-X1415
		#14	1.125 [28.58]	0.875 [22.23]	0.906 [23.01]	.156 [3.96]	.109 [2.77]	XX-X1656
	#10		1.125 [28.58]	0.687 [17.45]	0.812 [20.62]	.172 [4.37]	.063 X 45° [1.60 X 45°]	XX-X1418
#14			1.188 [30.18]	0.875 [22.23]	0.906 [23.01]	.172 [4.37]	.125 [3.18]	XX-X1423
		#16	1.219 [30.96]	1.000 [25.40]	0.969 [24.61]	.156 [3.96]	.125 [3.18]	XX-X1657
	#12		1.250 [31.75]	0.781 [19.84]	0.938 [23.83]	.172 [4.37]	.156 [3.96]	XX-X1658
#16			1.281 [32.54]	1.000 [25.40]	0.969 [24.61]	.172 [4.37]	.125 [3.18]	XX-X1434
		#18	1.312 [33.32]	1.125 [28.58]	1.063 [27.00]	.156 [3.96]	.125 [3.18]	XX-X1659
	#14		1.344 [34.14]	0.875 [22.23]	1.031 [26.19]	.172 [4.37]	.156 [3.96]	XX-X1660
#18			1.375 [34.93]	1.125 [28.58]	1.063 [27.00]	.203 [5.16]	.125 [3.18]	XX-X1439
		#20	1.469 [37.31]	1.281 [32.54]	1.156 [29.36]	.156 [3.96]	.125 [3.18]	XX-X1448
	#16		1.438 [36.53]	1.000 [25.40]	1.125 [28.58]	.172 [4.37]	.156 [3.96]	XX-X1661
#20			1.500 [38.10]	1.250 [31.75]	1.156 [29.36]	.203 [5.16]	.125 [3.18]	XX-X1455
	#18		1.516 [38.51]	1.125 [28.58]	1.203 [30.56]	.172 [4.37]	.156 [3.96]	XX-X1662
		#22	1.563 [39.70]	1.375 [34.93]	1.250 [31.75]	.130 [3.30]	.156 [3.96]	XX-X1461
#22			1.625 [41.28]	1.375 [34.93]	1.250 [31.75]	.203 [5.16]	.125 [3.18]	XX-X1465
	#20		1.672 [42.47]	1.250 [31.75]	1.297 [32.94]	.172 [4.37]	.187 [4.75]	XX-X1663
		#24	1.688 [42.88]	1.500 [38.10]	1.375 [34.93]	.156 [3.96]	.156 [3.96]	XX-X1664
#24			1.750 [44.45]	1.500 [38.10]	1.375 [34.93]	.203 [5.16]	.125 [3.18]	XX-X1480
	#22		1.750 [44.45]	1.375 [34.93]	1.375 [34.93]	.172 [4.37]	.187 [4.75]	XX-X1478
	#24		1.875 [47.63]	1.500 [38.10]	1.500 [38.10]	.172 [4.37]	.187 [4.75]	XX-X1665
#28			2.000 [50.80]	1.750 [44.45]	1.563 [39.70]	.203 [5.16]	.125 [3.18]	XX-X1491
#32			2.250 [57.15]	2.000 [50.80]	1.750 [44.45]	.219 [5.56]	-	XX-X1496
#36			2.500 [63.50]	2.188 [55.58]	1.938 [49.23]	.219 [5.56]	.125 [3.18]	XX-X1505
#40			2.750 [69.85]	2.438 [61.93]	2.188 [55.58]	.219 [5.56]	.125 [3.18]	XX-X1509
#44			3.000 [76.20]	2.781 [70.64]	2.375 [60.33]	.219 [5.56]	.125 [3.18]	XX-X1144
#48			3.250 [82.55]	3.031 [76.99]	2.625 [66.68]	.219 [5.56]	.109 [2.77]	XX-X1148
RF CONNECTORS								
BN & BNC			0.687 [17.45]	0.437 [11.10]	0.500 [12.70]	.100 [2.54]	.093 [2.36]	XX-X1402
C & N			1.000 [25.40]	0.625 [15.88]	0.719 [18.26]	.172 [4.37]	.125 [3.18]	XX-X1411
HN			1.188 [30.18]	0.750 [19.05]	0.906 [23.01]	.156 [3.96]	.140 [3.56]	XX-X1422
UHF			1.281 [32.54]	1.000 [25.40]	0.969 [24.61]	.172 [4.37]	.125 [3.18]	XX-X1434
LC			2.000 [50.50]	1.250 [31.75]	1.437 [36.50]	.265 [6.73]	.281 [7.14]	XX-X1666

*To form, a complete TECKNIT part no., substitute the appropriate material prefix from the Specifications Table for the “XX-X” in the above TECKNIT order number.

EMI Connector Gaskets, continued

U.S. Customary
[SI Metric]

COMMONLY USED CONNECTOR SIZES AND PART NUMBERS **Table 1.**

GASKET DIMENSIONS					
A ±.015 0.38	B ±.015 0.38	C ±.015 0.38	D ±.015 0.38	R ±015 0.38	*TECKNIT ORDER NUMBER
.687 [17.45]	.348 [8.84]	.500 [12.70]	.100 [2.54]	.093 [2.36]	XX-X1400
.687 [17.45]	.348 [8.84]	.500 [12.70]	.109 [2.77]	.093 [2.36]	XX-X1401
.687 [17.45]	.437 [11.10]	.500 [12.70]	.109 [2.77]	-	XX-X1403
.750 [19.05]	.375 [9.53]	-	-	.062 [1.57]	XX-X1404
.750 [19.05]	.500 [12.70]	-	-	-	XX-X1405
.800 [20.32]	.440 [11.18]	.500 [12.70]	.120 [3.05]	.150 [3.81]	XX-X1406
.812 [20.62]	.385 [9.53]	.500 [12.70]	.128 [3.25]	-	XX-X1407
.875 [22.23]	.531 [13.49]	.594 [15.09]	.120 [3.05]	.062 [1.57]	XX-X1409
.953 [24.21]	.609 [15.47]	.719 [18.26]	.120 [3.05]	.125X45° [3.18X45°]	XX-X1410
1.000 [25.40]	.656 [16.66]	.719 [18.26]	.120 [3.05]	.125 [3.18]	XX-X1110
1.000 [25.40]	.703 [17.86]	.719 [18.26]	.156 [3.96]	-	XX-X1412
1.031 [26.19]	.719 [18.26]	.719 [18.26]	.130 [3.30]	.156 [3.96]	XX-X1413
1.094 [27.79]	.750 [19.05]	.812 [20.62]	.150 [3.81]	.140 [3.56]	XX-X1414
1.094 [27.79]	.781 [19.84]	.812 [20.62]	.120 [3.05]	.125 [3.18]	XX-X1416
1.094 [27.79]	.875 [22.23]	.812 [20.62]	.143 [3.63]	-	XX-X1417
1.125 [28.58]	.750 [19.05]	.812 [20.62]	.156 [3.96]	.125 [3.18]	XX-X1419
1.160 [29.46]	.925 [23.50]	.906 [23.01]	.125 [3.18]	-	XX-X1420
1.188 [30.18]	.984 [25.00]	.812 [20.62]	.156 [3.96]	.125 [3.18]	XX-X1421
1.188 [30.18]	.906 [23.01]	.906 [23.01]	.120 [3.05]	.140 [3.56]	XX-X1114
1.188 [30.18]	.938 [23.83]	.906 [23.01]	.120 [3.05]	.141 [3.58]	XX-X1424
1.188 [30.18]	.950 [24.13]	.906 [23.01]	.120 [3.05]	.125 [3.18]	XX-X1425
1.188 [30.18]	1.000 [25.40]	.969 [24.61]	.065 [1.65]	-	XX-X1426
1.203 [30.58]	.875 [22.23]	.906 [23.01]	.125 [3.18]	.063X45° [1.60X45°]	XX-X1427
1.250 [31.75]	.875 [22.23]	.938 [23.83]	.156 [3.96]	.125 [3.18]	XX-X1428
1.265 [32.13]	.875 [22.23]	-	-	-	XX-X1429
1.265 [32.13]	.937 [23.80]	.906 [23.01]	.140 [3.56]	-	XX-X1430
1.266 [32.16]	.781 [19.84]	.938 [23.83]	.125 [3.18]	-	XX-X1431
1.281 [32.54]	.875 [22.23]	.969 [24.61]	.150 [3.81]	.160 [4.06]	XX-X1432
1.281 [32.54]	.875 [22.23]	.969 [24.61]	.146 [3.71]	.188 [4.78]	XX-X1433
1.281 [32.54]	1.031 [26.19]	.969 [24.61]	.120 [3.05]	.125 [3.18]	XX-X1116
1.281 [32.54]	1.063 [27.00]	969 [24.61]	.120 [3.05]	.156 [3.96]	XX-X1435
1.344 [34.14]	1.000 [25.40]	1.031 [26.19]	.156 [3.96]	.125 [3.18]	XX-X1436
1.360 [34.54]	.870 [22.10]	1.030 [26.16]	.120 [3.05]	.120 [3.05]	XX-X1437
1.375 [34.93]	1.000 [25.40]	1.063 [27.00]	.128 [3.25]	.156 [3.96]	XX-X1438
1.375 [34.93]	1.156 [29.36]	1.063 [27.00]	.120 [3.05]	.188 [4.76]	XX-X1118
1.375 [34.93]	1.188 [30.18]	1.063 [27.00]	.120 [3.05]	.156 [3.96]	XX-X1440
1.375 [34.93]	1.000 [25.40]	1.062 [26.97]	.166 [4.22]	.166 [4.22]	XX-X1441
1.375 [34.93]	1.000 [25.40]	-	-	-	XX-X1442
1.406 [35.71]	1.000 [25.40]	1.000 [25.40]	.177 [4.50]	.201 [5.11]	XX-X1443
1.406 [35.71]	1.125 [28.58]	1.062 [26.97]	.149 [3.78]	.125 [3.18]	XX-X1444
1.437 [36.49]	1.062 [26.97]	1.125 [28.58]	.156 [3.96]	.156 [3.96]	XX-X1445
1.437 [36.49]	1.125 [28.58]	1.125 [28.58]	.156 [3.96]	.125 [3.18]	XX-X1446
1.437 [36.49]	1.250 [31.75]	1.188 [30.18]	.125 [3.18]	.125 [3.18]	XX-X1447
1.469 [36.49]	1.312 [33.32]	1.188 [30.18]	.125 [3.18]	.156 [3.96]	XX-X1449
1.500 [38.10]	.875 [22.23]	1.062 [26.97]	.177 [4.50]	-	XX-X1450
1.500 [38.10]	1.000 [25.40]	1.125 [28.58]	.188 [4.78]	-	XX-X1451
1.500 [38.10]	1.031 [26.19]	1.125 [28.58]	.173 [4.39]	.188 [4.78]	XX-X1452
1.500 [38.10]	1.140 [28.96]	1.156 [29.36]	.120 [3.05]	.171 [4.34]	XX-X1453

GASKET DIMENSIONS					
A ±.015 0.38	B ±.015 0.38	C ±.015 0.38	D ±.015 0.38	R ±015 0.38	*TECKNIT ORDER NUMBER
1.500 [38.10]	1.219 [30.96]	1.156 [29.36]	.156 [3.96]	.171 [4.34]	XX-X1454
1.500 [38.10]	1.281 [32.54]	1.156 [29.36]	.120 [3.05]	.187 [4.75]	XX-X1120
1.500 [38.10]	1.240 [31.50]	1.160 [29.46]	.156 [3.96]	.160 [4.06]	XX-X1456
1.500 [38.10]	1.344 [34.14]*	1.188 [30.18]	.171 [4.34]	.187 [4.75]	XX-X1457
1.516 [38.51]	1.250 [31.75]	1.203 [30.56]	.156 [3.96]	.125 [3.18]	XX-X1458
1.516 [38.51]	1.125 [28.58]	-	-	-	XX-X1459
1.531 [38.89]	1.156 [29.36]	1.203 [30.56]	.125 [3.18]	-	XX-X1460
1.594 [40.49]	1.312 [33.32]	1.250 [31.75]	.173 [4.39]	-	XX-X1462
1.594 [40.49]	1.406 [35.71]	1.250 [31.75]	.141 [3.58]	.125 [3.18]	XX-X1463
1.625 [41.28]	1.375 [34.93]	1.250 [31.75]	.171 [4.34]	.188 [4.78]	XX-X1464
1.625 [41.28]	1.406 [35.71]	1.250 [31.75]	.120 [3.05]	.125 [3.18]	XX-X1466
1.625 [41.28]	1.437 [36.50]	1.250 [31.75]	.120 [3.05]	.187 [4.75]	XX-X1467
1.640 [41.66]	1.250 [31.75]	-	-	.35 X 45° [8.89 X 45°]	XX-X1468
1.672 [42.47]	1.375 [34.93]	1.297 [32.94]	.125 [3.18]	.125 [3.18]	XX-X1469
1.688 [42.88]	1.385 [35.18]	1.297 [32.94]	.150 [3.81]	-	XX-X1470
1.688 [42.88]	1.375 [34.93]	1.297 [32.94]	.150 [3.81]	.181 [4.60]	XX-X1471
1.687 [42.85]	1.312 [33.32]	1.312 [33.32]	.156 [3.96]	.156 [3.96]	XX-X1472
1.735 [44.09]	1.560 [39.62]	1.312 [33.32]	.125 [3.18]	.200 [5.59]	XX-X1473
1.470 [44.20]	1.439 [36.55]	1.312 [33.32]	.136 [3.45]	-	XX-X1474
1.750 [44.45]	1.281 [32.54]	1.297 [32.94]	.173 [4.39]	.226 [5.74]	XX-X1475
1.750 [44.45]	1.562 [39.67]	1.312 [33.32]	.140 [3.56]	.125 [3.18]	XX-X1476
1.750 [44.45]	1.500 [38.10]	1.312 [33.32]	.125 [3.18]	.156 [3.96]	XX-X1477
1.750 [44.45]	1.500 [38.10]	1.375 [34.92]	.125 [3.18]	.125 [3.18]	XX-X1479
1.750 [44.45]	1.531 [38.89]	1.375 [34.92]	.147 [3.73]	.125 [3.18]	XX-X1124
1.750 [44.45]	1.500 [38.10]	1.375 [34.92]	.109 [2.77]	.188 [4.78]	XX-X1481
1.781 [45.24]	1.594 [40.49]	1.438 [36.53]	.136 [3.45]	.062 [1.57]	XX-X1482
1.800 [45.72]	1.440 [36.58]	1.380 [35.05]	.204 [5.18]	.093 [2.36]	XX-X1483
1.812 [46.02]	1.560 [39.62]	1.312 [33.32]	.125 [3.18]	.250 [6.35]	XX-X1484
1.812 [46.02]	1.375 [34.93]	-	-	-	XX-X1485
1.875 [47.63]	1.625 [41.28]	1.500 [38.10]	.156 [3.96]	.125 [3.18]	XX-X1486
1.875 [47.63]	1.531 [38.89]	1.375 [34.92]	.109 [2.77]	.250 [6.35]	XX-X1487
1.950 [49.53]	1.500 [38.10]	-	-	-	XX-X1488
2.000 [50.80]	1.437 [36.50]	1.437 [36.50]	.257 [6.53]	.125 [3.18]	XX-X1489
2.000 [50.80]	39.80 [1.567]	1.437 [38.50]	.257 [6.53]	.125 [3.18]	XX-X1490
2.000 [50.80]	1.781 [45.24]	1.563 [39.70]	.147 [3.73]	.218 [5.54]	XX-X1128
2.000 [50.80]	1.781 [45.24]	1.563 [39.70]	.188 [4.76]	.125 [3.18]	XX-X1492
2.070 [52.58]	1.625 [41.28]	-	-	-	XX-X1493
2.125 [53.98]	1.688 [42.88]	1.688 [42.88]	.195 [4.95]	.218 [5.54]	XX-X1494
2.250 [57.15]	1.843 [46.81]	1.750 [44.45]	.219 [5.56]	-	XX-X1495
2.250 [57.15]	2.000 [50.80]	1.750 [44.45]	.219 [5.56]	.125 [3.18]	XX-X1497
2.250 [57.15]	2.031 [51.59]	1.750 [44.45]	.173 [4.39]	.125 [3.18]	XX-X1498
2.250 [57.15]	2.031 [51.59]	1.750 [44.45]	.219 [5.56]	.125 [3.18]	XX-X1499
2.281 [57.94]	2.015 [51.18]	1.688 [42.88]	.219 [5.56]	.125 [3.18]	XX-X1500
2.375 [60.33]	2.032 [51.61]	1.688 [42.88]	.125 [3.18]	.250 [6.35]	XX-X1501
2.500 [63.50]	1.250 [31.75]	1.750 [44.45]	.312 [7.92]	-	XX-X1502
2.500 [63.50]	1.625 [41.28]	1.750 [44.45]	.312 [7.92]	-	XX-X1503
2.500 [63.50]	2.250 [57.15]	1.852 [47.04]	.177 [4.50]	.312 [7.92]	XX-X1504
2.500 [63.50]	2.281 [57.94]	1.983 [49.23]	.173 [4.39]	.093 [2.36]	XX-X1136

COMMONLY USED CONNECTOR SIZES AND PART NUMBERS, CONT.

Table 2.

GASKET DIMENSIONS						GASKET DIMENSIONS					
A ±.015 0.38	B ±.015 0.38	C ±.015 0.38	D ±.015 0.38	R ±015 0.38	*TECKNIT ORDER NUMBER	A ±.015 0.38	B ±.015 0.38	C ±.015 0.38	D ±.015 0.38	R ±015 0.38	*TECKNIT ORDER NUMBER
2.500 [63.50]	2.281 [57.94]	1.983 [49.23]	.281 [7.14]	.093 [2.36]	XX-X1506	3.265 [82.93]	3.035 [77.09]	2.531 [64.29]	.296 [7.52]	.312 [7.92]	XX-X1515
2.625 [66.68]	2.188 [55.58]	2.093 [53.16]	.221 [5.61]	.266 [6.76]	XX-X1507	3.281 [83.34]	3.015 [76.58]	2.531 [64.29]	.281 [7.14]	.125 [3.18]	XX-X1516
2.690 [68.33]	2.250 [57.15]	2.250 [57.15]	.201 [5.11]	.125 X 45° [3.18 X 45°]	XX-X1508	3.375 [85.73]	2.138 [79.71]	2.475 [62.87]	.166 [4.22]	1.000 [25.40]	XX-X1517
2.750 [69.85]	2.531 [64.29]	2.188 [55.58]	.173 [4.39]	.125 [3.18]	XX-X1140	3.812 [96.82]	3.125 [79.38]	3.250 [82.55]	.312 [7.92]	-	XX-X1518
2.750 [69.85]	2.531 [64.29]	2.234 [56.74]	.173 [4.39]	.26 X 45° [6.60 X 45°]	XX-X1510	4.000 [101.60]	2.000 [50.80]	3.000 [72.20]	.281 [7.14]	-	XX-X1519
2.765 [70.23]	2.515 [63.88]	2.085 [52.96]	.236 [5.99]	.250 [6.60]	XX-X1511	4.000 [101.60]	2.938 [74.63]	3.375 [85.73]	.180 [4.57]	.312 [7.92]	XX-X1520
2.781 [70.64]	2.500 [63.50]	2.234 [56.74]	.166 [4.22]	FULL	XX-X1512	4.500 [114.30]	3.000 [76.20]	3.800 [96.52]	.250 [6.35]	.35 X 45° [8.89 X 45°]	XX-X1521
2.875 [73.03]	2.531 [64.29]	2.094 [53.19]	.138 [3.51]	.250 [6.60]	XX-X1513	4.500 [114.30]	4.000 [101.60]	3.875 [98.43]	.281 [7.14]	.312 [7.92]	XX-X1522
2.875 [73.03]	2.500 [63.50]	2.500 [63.50]	.154 [3.91]	.188 [4.78]	XX-X1514	4.625 [117.48]	3.888 [98.76]	-	-	-	XX-X1523

*To form a complete TECKNIT part no., substitute the appropriate material prefix from Specifications Table for the "XX-X" in the above TECKNIT order number.

STANDARD CONNECTOR GASKETS

Table 3.

CONNECTOR SHELL SIZE MIL-C-38999		GASKET DIMENSIONS						
NUMBER	± .015 SERIES	A +.020 [0.38]	B ± .015 -.000 [+ 0.51,-000]	C ± .015 [0.38]	D ± .015 [0.38]	R ± .015 [0.38]	E** [0.38]	TECKNIT* ORDER NUMBER
8	II	.840 [21.34]	.630 [16.00]	.594 [15.09]	.135 [3.43]	.125 [3.18]		XX-X1616
9	I	.965 [24.51]	.750 [19.05]	.719 [18.26]	.135 [3.43]	.125 [3.18]		XX-X1617
9A	III	.965 [24.51]	.750 [19.05]	.719 [18.26]	.135 [3.43]	.125 [3.18]	.222[5.64]	XX-X1640
10	II	.965 [24.51]	.750 [19.05]	.719 [18.26]	.135 [3.43]	.125 [3.18]		XX-X1617
11	I & 1V	1.060 [26.92]	.875 [22.23]	.812 [20.62]	.141 [3.58]	.125 [3.18]		XX-X1618
11B	III	1.060 [26.92]	.875 [22.23]	.812 [20.62]	.141 [3.58]	.125 [3.18]	.206 [5.23]	XX-X1641
12	II	1.060 [26.92]	.875 [22.23]	.812 [20.62]	.141 [3.58]	.125 [3.18]		XX-X1618
13	I & IV	1.153 [29.29]	1.005 [25.53]	.906 [23.01]	.135 [3.43]	.125 [3.18]		XX-X1619
13C	III	1.153 [29.29]	1.005 [25.53]	.906 [23.01]	.135 [3.43]	.125 [3.18]	.206 [5.23]	XX-X1642
14	II	1.153 [29.29]	1.005 [25.53]	.906 [23.01]	.135 [3.43]	.125 [3.18]		XX-X1619
15	I & IV	1.258 [31.95]	1.135 [28.83]	.969 [24.61]	.156 [3.96]	.141 [3.58]		XX-X1620
15D	III	1.258 [31.95]	1.135 [28.83]	.969 [24.61]	.156 [3.96]	.141 [3.58]	.206 [5.23]	XX-X1643
16	II	1.258 [31.95]	1.135 [28.83]	.969 [24.61]	.156 [3.96]	.141 [3.58]		XX-X1620
17	I & IV	1.351 [34.32]	1.260 [32.00]	1.062 [26.97]	.156 [3.96]	.141 [3.58]		XX-X1621
17E	III	1.351 [34.32]	1.260 [32.00]	1.062 [26.97]	.156 [3.96]	.141 [3.58]	.222 [5.64]	XX-X1644
18	II	1.351 [34.32]	1.260 [32.00]	1.062 [26.97]	.156 [3.96]	.141 [3.58]		XX-X1621
19	I & IV	1.500 [38.10]	1.375 [34.93]	1.156 [29.36]	.141 [3.58]	.172 [437]		XX-X1622
19F	III	1.500 [38.10]	1.375 [34.93]	1.156 [29.36]	.141 [3.58]	.172 [437]	.206 [5.23]	XX-X1645
20	II	1.500 [38.10]	1.375 [34.93]	1.156 [29.36]	.141 [3.58]	.172 [437]		XX-X1622
21	I & IV	1.625 [41.28]	1.500 [38.10]	1.250 [31.75]	.141 [3.58]	.188 [4.78]		XX-X1623
21G	III	1.625 [41.28]	1.500 [38.10]	1.250 [31.75]	.141 [3.58]	.188 [4.78]	.206 [5.23]	XX-X1646
22	II	1.625 [41.28]	1.500 [38.10]	1.250 [31.75]	.141 [3.58]	.188 [4.78]		XX-X1623
23	I & IV	1.750 [44.45]	1.625 [41.28]	1.375 [34.93]	.172 [4.37]	.188 [4.78]		XX-X1624
23H	III	1.750 [44.45]	1.625 [41.28]	1.375 [34.93]	.172 [4.37]	.188 [4.78]	.259 [6.58]	XX-X1647
24	II	1.750 [44.45]	1.625 [41.28]	1.375 [34.93]	.172 [4.37]	.188 [4.78]		XX-X1624
25	I & IV	1.875 [47.63]	1.750 [44.45]	1.500 [38.10]	.172 [4.37]	.188 [4.78]		XX-X1625
25J	III	1.875 [47.63]	1.750 [44.45]	1.500 [38.10]	.172 [4.37]	.188 [4.78]	.259 [6.58]	XX-X1648

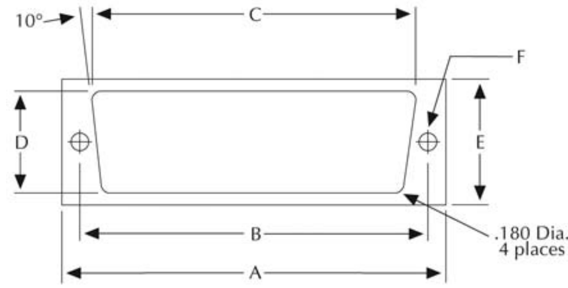
* To form a complete TECKNIT part no., substitute the appropriate material suffix from the SPECIFICATIONS TABLE for the "XX-X" in the TECKNIT order number.

**Required for Series III only. At TECKNIT's option dimension "E" may be slotted through to Hole "B" (see Figure 2).

EMI Connector Gaskets, continued

U.S. Customary
[SI Metric]

"D" SUBMINIATURE CONNECTOR GASKETS



GASKET DIMENSIONS

PART NUMBER	MOUNTING METHOD	NUMBER OF CONNECTOR PINS	A ± .020	B ± .005	C ± .010	D ± .010	E ± .020	F ± .005
42-X1700	Front Mounting	9	1.313	.984	.782	.450	.750	.140
42-X1701	Rear Mounting		1.313	.984	.665	.370	.750	.140
42-X1702	Front Mounting	15	1.641	1.312	1.110	.450	.750	.140
42-X1703	Rear Mounting		1.641	1.312	.993	.370	.750	.140
42-X1704	Front Mounting	25	2.188	1.852	1.650	.450	.750	.140
42-X1705	Rear Mounting		2.188	1.852	1.533	.370	.750	.140
42-X1706	Front Mounting	37	2.829	2.500	2.298	.450	.750	.140
42-X1707	Rear Mounting		2.829	2.500	2.181	.370	.750	.140
42-X1708	Front Mounting	50	2.740	2.406	2.200	.562	.860	.140
42-X1709	Rear Mounting		2.740	2.406	2.087	.480	.860	.140

NOTE: "D" Subminiature Connector Gaskets can be fabricated from any of Tecknit's sheet stock materials. Contact your nearest Tecknit representative or factory location for part numbers and design assitance.

Conductive O-Seals

CONDUCTIVE ELASTOMER RING SEALS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

O-SEALS are resilient O-rings of electrically conductive silicone elastomer. They can be manufactured from a variety of TECKNIT CONSIL® materials, and are available in round or rectangular cross-sections and provide high electrical conductivity, shielding effectiveness, and moisture or pressure sealing. They are designed for static applications in which the sealed surfaces do not move relative to each other.

APPLICATION INFORMATION

Typical applications for O-SEALS include connector, jam-nut and interfacial seals, waveguide flange seals, cap seals, and conductive moisture seals for sealing screws. Typical groove dimensions for round cross-section O-SEALS are listed in Table 1 below.

Table 1. Groove Dimensions for Round Cross-Section O-SEALS

O-SEAL Cross-Section Diameter	Groove Depth ±.003 in. [0.07 mm]	Groove Width ±.005 in. [0.12 mm]
.070 in. [1.78 mm]	.055 in. [1.40 mm]	.080 in. [2.03 mm]
.103 in. [2.62 mm]	.082 in. [2.06 mm]	.1127 in. [2.97 mm]

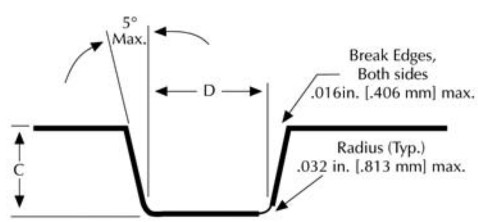


Figure 1. Groove Design

SPECIFICATIONS

STANDARD MATERIALS*	CONDUCTIVE FILLER	ELASTOMER	VOL. RES.(max.)
Consil-II 842	Silver plated inert particles	Silicone	.01 ohm-cm
Consil-C 871	Silver plated copper particles	Silicone	.004 ohm-cm
Consil-C 873	Silver plated copper particles	Silicone	.005 ohm-cm
Consil-A 895	Silver plated aluminum particles	Silicone	.008 ohm-cm

*For detailed material specifications see applicable data sheets.

ORDERING INFORMATION

To order O-SEALS specify the TECKNIT Part Numbers shown in Tables II and III and the quantity required. For part not listed in Tables II and III, or for part numbers of other CONSIL materials, contact your nearest TECKNIT area representative or factory location to determine availability of the required tooling.

INTERFACIAL SEALS

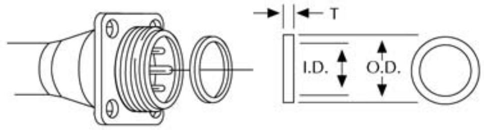


Table 2.

CONNECTOR SHELL MIL-C-26482	MIL-C-5015	DIMENSIONS I.D. ± .010 in. [0.25mm]	O.D. ± .010 [0.25 mm]	T ± .005 in. [0.13]	Consil II 842	Consil-C 871	Consil-A 895
#8		.319 [8.10]	.422 [10.72]	.075 [1.91]	84-30220	87-30220	89-50220
	#8	.328 [8.33]	.391 [9.93]	.030 [0.76]	84-30221	87-30221	89-50221
#10		.447 [11.35]	.550 [13.97]	.075 [1.91]	84-30222	87-30222	89-50222
	#10	.406 [10.31]	.469 [11.91]	.030 [0.76]	84-30223	87-30223	89-50223
#12		.547 [13.89]	.703 [17.86]	.075 [1.91]	84-30224	87-30224	89-50224
	#12	.531 [13.49]	.594 [15.09]	.030 [0.76]	84-30225	87-30225	89-50225
#14		.671 [17.04]	.828 [21.03]	.075 [1.91]	84-30226	87-30226	89-50226
	#14	.641 [16.28]	.700 [17.78]	.030 [0.76]	84-30227	87-30227	89-50227
#16		.797 [20.24]	.953 [24.21]	.075 [1.91]	84-30228	87-30228	89-50228
	#16	.781 [19.84]	.844 [21.44]	.030 [0.76]	84-30229	87-30229	89-50229
#18		.891 [22.63]	1.047 [26.59]	.075 [1.91]	84-30230	87-30230	89-50230
	#18	.891 [22.63]	.953 [24.21]	.030 [0.76]	84-30231	87-30231	89-50231
#20		1.039 [26.39]	1.172 [29.77]	.075 [1.91]	84-30232	87-30232	89-50232
	#20	.984 [24.99]	1.047 [26.59]	.030 [0.76]	84-30233	87-30233	89-50233
#22		1.141 [28.98]	1.297 [32.94]	.075 [1.91]	84-30234	87-30234	89-50234
	#22	1.109 [28.17]	1.172 [29.77]	.030 [0.76]	84-30235	87-30235	89-50235
#24		1.266 [32.16]	1.322 [36.12]	.075 [1.91]	84-30236	87-30236	89-50236
	#24	1.219 [30.96]	1.281 [32.54]	.030 [0.76]	84-30237	87-30237	89-50237
	#28	1.455 [36.96]	1.547 [39.29]	.040 [1.02]	84-30238	87-30238	89-50238
	#32	1.672 [42.47]	1.766 [14.86]	.040 [1.02]	84-30239	87-30239	89-50239
	#36	1.891 [48.03]	1.984 [50.39]	.040 [1.02]	84-30240	87-30240	89-50240

JAM NUT AND O-RING SEAL

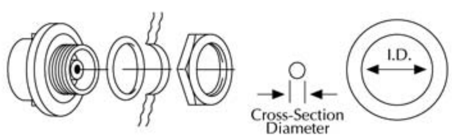


Table 3.

CONNECTOR SHELL MIL-C-26482 MIL-C-38999	MIL-C-81511	REFERENCE Substitute for MS-29513 Size Reference Dash Number	DIMENSIONS I.D. ± 0.010 in. [0.25 mm]	Section Dia. ± .005 in. [0.13 mm]	Consil-II 842	Consil-C 871	Consil-A 895
		-11	.301 [7.65]	.070 [1.78]	84-30200	87-30200	89-50200
		-13	.426 [10.82]	.070 [1.78]	84-30201	87-30201	89-50201
		-14	.489 [12.42]	.070 [1.78]	84-30202	87-30202	89-50202
#6		-15	.551 [14.00]	.070 [1.78]	84-30203	87-30203	89-50203
#8		-17	.676 [17.17]	.070 [1.78]	84-30204	87-30204	89-50204
	#8	-18	.739 [18.77]	.070 [1.78]	84-30205	87-30205	89-50205
#9, 10		-19	.801 [20.35]	.070 [1.78]	84-30206	87-30206	89-50206
	#10	-20	.864 [21.95]	.070 [1.78]	84-30207	87-30207	89-50207
#11, 12		-22	.989 [25.12]	.070 [1.78]	84-30208	87-30208	89-50208
#13, 14	#14	-24	1.114 [28.30]	.070 [1.78]	84-30209	87-30209	89-50209
#15, 16	#16	-26	1.239 [31.47]	.070 [1.78]	84-30210	87-30210	89-50210
#17, 18	#18	-28	1.364 [34.65]	.070 [1.78]	84-30211	87-30211	89-50211
#19, 20			1.487 [37.77]	.103 [2.62]	84-30212	87-30212	89-50212
#21, 22			1.612 [40.94]	.103 [2.62]	84-30213	87-30213	89-50213
#23, 24			1.737 [44.12]	.103 [2.62]	84-30214	87-30214	89-50214
#25			1.862 [47.30]	.103 [2.62]	84-30215	87-30215	89-50215

Waveguide Gaskets

CONDUCTIVE SILICONE ELASTOMER GASKETS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

TECKNIT® WAVEGUIDE GASKETS are made from a silicone elastomer filled with silver-plated particles designed to achieve maximum electrical conductivity. Gaskets for choke or grooved contact flanges are molded from TECKNIT CONSIL®- C (Compound 873) elastomer in solid round or solid "D" shaped cross sections. Flat contact flange gaskets are die cut from .027 in. [0.69 mm] thick TECKNIT CONSIL-C (Compound 877) elastomer. CONSIL-C (Compound 877) contains an expanded copper metal reinforcement to eliminate cold flow. All gaskets are reusable and have no metal surfaces to mar flanges.

APPLICATION INFORMATION

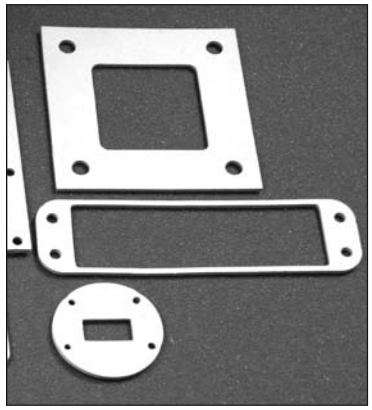
TECKNIT WAVEGUIDE GASKETS offer the circuit designer a wide variety of RF and pressure tight seals for any waveguide system. They can be used for EMP and TEMPEST applications, and are widely used by the military and aerospace communities in sophisticated electronic countermeasure, communication, and guidance systems. Recommended design compression is 7 to 10% of thickness for rectangular cross sections, 18 to 20% of diameter for round cross sections and 12 to 15% of height for "D" shaped cross sections. All at 50 to 200 PSI closure force.

EMI SHIELDING PERFORMANCE*

TECKNIT CONSIL-C Shielding Effectiveness has been tested in accordance with TECKNIT test method TSETS-01 and based upon MODIFIED MIL-STD- 285. Typical values are given below.

MATERIALS	H-FIELD 100 kHz	E-FIELD 10 MHz	PLANE WAVE 1 GHz	PLANE WAVE 10 GHz
	dB	dB	dB	dB
873	75	130+	115	110
877	75	130+	115	110

(*Based on 127 mm x 127 mm Aperture)



SPECIFICATIONS

MATERIAL DESCRIPTION

Consil-C Compound No.	873	877
Elastomer	Silicone	Silicone
Filler	Silver Plated Copper Particles	Silver Plated Copper Particles & Expanded Copper Reinforcement
Color	Gray	Red
Texture	Smooth	Smooth

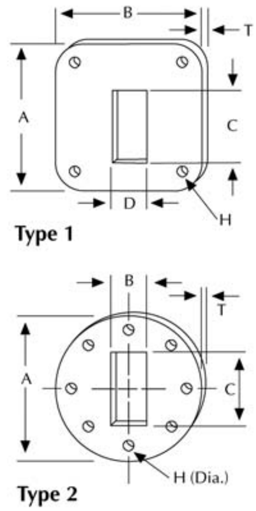
PERFORMANCE CHARACTERISTICS

Hardness Shore A Durometer, ASTM D-2240	85 ±7	80 ±7
Volume Res. (max.) QA-1039	.005 ohm-cm	.007 ohm-cm
Specific Gravity ASTM D-792	3.5 ±13%	4.75 ±.75
Tensile Strength (Min.) ASTM D-412	400 psi	600 psi [4.05 MPa]
Tear Strength (Min.) ASTM D-624	40 ppi [7 kN/m]	70 ppi [12.25 kN/m]
Elongation to (Min/Max) ASTM D-412	100%/ 300%	NA[1]
Temperature Range	-49°F to 257°F [-45°C to 125°C]	-49°F to 257°F [-45°C to 125°C]
Form Available:	Molded & Extruded	Die Cut

[1] NA = Not Applicable

TECKNIT WAVEGUIDE GASKET SELECTION CHART

Wave-guide Size	Band	Frequency Range GHz	Flange Description	Flange Type	Gasket Type[1]	Gasket Material	Part Number
WR28	K_a	26.5	UG-599/U	Cover	1	877	87-87000
WR42	K	18.0	UG-595/U UG-597/U	Cover	1	877	87-87001
WR62	K_u	12.4	UG-419/U	Cover	1	877	87-87002
WR90	X	8.2 12.4	UG-39/U UG-135U	Cover	1	877	87-87003
			UG-1736/U UG-1737/U	Flat Contact	1	877	87-87004
WR112	X_1	7.05 10.00	UG-51/U UG-138/U	Cover	1	877	87-87005
			UG-1734/U UG-1735/U	Flat Contact	1	877	87-87006
WR137	X_b	5.85 8.20	UG-344/U UG-441/U	Cover	2	877	87-87007
			UG-1732/U UG-1733/U	Flat Contact	1	877	87-87008
WR159		4.90 7.05	UG-1730/U UG-1731/U	Flat Contact	1	877	87-87009
WR187	C	3.95 5.85	UG-149A/U UG-407/U	Cover	2	877	87-87010
			UG-1728/U UG-1729/U	Flat Contact	1	877	87-87011
WR284		2.60 3.95	UG-53U UG-584/U	Cover	2	877	87-87012
			UG-1724/U UG-1725/U	Flat Contact	1	877	87-87013



GASKET TYPE

1 Die Cut Rectangular
2 Die Cut Circular

Waveguide Gaskets, continued

U.S. Customary
[SI Metric]

TYPE 1 GASKET DIMENSIONS

Table 3.

A ± .015 [0.38]	B ± .015 [0.38] -0	C +.015 [0.38] -0	D +.015 [0.38]	H ±.010 [0.25]	T ±.005 [0.13]	PART NUMBER
.750 [19.05]	.750 [19.05]	.145 [3.68]	.285 [7.24]	.116 [2.95]	.027 [0.69]	87-87000
.875 [22.23]	.875 [22.23]	.175 [4.45]	.425 [10.80]	.116 [2.95]	.027 [0.69]	87-87001
1.313 [33.35]	1.313 [33.35]	.630 [16.00]	.320 [8.13]	.140 [3.56]	.027 [0.69]	87-87002
1.625 [41.28]	1.625 [41.28]	.905 [22.99]	.405 [10.29]	.169 [4.29]	.027 [0.69]	87-87003
1.594 [40.49]	2.094 [53.19]	.405 [10.29]	.905 [22.99]	.169 [4.29]	.027 [0.69]	87-87004
1.875 [47.63]	1.875 [47.63]	1.130 [28.70]	.505 [12.83]	.180 [4.57]	.027 [0.69]	87-87005
1.750 [44.45]	2.500 [63.50]	.505 [12.83]	1.130 [28.70]	.171 [4.34]	.027 [0.69]	87-87006
1.937 [49.20]	2.687 [68.25]	.633 [16.08]	1.380 [35.05]	.206 [5.23]	.027 [0.69]	87-87008
2.438 [61.93]	3.188 [80.98]	.805 [20.45]	1.600 [40.64]	.257 [6.53]	.027 [0.69]	87-87009
3.500 [88.90]	2.500 [63.50]	1.880 [47.75]	.880 [22.35]	.266 [6.76]	.027 [0.69]	87-87011
4.500 [114.30]	3.000 [76.20]	2.850 [72.39]	1.350 [34.29]	.266 [6.76]	.027 [0.69]	87-87013

TYPE 2 GASKET DIMENSIONS

Table 4.

A ±.015 [0.38]	B +.015 [0.38] -0	C +.015 [0.38] -0	H ±.010 [0.38]	T ±.005 [0.13]	PART NUMBER
3.125 [79.38]	.632 [16.05]	1.382 [35.10]	.234 [5.94]	.027 [0.69]	87-87007
3.625 [92.08]	.882 [22.40]	1.882 [47.80]	.234 [5.94]	.027 [0.69]	87-87010
5.312 [134.93]	1.350[34.29]	2.850 [72.39]	2.90 [7.37]	.027 [0.69]	87-87012

U.S.A.: 908-272-5500 • U.K.: 44-1476-590600 • Spain: 34-91-4810178

EMC Foil Tape

CONDUCTIVE FOIL TAPE WITH CONDUCTIVE ADHESIVE

GENERAL DESCRIPTION

TECKNIT® EMC FOIL TAPE consists of copper or aluminum foil backed with conductive acrylic adhesive on one side. The adhesive is a pressure-sensitive type consisting of a uniform dispersion of conductive particles.

APPLICATION INFORMATION

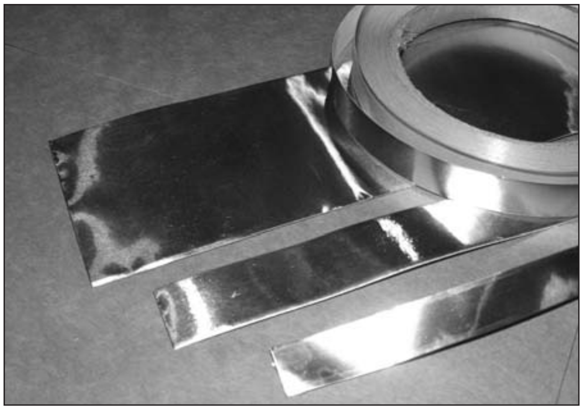
- Sealing of seams on EMI shielding rooms, enclosures and electronic equipment.
- Shielding of cables by wrapping.
- Provides a reliable ground surface.
- Static discharge drain.
- Practical multi-purpose repair material.

STANDARD PART NUMBER DESIGNATION

	WIDTH	PART NUMBER
Copper	0.5 Inch	23-60005
	1.0 Inch	23-60010
	2.0 Inch	23-60020
	4.0 Inch	23-60040
Aluminum	0.5 Inch	23-70005
	1.0 Inch	23-70010
	2.0 Inch	23-70020
	4.0 Inch	23-70040

ORDERING INFORMATION

TECKNIT EMC FOIL TAPE is available in standard widths of .5", 1.0", 2.0" and 4.0" in standard 36 yard lengths. Widths up to 24", different lengths are available on special order.



SPECIFICATIONS

MATERIAL DESCRIPTION

- **Foil**
  Copper* .0014 inch. (1 oz.)
  Aluminum .002 inch.
- **Thickness**
  Copper .0029 inch ±10%.
  Aluminum .0035 inch ±10%.
- **Interliner:** Polyethylene Coated Paper.
- **Adhesive**
  Conductive Acrylic .0015 inch ±10%.

PERFORMANCE CHARACTERISTICS

- **Peel Strength (ASTM D-1000)**
  Copper 40 oz./inch of width.
  Aluminum 35 oz./inch of width.
- **Tensile Strength (ASTM D-1000)**
  Copper 35 lb./inch of width.
  Aluminum 20 lb./inch of width.
- **Conductivity through Adhesive**
  Copper 0.010 ohms/in.2
  Aluminum 0.010 ohms/in.2
- **Shielding Effectiveness:** 10MHz to 1GHz
  Copper 60 dB
  Aluminum 55 dB
- **Temperature Range**
  -131°F to +311°F [-55°C to + 155°C]

*Available Tinned

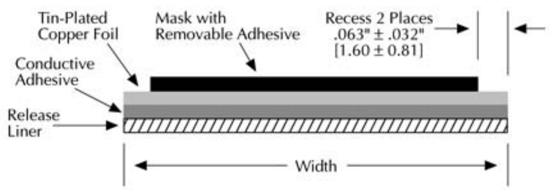
U.S. Customary
[SI Metric]

TeckMask™

EMI FOIL TAPE WITH EASY PEEL MASK

GENERAL DESCRIPTION

Tecknit's TECKMASK tape has been designed to withstand the rigorous powder painting processes currently used in sheet metal cabinet manufacturing. TECKMASK tape also provides a conductive, non- corroding surface, thus eliminating expensive plating, hand masking and chromate conversion coating of enclosure flanges prior to painting. After painting and baking, the high temperature recessed paint mask is removed, leaving a clean conductive surface with a smooth paint edge.



APPLICATION INFORMATION

TECKMASK tape is recommended for use in areas where a conductive path is required, typically, the interface between the cabinet frame and an EMI gasket.

TECKMASK consists of an easily removable 2-mil nylon protective film mask over 2 oz. tin-plated copper foil and backed with an aggressive conductive pressure sensitive adhesive. The foil tape is a special electrolytic grade of premium, dead soft, zero temper, high tensile copper that is tin clad on both sides. The high temperature nylon film mask is backed with a thin film of removable adhesive which has been formulated to leave no trace of adhesive or residue upon removal of the film from the foil tape.

EMI SHIELDING PERFORMANCE

TECKMASK tape shielding effectiveness has been tested in accordance with MIL-STD-285. Typical values are given below.

H-FIELD 100 kHZ	E-FIELD 10 MHz	PLANE WAVE 1 GHz
dB	dB	dB
141	114.5	116

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Foil:**
  Tinned Copper
  Thickness .0028"
  Tin plating per MIL-T-10727
- **Mask:**
  Nylon
  Thickness: .002"
  Color: Light green
- **Total Thickness:** .0077"
- **Temperature Range:** -10°F to 400°F
  [-23°C to 204°]
- **Adhesion:**
  Film to Foil: 20 oz/in.
  Foil to Substrate: 70 oz/inch width
- **Shear:** 2.2 psi (PSTC #7)
- **Electrical Resistance:** .002 ohm/sq. inch
- **Surface Resistivity:** .010 ohm
- **Release Liner:** 65# Kraft.
- **Standard Widths:** .430" to 1.5"
- **Standard Lengths:** 18 yards
- **Custom lengths and widths:** consult factory

APPLICATION GUIDELINES

A. SURFACE PREPARATION:

Teckmask tape should be applied to a clean dry Surface (Figure 1). If the surface is contaminated, clean with a rag dipped in methylethyl ketone. Use a rubber roller or rubber squeegee and moderate pressure (4-10 lbs) to ensure proper adhesion of Teckmask tape to cabinet. After applying, allow Teckmask Tape to stand one hour at room temperature to develop adhesion sufficient to withstand normal processing and handling. Full adhesion is developed after 24 hours.

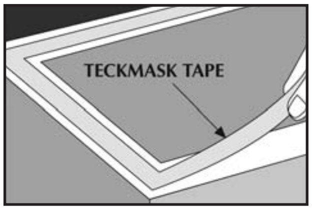


Figure 1.

B. APPLICATION INSTRUCTIONS:

1. Paint the cabinet using conventional methods (Figure 2).

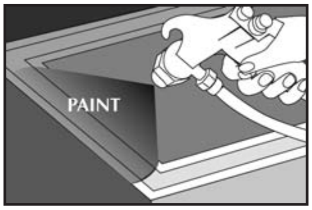


Figure 2.

2. BAKE. Recommended baking schedule for optimum performance of Teckmask Tape is 5 to 60 minutes at 225° to 350°F (Figure 3).

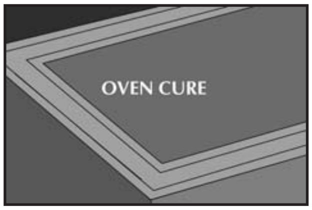


Figure 3.

3. Allow painted area to cool to ambient temperature before removing mask portion of tape (Figure 4). Mask should be removed immediately after cooling as it will reestablish adhesion within 24 to 48 hours. If the mask does regain adhesion it can be removed by reheating to the recommended bake schedule listed above.

4. To minimize the chance of lifting the metal tape, the mask should be peeled back at an angle as close to 180° as possible. If the tape shows signs of lifting during mask removal, it can be rolled back down, using moderate pressure, with a rubber roller or squeegee.

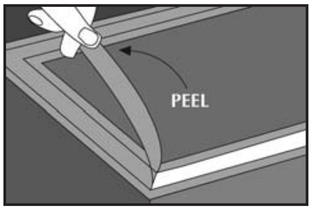


Figure 4.

ORDERING INFORMATION

Standard TECKMASK Tape is available in 18 yard length rolls. Consult factory for custom length, and/or width requirements. TECKMASK tape is available with a non-recessed mask.

PART NUMBERS

PART NUMBER	WIDTH
23-61004	.43" [10.92]
23-61005	.50" [12.70]
23-61006	.625" [15.88]
23-61007	.75" [19.05]
23-61010	1.0" [25.40]
23-61015	1.5" [38.10]

U.S. Customary
[SI Metric]

Section I:
Beryllium Copper Gaskets

PRODUCT **PAGE**

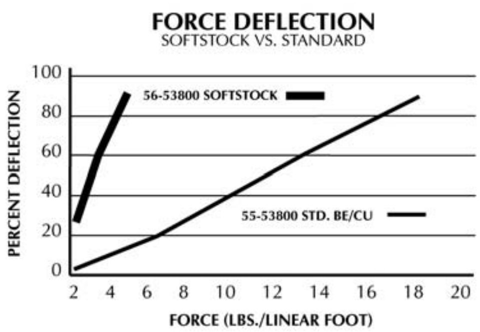
Beryllium Copper

EMI SHIELDING FINGERSTOCK GASKETS

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

Tecknit Beryllium Copper EMI Shielding Fingerstock Gaskets are durable metal strips used as gasket material to provide high shielding effectiveness in closure applications where low closure forces are required. Where extremely low closure force is required, Softstock gaskets are available in all standard cross sections. The following graph compares the force / deflection of Softstock to standard Beryllium Copper gasketing.



Both Softstock and standard Beryllium Copper gaskets are ideal for applications where closure force is applied parallel to the mating surface and the gasket is “wiped” rather than perpendicularly compressed. Beryllium copper gaskets retain a high resistance to relaxation - virtually eliminating compression set.

Note: For detailed technical data, please contact our Customer Service Department at (908) 272-5500 for information on the following:

- Force/deflection on specific part numbers
- Shielding effectiveness on specific part numbers
- Physical properties of Beryllium Copper Alloy
- Pressure sensitive adhesive tape specifications
- Product tolerances and detailed drawings
- Plating specifications

Tecknit offers a wide choice of Beryllium Copper gaskets specially designed for both large and small enclosures. They can be installed by a variety of methods, including adhesive strips, clip-on, and rivet mount designs.

APPLICATION INFORMATION

Tecknit Beryllium Copper EMI Shielding Gaskets can be used in a broad range of electronic equipment where EMI/RFI or ESD problems exist. Beryllium Copper Gaskets perform flawlessly in a variety of environments. They can be plated with a large choice of metal finishes to ensure their compatibility with any mating surface. They will not burn nor are they affected by radiation, or ultraviolet. For these reasons, top designers use Beryllium Copper EMI Shielding in everything from computers and radios to military guidance systems and consumer electronics.

SPECIFICATIONS

MATERIAL DESCRIPTION

- **Metal:** Beryllium Copper Alloy C17200 (ASTM B194)
- **Heat Treated:** 353-435 DPH/Vickers

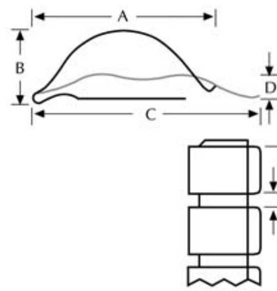
PERFORMANCE CHARACTERISTICS

TYPICAL SHIELDING EFFECTIVENESS
25% deflection in accordance with MIL-STD-285 test procedure.

	H-FIELD	E-FIELD	PLANE WAVE
Standard	100 kHz	10 MHz	1 GHz
Finger Stock	110 dB	100 dB	90 dB
Softstock	95dB	85dB	75dB

PRODUCT DESCRIPTIONS

OPEN END - Low compression force strips with adhesive backing. All-purpose contact strip offers superior performance under minimum compression. Ideally suited for applications requiring a range of compression due to variations in mounting surface.

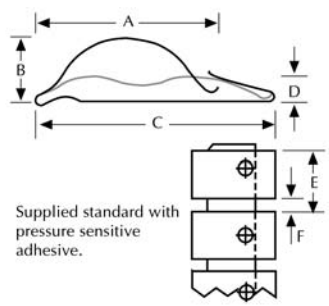


Supplied standard with pressure sensitive adhesive.

Product Number	A	B Ref.	C	D	E	F	Approx. Length
5X-50000	.580[14.73]	.235[5.96]	.770[19.55]	.060[1.52]	.375[9.52]	.032[0.81]	24"
5X-52000	.380[9.65]	.150[3.81]	.500[12.7]	.060[1.52]	.250[6.35]	.022[0.55]	16"
5X-54000	.280[7.11]	.120[3.04]	.370[9.39]	.040[1.01]	.188[4.77]	.018[0.45]	16"
5X-53800	.780[19.81]	.270[6.85]	.940[23.87]	.060[1.52]	.375[9.52]	.040[1.01]	24

Contact Tecknit for availability of 25ft. coils

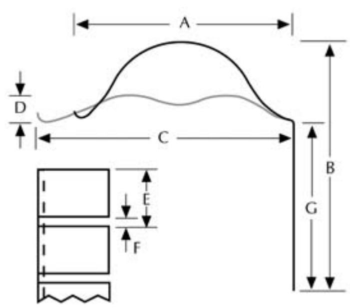
FOLD-OVER - Same characteristics as the open end series. However, this design incorporates a “fold over” design which encaptures each finger protecting them from damage.



Product Number	A	B Ref.	C	D	E	F	Approx. Length
5X-51500	.580[14.73]	.223[5.84]	.760[19.30]	.060[1.52]	.375[9.52]	.032[0.81]	24"
5X-52100	.400[10.16]	.150[3.81]	.510[12.95]	.060[1.52]	.250[6.35]	.022[0.55]	16"
5X-54100	.280[7.11]	.120[3.04]	.380[9.65]	.050[1.27]	.188[4.77]	.018[0.45]	16"
5X-54200	.173[4.39]	.080[2.32]	.250[6.35]	.050[1.27]	.187[4.76]	.018[0.45]	16"

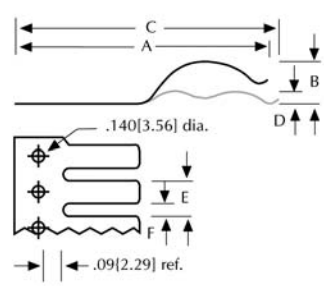
Contact Tecknit for availability of 25ft. coils

RIGHT ANGLE - For applications where a minimal amount of material thickness is desired. This series provides optimum shielding with minimal closure force.



Product Number	A	B Ref.	C	D	E	F	G Ref.	Approx. Length
5X-50400	.580[14.73]	.735[18.66]	.770[19.55]	.060[1.52]	.375[9.52]	.032[.812]	.50[12.7]	24"
5X-52400	.380[9.65]	.450[11.43]	.500[12.7]	.060[1.52]	.250[6.35]	.022[.558]	.30[7.62]	16"
5X-54400	.280[7.11]	.354[8.99]	.370[9.39]	.040[1.01]	.188[4.77]	.018[.457]	.23[5.84]	16"
5X-53400	.780[19.81]	.810[20.57]	.940[23.87]	.060[1.52]	.375[9.52]	.040[1.016]	.54[13.71]	24"

LARGE ENCLOSURE - A design uniquely suited to applications such as shielded room doors or large electronic enclosures. May be used in wiping or compression applications.



Product Number	A	B Ref.	C	D	E	F	Approx. Length
5X-63900	1.500[38.1]	.225[5.71]	1.760[44.70]	.060[1.524]	.375[9.52]	.040[1.016]	24"
5X-63800	1.090[27.68]	.225[5.71]	1.350[34.29]	.060[1.524]	.375[9.52]	.040[1.016]	24"

Contact Tecknit for availability of 25ft. coils.

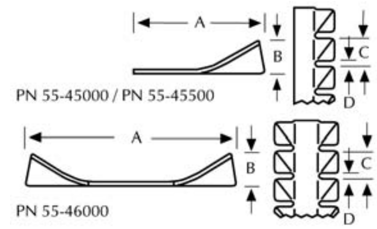
Beryllium Copper, continued

U.S. Customary
[SI Metric]

TWIST - Designed for compression applications with minimum flange widths. Available in single sided and double sided versions.

Product Number	A	B	C	D	Approx. Length
5X-45000	.230[5.84]	.030[0.762]	.095[2.41]	.015[0.381]	24"
5X-45500	.340[8.64]	.070[1.77]	.165[4.19]	.015[0.381]	24"
5X-46000	.500[12.7]	.070[1.77]	.165[4.19]	.015[0.381]	24"

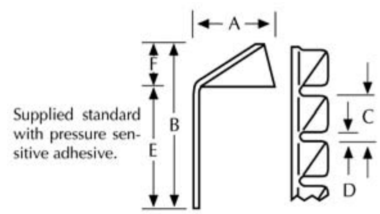
Contact Tecknit for availability of 25ft. coils



Supplied standard with pressure sensitive adhesive.

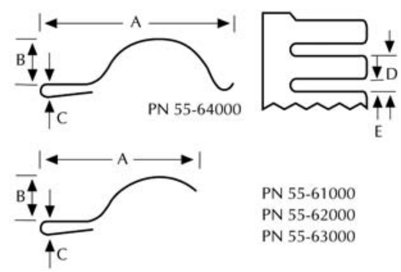
RIGHT ANGLE TWIST- For compression applications where side mounting is desired.

Product Number	A	B	C	D	E Ref.	F	Approx. Length
5X-65100	.080[2.03]	.190[4.82]	.095[2.41]	.015[0.381]	.160[4.064]	.03[.762}	24"
5X-65500	.160[4.06]	.260[6.60]	.165[4.19]	.015[0.381]	.190[4.830]	.07[1.778]	24"



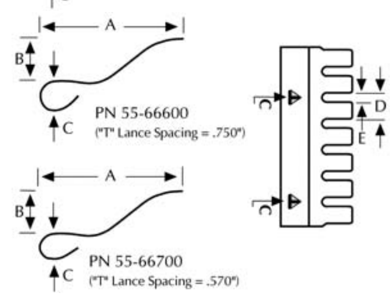
CLIP-ON - For applications where adhesive mounting is not possible.

Product Number	A	B	C	D	E	Approx. Length
*5X-61000	.300[7.62]	.092[2.33]	.078[1.98]	.188[4.77]	.047[1.19]	16"
*5X-62000	.440[11.17]	.078[1.98]	.078[1.98]	.188[4.77]	.047[1.19]	16"
*5X-63000	.600[15.24]	.205[5.20]	.078[1.98]	.188[4.77]	.047[1.19]	16"
*5X-64000	1.090[27.68]	.255[6.47]	.081[2.05]	.375[9.52]	.040[1.016]	16"



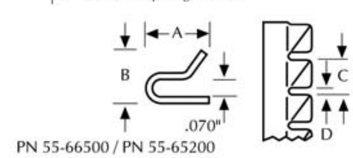
MODIFIED CLIP-ON - For applications where adhesive mounting is not possible and where space limitations exist.

Product Number	A	B	C	D	E	Approx. Length
5X-66600	.600[15.23]	.165[4.14]	.097[2.46]	.188[4.77]	.047[1.19]	16"
5X-66700	.272[6.90]	.200[5.08]	.070[1.78]	.190[4.82]	.030[.762]	18"



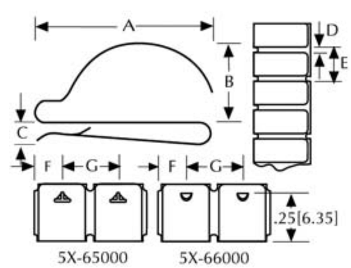
CLIP-ON TWIST - For compression applications where non-adhesive mounting is desired.

Product Number	A	B	C	D	Approx. Length
5X-65200	.150[3.81]	.100[2.54]	.095[2.41]	.015[0.381]	24"
*5X-66500	.270[6.85]	.110[2.79]	.165[4.19]	.015[0.381]	24"



REVERSE CLIP-ON - For applications where closure force is applied from the same side as the flange form.

Product Number	A	B	C	D	E	F	G	Approx. Length	Lance
5X-65000	.380 [9.65]	.200 [5.08]	.070 [1.77]	.040 [1.016]	.250 [6.35]	.250 [6.35]	.500 [12.70]	16"	T
5x-66000	.380 [9.65]	.200 [5.08]	.070 [1.77]	.040 [1.016	.250 [6.35]	.250 [6.35]	.500 {12.70]	16"	D

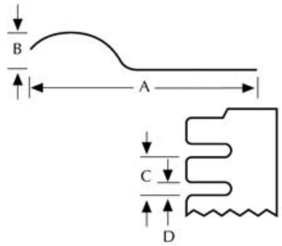


* "D" and "T" Lances available in 1/2" and 1" spacing. Contact the factory.
NOTE: Clip dimension alternatives available. Contact TECKNIT factory.

CONTACT STRIPS - For a variety of design applications. Contact strips offer near continuous contact from each finger.

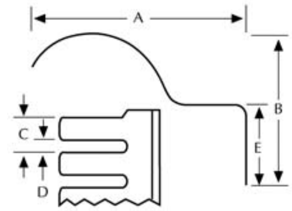
Product Number	A	B	C	D	Approx. Length
5X-60900	.520[13.20]	.100[2.54]	.188[4.77]	.047[1.19]	16"
5X-61900	.670[17.01]	.080[2.03]	.188[4.77]	.047[1.19]	16"
5X-62900	.860[21.84]	.205[5.20]	.188[4.77]	.047[1.19]	16"

Contact Tecknit for availability of 25ft. coils.



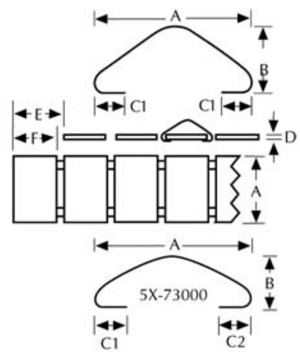
RIGHT ANGLE CONTACT STRIP - Same performance characteristics of the contact strip, but designed for side mounting applications.

Product Number	A	B	C	D	E	Approx. Length
5X-61500	.300[7.62]	.357[9.06]	.188[4.77]	.047[1.19]	.257[6.52]	16"
5X-62500	.440[11.17]	.360[9.14]	.188[4.77]	.047[1.19]	.280[7.112]	16"
5X-63500	.600[15.24]	.500[12.11]	.188[4.77]	.047[1.19]	.290[7.36]	16"
5X-64500	1.090[27.68]	.650[14.09]	.375[9.52]	.040[1.016]	.395[10.03]	16"



SYMMETRICAL SLOT MOUNT SERIES - Fingers are designed to snap into parallel slots and can be compressed to stock thickness.

Product Number	A	B Min.	C1	C2	D Ref.	E	F	Ref. Length
5X-71000	.320[8.13]	.110[2.79]	.085[2.16]	-	.040[1.01]	.187[4.74]	.169[4.29]	16"
5X-71100	.320[8.13]	.110[2.79]	.085[2.16]	-	.040[1.01]	.187[4.74]	.169[4.29]	.187" (1 finger)
5X-71200	.320[8.13]	.110[2.79]	.085[2.16]	-	.040[1.01]	.187[4.74]	.169[4.29]	.375" (2 finger)
5X-71300	.320[8.13]	.110[2.79]	.085[2.16]	-	.040[1.01]	.187[4.74]	.169[4.29]	.563" (3 finger)
5X-72000	.600[15.23]	.220[5.58]	.140[3.56]	-	.070[1.77]	.282[7.16]	.25[6.35]	15.75"
5X-72100	.600[15.23]	.220[5.58]	.140[3.56]	-	.070[1.77]	.282[7.16	.250[6.35]	.282" (1 finger)
5X-72200	.600[15.23]	.220[5.58]	.140[3.56]	-	.070[1.77]	.282[7.16]	.250[6.35]	.563" (2 finger)
5X-72300	.600[15.23]	.220[5.58]	.140[3.56]	-	.070[1.77]	.282[7.16]	.250[6.35]	.845" (3 finger)
55-73000	.358[9.09]	.128[3.25]	.110[2.79]	.098[2.29]	.050[1.27]	.202[5.13]	.184[5.67]	.389" (2 fingers)

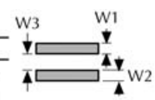


SUGGESTED SLOT DIMENSIONS

(Modification may be needed for certain applications)

Product #	W1	W2	W3
5X-71XXX	.090[2.29]	.090.[2.29]	260[6.60]
5X-72XXX	.145[4.12]	.145[4.12]	.520[13.21]
55-73XXX	.105[2.66]	.115[2.92]	.300[7.62]

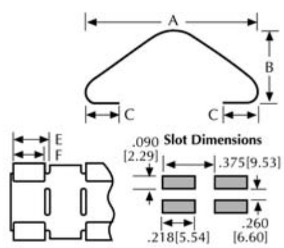
(Length of slots will vary with the number of fingers)



SYMMETRICAL STAGGERED SLOT MOUNT - Designed to ease longer strip mount installations.

Product Number	A	B Min.	C	D	E	F	Length
56-74016	.320[8.13]	.110[2.79]	.085[2.16]	.040[1.02]	.187[4.75]	.169[4.29]	.92" (5 fingers)
56-74000	.320[8.13]	.110[2.79]	.085[2.16]	.040[1.02]	.187[4.75]	.169[4.29]	16.3"
56-75016	.560[14.22]	.240[6.09]	.128[3.25]	.040[1.02]	.281[7.15]	.250[6.35]	4.187[106.3] (15 fingers)

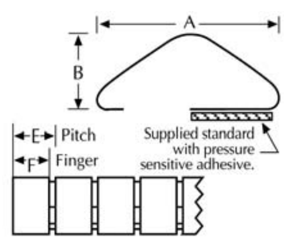
*Availble in soft stock only.



SOFT FINGERS - Superior elastic performance in applications where extremely low closure forces are required. Softstock version only.

Product Number	A	B Min.	C	D	E	F	Max. Length	Thickness
56-70000	.370[9.398]	.13[3.30]	-	-	.250[6.35]	.225[5.71]	16"	.0020[.0508]

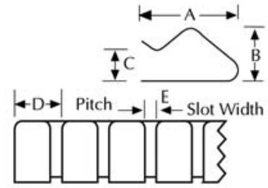
*Availble in soft stock only.



Beryllium Copper, continued

U.S. Customary
[SI Metric]

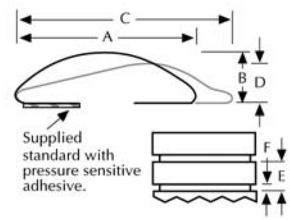
SOFT MINI CLIP-ON - Designed for use on connectors and other small applications. Softstock version only.



Product Number	A	B Min.	C	D	E	Length	Thickness
56-68000*	.025[0.64]	.042[1.07]	.025[0.64]	.049[1.25]	.020[0.51	.784[19.92] ± .020[.50]	.002 [.0508]

*Available in Softstock only.

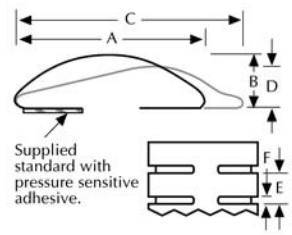
SYMMETRICAL - A symmetrical strip suited for use applications with bi-directional closure force designs.



Product Number	A	B Min.	C	D	E	F	Approx. Length
5X-55700	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	15"
5X-3000	.450[11.43]	.080[203]	.510[12.95]	.040[1.016	.125[3.175]	.05[.635]	24"
5X-55400	.450[11.43]	.140[3.55]	.510[12.95]	.080[2.03]	.250[6.35]	.022[0.55]	15"

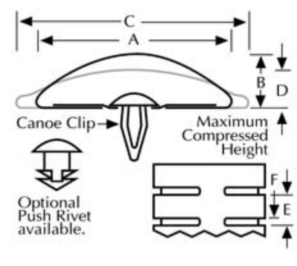
*Available in Softstock only.

SYMMETRICAL WITH SPINE - All the advantages of standard symmetrical with the added feature of a spine running lengthwise to allow for parallel sliding. Symmetrical strips are suited for use with bi-directional closure force designs.



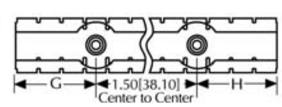
Product Number	A	B Min.	C	D	E	F	Approx. Length
5X-55300	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	15"

SYMMETRICAL WITH RIVET MOUNT - For bi-directional closure force designs that require the highest reliability mounting methods.

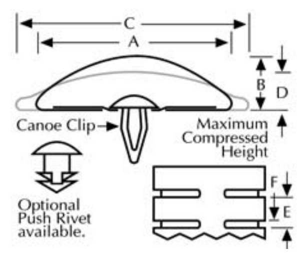


Product Number	A	B Min.	C	D	E	F	G	H	Approx. Length	Rivet Type
5X-55800	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	.66	.84	15"	Clip
5X-55500	.450[11.43]	.140[3.55]	.510[12.95]	.080[2.03]	.250[6.35]	.022[0.55]	.63	.88	15"	Clip
5X-55900	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	.66	.84	15"	Push
5X-55600	.450[11.43]	.140[3.55]	.510[12.95]	.080[2.03]	.250[6.35]	.022[0.55]	.63	.88	15"	Push

RIVET LOCATION INFORMATION
Canoe Clip and Push Rivet are designed to fit .125[3.18] hole.

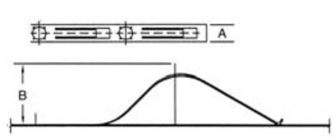


SYMMETRICAL RIVET MOUNT WITH SPINE - Standard symmetrical advantages with added feature of a spine running lengthwise to allow parallel sliding.



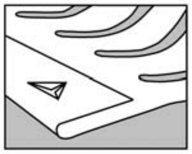
Product Number	A	B Min.	C	D	E	F	G	H	Approx. Length	Rivet Type
5X-55100	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	.66	.84	15"	Clip
5X-55200	.350[8.89]	.110[2.79]	.380[9.65]	.070[1.77]	.187[4.74]	.018[0.45]	.66	.84	15"	Push

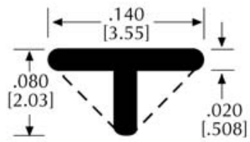
LONGITUDINAL GROUNDING STRIP - Designed for sliding contact applications, such as rack-mounted equipment equipment and sliding drawer or cover applications.



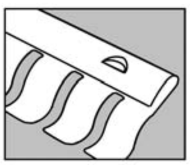
Product Number	A	B Min.	C	D Length	E	Approx.
55-00101	.250[6.35]	.177[4.49]	–	.070[1.77]	.102[2.59]	6.38"

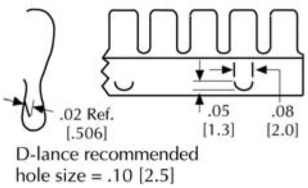
T-LANCE - Clip-on Gaskets with the "T" lance assure extra grip and electrical conductivity. "T" lance is the perfect solution for mounting gaskets on aluminum and other softer metals. All "T" lance gaskets are available in standard finishes.





D-LANCE - "D" lances snap into mounting surface holes for enhanced gripping power and conductivity.

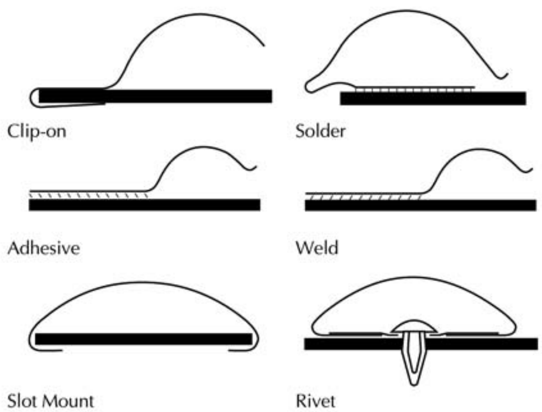




Standard lance locations are on .50" centers. Other locations are available. Please contact factory.

MOUNTING METHODS

TECKNIT supplies gaskets adaptable to six attachment methods: clip-on, pressure sensitive adhesive, solder, weld, slot, and rivet mounting. Please note that the clip dimensions depicted in this catalog can be modified to accommodate a variety of mounting surface material thicknesses. In addition, various rivet styles are available for the symmetrical rivet series.



ORDERING INFORMATION

When ordering standard Beryllium Copper Gaskets replace the second digit of the part number (X) with a 5. To order the low compression Softstock version, change the "X" to a 6.

Example: 5X - 71000 = 55 - 71000 (Standard)
56 - 71000 (Softstock)

T-LANCE AND D-LANCE - Items requiring a "T" or "D" lance, add a "T" or "D" on the end ot the part number. Also add the spacing dimension: .500" or 1000"

Example: 55-63000T500
"T" lance with .500" spacing

Example: 55-62000D100
"D" lance with 1.000" spacing

COILS - When ordering Be/Cu coils, simply add the code letter "C" to the part number.

Example: 55-51500C

When ordering Beryllium Copper Gaskets with plating, refer to the Tecknit Plating Code Chart below. Simply substitute the last two digits of the part number with the appropriate code number of the plating to specified.

Example: 55 - 520 00 = 55-520 06 (Satin Tin Finish)

PLATING CODE CHART

Standard plating thickness: 0001" min. (Gold is: 00005" min.)

Finish	Identification	Finish	Identification
Bright Finish	00	Electroless Nickel	09
Gold	01	Bright Nickel	10
Silver	02	Tin/Nickel	11
Tin Lead	05	Zinc	12
Satin Tin	06	Zinc Chromate (Yellow)	13
Bright Tin	07		
Dull Nickel	08	Zinc Chromate (Clear)	40

PLATING FOR GALVANIC COMPATABILITY

Often plating is advisable to prevent inter action with Beryllium Copper and the metal it contacts. The figure below shows groups of compatible metals. Each group of metals overlap with those next in the group. It is safe to use metals from adjacent groups. For example, Beryllium Copper is found in Group III, makining it safe to use with metals and platings from groups II, III or IV.

Beryllium Copper, continued

U.S. Customary
[SI Metric]

GROUPING OF METALS BY ELECTROCHEMICAL COMPATIBILITY

ANODE

Group I	Group II	Group III	Group IV
Magnesium	Aluminum	Cadmium Plating	Brass
Magnesium Alloys	Aluminum Alloys	Carbon Steel	Stainless Steel
Aluminum	Zinc & Zinc Plating	Iron	Beryllium Copper
Aluminum Alloys	Chromium Plating	Nickel & Nickel Plating	Copper / Copper Alloys
Zinc / Zinc Plating	Cadmium Plating	Tin & Tin Plating	Nickel / Copper Alloys
Chromium Plating	Carbon Steel	Tin / Lead Solder	Monel
	Iron	Lead	Silver
	Nickel & Nickel Plating	Brass	Graphite
	Tin & Tin Plating	Stainless Steel	Rhodium
	Tin / Lead Solder	Beryllium Copper	Titanium
		Copper / Copper Alloys	Platinum
		Nickel / Copper Alloys	Gold

CATHODE

Section J: Tecksof 2000

U.S. Customary
[SI Metric]

PRODUCT	PAGE
TECKSOF 2000™ (Conductive Fabric over Foam Gaskets)	J1 - J9

TECKSOF 2000™

CONDUCTIVE FABRIC OVER FOAM GASKETS -- UL 94-VO RATED

U.S. Customary
[SI Metric]

GENERAL DESCRIPTION

The Tecknit TECKSOF 2000 Series gasket consists of conductive fabric over foam and has been designed to meet today's commercial EMI shielding application demands where wide tolerance gaps exist. The foam core is flexible and conformable, making it ideal for applications requiring low closure force and minimal compression set. Tecknit TECKSOF 2000 Series gaskets are ideally suited for commercial electronic enclosures. They provide shielding effectiveness in excess of 100 dB.

APPLICATION INFORMATION

Conductive soft gaskets are an ideal low cost solution for placement in enclosures where weight and space are limited. TECKSOF 2000 is an excellent choice where conformability as well as high shielding requirements are specified. Applications recommended include electronic cabinets/enclosures, laptop computers, cellular devices and portable electronic devices such as PDA's.

FEATURES

- Low compression force requirements: Typicaly less than 2lbs./1 inch
- Shielding effectiveness of over 100 dB
- Highly flexible and conformable
- Thin light weight design
- Corrosion resistant nickel coating for excellent galvanic compatibility
- Low surface contact resistance
- Continuous intimate contact between mating surfaces
- Pressure sensitive adhesive as well as rigid mounting mechanisms
- Easy cut to length installation
- Wide variety of profile options
- General Duty and Flame resistant, UL 94-VO Rated. Foam cores available

SPECIFICATIONS

MATERIAL DESCRIPTION

Foam Core:
- Urethane

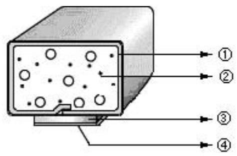
Conductive Fabric:
- Nickel Copper metallized fabric
- Others available

GENERAL PERFORMANCE CHARACTERISTICS

• Shielding Effectiveness:	.250"x.375" profile: >100 dB (20 MHz to 10 GHz, MIL-G-83528B)
• Surface Resistivity:	< 0.07 ohm/sq. (Typically <0.05 ohm/sq.)
• Compression set:	8% - 20%
• Service Temperature:	-40°F (-40°C) to 158°F (70°C)
• Abrasion Resistance:	>500,000 Cycles (ASTM D3886)
• Corrosion Resistance:	Galvanic Compatibility With Aluminum, Galvanized Steel, Electrogalvanized Steel And Other Materials.
• Flammability Rating	UL94V-0 or UL94V-1 depending on profile
• Minimum compression	10%-Profile Dependent
• Typical compression	30-40%
• Maximum compression	80%-Profile Dependent
• Expected minimum IP rating	54

U.S.A.: 908-272-5500 • U.K.: 44-1476-590600 • Spain: 34-91-4810178

TECKSOF 2000 Structure



1= Conductive Fabric
2= Foam core
3= PSA tape
4= Paper liner

SPECIFICATIONS – CONDUCTIVE FABRICS

There are main four types of conductive fabric for T2000 fabric-over-foam:

CONDUCTIVE FABRIC – RIPSTOP, WOVEN (NO.SR-W23B)

Applications	For extra abrasion resistance, Conductive Polyester
Flammability	UL94V-1: 0.8MM to 1.0mm.UL94V-0: >1.0mm
Plating type	Nickel + Copper + Nickel
Tensile strength	CD60/MD65 (LB/INCH)
Max. short duration temp	210°C
Surface Resistance	0.04 to 0.08 ohms per square

CONDUCTIVE FABRIC – TAFFETA, WOVEN (NO.ST-W29B)

Applications	standard material, Conductive polyester
Flammability	UL94V-0: >0.8mm
Plating type	Nickel + Copper + Nickel
Tensile strength	CD60/MD65 (LB/INCH)
Max. short duration temp	200°C
Surface Resistance	0.04 to 0.07 ohms per square

CONDUCTIVE FABRIC – NON WOVEN (NO.SN-W05B)

- Limited availability; contact Tecknit Sales for assistance

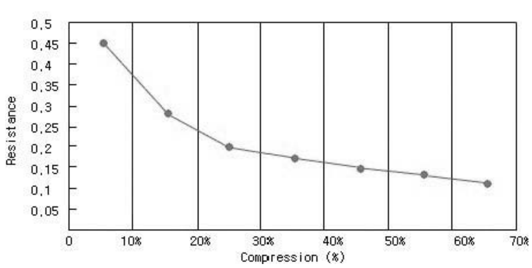
Applications	Die cut gaskets. Non UL94 rated.
Material	Conductive non woven Polyester
Plating type	Nickel + Copper + Nickel
Tensile strength	CD6.30/MD15.20
Max. short duration temp:	210°C
Surface Resistance	0.04 to 0.07 ohms per square

CONDUCTIVE WRAP – USING CONDUCTIVE RUBBER (NO.SN-RUB)

- Limited availability; contact Tecknit Sales for assistance

Applications	Provides an environmental seal, as well as EMI shield
Material	Urethane rubber, coated with silver powder.
Plating type	Silver
Surface resistance:	Calculated to 0.016 ohm - square
Tensile strength	15kgf/cm2 to ASTM D638
Ozone resistance:	250 ppm for 96 hours, no cracking to KSM6518
Elongation	120% to ASTM D638

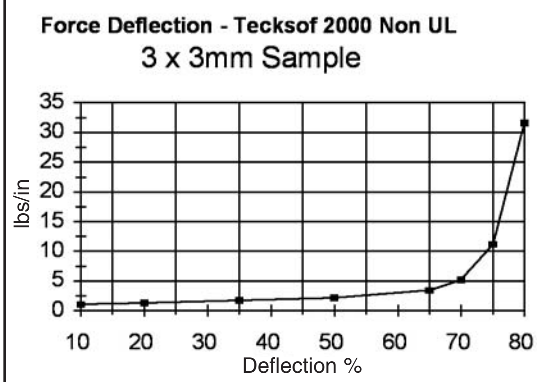
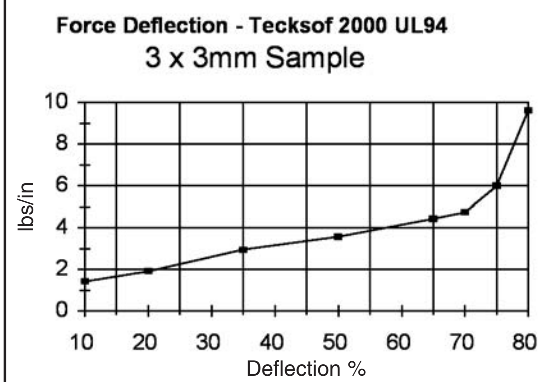
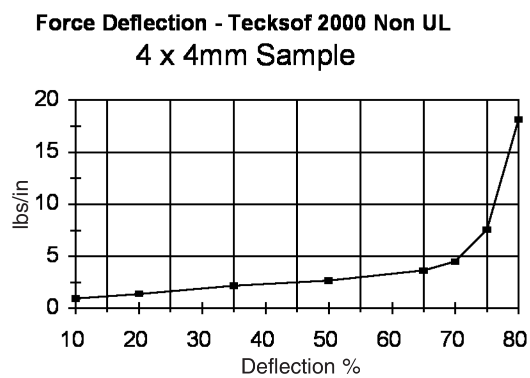
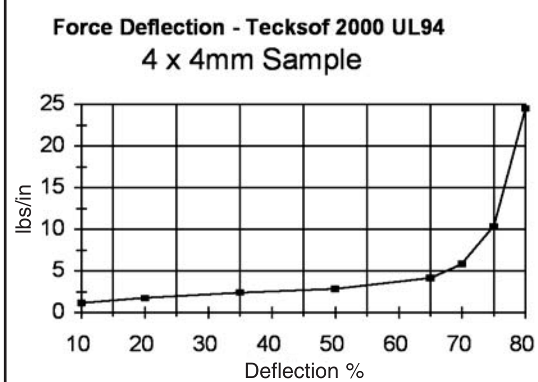
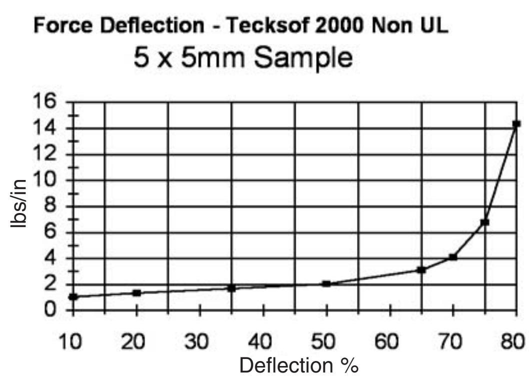
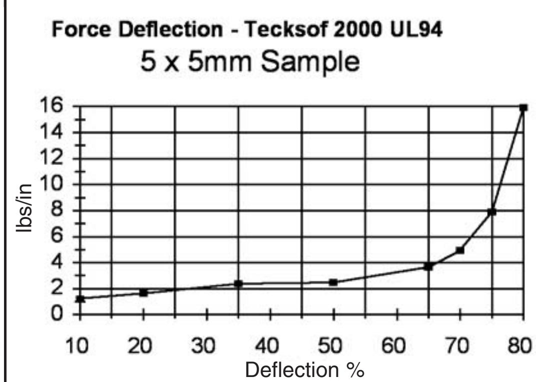
TYPICAL RESISTANCE VS COMPRESSION GRAPH



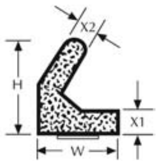
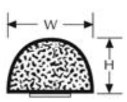
TECKSOF 2000, continued

U.S. Customary
[SI Metric]

COMPRESSION/DEFLECTION DATA

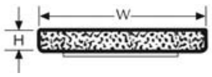
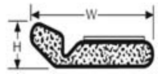
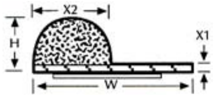
SAMPLE SIZE	GENERAL DUTY	UL94
3x3mm		
4x4mm		
5x5mm		

TECKSOF 2000 Profile Descriptions

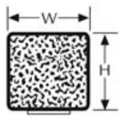
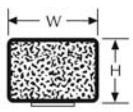
TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	406	C-FOLD	6.4	6.4	0.250	0.250	V-0	
	410	C-FOLD W/ INSERT	9.8	10.9	0.386	0.430	V-0	
	407	C-FOLD	10.7	9.8	0.420	0.385	V-0	
	402	C-FOLD	10.9	10.0	0.430	0.395	V-0	
	409	C-FOLD	10.9	10.0	0.430	0.395	V-0	
	403	C-FOLD	12.4	11.9	0.487	0.470	V-0	
	405	C-FOLD	14.7	17.1	0.580	0.675	V-0	
	401	C-FOLD	15.0	17.1	0.590	0.675	V-0	
	404	C-FOLD	15.2	17.1	0.600	0.675	V-0	
	412	C-FOLD	19.0	23.0	0.748	0.906	V-0	
27-	408	DOUBLE D	2.8	9.7	0.110	0.380	V-0	
	411	DOUBLE D	15.0	3.8	0.591	0.150	V-0	
27-	206	D-SHAPE	2.3	2.3	0.090	0.090	V-0	
	209	D-SHAPE	2.3	3.2	0.090	0.125	V-0	
	201	D-SHAPE	3.8	1.5	0.150	0.060	V-0	
	205	D-SHAPE	3.8	2.3	0.150	0.090	V-0	
	203	D-SHAPE	3.8	3.0	0.150	0.120	V-0	
	210	D-SHAPE	3.8	3.8	0.150	0.150	V-0	
	218	D-SHAPE	4.0	3.0	0.157	0.118	V-0	
	215	D-SHAPE	4.8	5.1	0.190	0.200	V-0	
	217	D-SHAPE	4.8	7.6	0.189	0.300	V-0	
	219	D-SHAPE	5.0	3.0	0.197	0.118	V-0	
	220	D-SHAPE	5.4	3.6	0.213	0.142	V-0	
	222	D-SHAPE	6.0	8.0	0.236	0.315	V-0	
	221	D-SHAPE	6.4	2.0	0.252	0.079	V-0	
	207	D-SHAPE	6.4	3.0	0.250	0.120	V-0	
	216	D-SHAPE	6.4	3.2	0.250	0.125	V-0	
	202	D-SHAPE	6.4	3.6	0.250	0.140	V-0	
	211	D-SHAPE	6.4	6.4	0.250	0.250	V-0	
	223	D-SHAPE	7.6	4.8	0.299	0.189	V-0	
	214	D-SHAPE	8.0	5.0	0.315	0.196	V-0	
	224	D-SHAPE	8.0	8.5	0.315	0.335	V-0	
	225	D-SHAPE	9.0	4.0	0.354	0.157	V-0	
	208	D-SHAPE	9.1	3.0	0.360	0.120	V-0	
	204	D-SHAPE	9.5	6.4	0.375	0.250	V-0	
	226	D-SHAPE	9.7	3.3	0.382	0.130	V-0	
	227	D-SHAPE	10.0	2.5	0.394	0.098	V-0	
	228	D-SHAPE	10.0	4.6	0.394	0.181	V-0	
	229	D-SHAPE	10.0	5.0	0.394	0.197	V-0	
	230	D-SHAPE	10.0	10.0	0.394	0.394	V-0	
	231	D-SHAPE	10.0	11.0	0.394	0.433	V-0	
	232	D-SHAPE	12.0	10.0	0.472	0.394	V-0	
	233	D-SHAPE	12.2	5.1	0.480	0.201	V-0	
	234	D-SHAPE	12.7	9.5	0.500	0.374	V-0	
	212	D-SHAPE	12.7	12.7	0.500	0.500	V-0	
	213	D-SHAPE	12.7	17.8	0.500	0.700	V-0	
	235	D-SHAPE	13.0	4.8	0.512	0.189	V-0	
	236	D-SHAPE	18.0	10.0	0.709	0.394	V-0	
	237	D-SHAPE	18.0	14.3	0.709	0.563	V-0	
	238	D-SHAPE	20.0	5.0	0.787	0.197	V-0	
	239	D-SHAPE	20.0	7.0	0.787	0.276	V-0	
	240	D-SHAPE	49.0	7.0	1.929	0.276	V-0	

TECKSOF 2000, continued

TECKSOF 2000 Profile Descriptions

TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	302	I/O	19.1	1.5	0.750	0.060	V-0	
	313	I/O	21.0	1.7	0.827	0.067	V-0	
	307	I/O	21.1	2.0	0.830	0.080	V-0	
	303	I/O	22.0	1.5	0.866	0.060	V-0	
	304	I/O	22.9	1.5	0.900	0.060	V-0	
	312	I/O	24.0	2.5	0.945	0.098	V-0	
	314	I/O	24.0	1.0	0.945	0.039	V-0	
	311	I/O	24.8	2.0	0.976	0.079	V-0	
	315	I/O	25.0	1.0	0.984	0.039	V-0	
	300	I/O	25.4	1.5	1.000	0.060	V-0	
	316	I/O	25.5	1.9	1.004	0.075	V-0	
	317	I/O	29.0	1.0	1.142	0.039	V-0	
	318	I/O	31.0	1.0	1.220	0.039	V-0	
	319	I/O	33.0	1.0	1.299	0.039	V-0	
	305	I/O	33.8	1.5	1.330	0.060	V-0	
	320	I/O	35.0	1.0	1.378	0.039	V-0	
	321	I/O	35.0	2.0	1.378	0.079	V-0	
	310	I/O	38.1	1.5	1.500	0.060	V-0	
	322	I/O	39.4	3.2	1.550	0.125	V-0	
	323	I/O	40.0	1.5	1.575	0.059	V-0	
	324	I/O	40.0	2.0	1.575	0.079	V-0	
	327	I/O	40.0	3.0	1.575	0.118	V-0	
	326	I/O	40.5	2.0	1.594	0.079	V-0	
	325	I/O	40.9	3.1	1.610	0.120	V-0	
	306	I/O	41.0	1.5	1.615	0.060	V-0	
	308	I/O	41.0	3.2	1.615	0.125	V-0	
	328	I/O	42.0	2.0	1.654	0.079	V-0	
	329	I/O	43.0	2.5	1.693	0.098	V-0	
	330	I/O	45.0	1.0	1.772	0.039	V-0	
	331	I/O	45.0	1.5	1.772	0.059	V-0	
	332	I/O	45.0	2.0	1.772	0.079	V-0	
	301	I/O	50.8	1.6	2.000	0.062	V-0	
	309	I/O	65.0	1.8	2.560	0.070	V-0	
	333	I/O	68.9	2.0	2.713	0.079	V-0	
	334	I/O	74.9	2.0	2.949	0.079	V-0	
	335	I/O	84.0	1.5	3.307	0.059	V-0	
27-	502	KNIFE	6.0	2.0	0.236	0.079	V-0	
	501	KNIFE	11.3	2.7	0.445	0.106	V-0	
	500	KNIFE	19.1	6.4	0.750	0.250	V-0	
27-	801	P-SHAPE	10.0	2.6	0.394	0.102	V-0	
	802	P-SHAPE	12.0	3.7	0.472	0.146	V-0	
	803	P-SHAPE	13.2	3.3	0.520	0.130	V-0	
	800	P-SHAPE	13.2	4.0	0.520	0.157	V-0	
	805	T-SHAPE	14.7	17.0	0.579	0.669	V-0	
* Part has rigid insert in base leg	804	P-SHAPE	17.0	10.0	0.669	0.394	V-0	
27-	806	ROUND	3.0	DIA	0.118	DIA	V-0	
	807	ROUND	8.0	DIA	0.315	DIA	V-0	

TECKSOF 2000 Profile Descriptions

TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	107	SQUARE	2.0	2.0	0.079	0.079	V-0	
	108	SQUARE	2.3	2.3	0.091	0.091	V-0	
	100	SQUARE	3.0	3.0	0.118	0.118	V-0	
	109	SQUARE	4.0	4.0	0.157	0.157	V-0	
	103	SQUARE	5.0	5.0	0.195	0.195	V-0	
	110	SQUARE	6.0	6.0	0.236	0.236	V-0	
	101	SQUARE	6.4	6.4	0.250	0.250	V-0	
	111	SQUARE	8.0	8.0	0.315	0.315	V-0	
	112	SQUARE	9.0	9.0	0.354	0.354	V-0	
	104	SQUARE	9.5	9.5	0.376	0.375	V-0	
	105	SQUARE	10.0	10.0	0.395	0.395	V-0	
	113	SQUARE	12.0	12.0	0.472	0.472	V-0	
	102	SQUARE	12.7	12.7	0.500	0.500	V-0	
	114	SQUARE	13.0	13.0	0.512	0.512	V-0	
	115	SQUARE	15.0	15.0	0.591	0.591	V-0	
	106	SQUARE	17.0	17.0	0.670	0.670	V-0	
	116	SQUARE	17.0	17.0	0.669	0.669	V-0	
	117	SQUARE	30.0	30.0	1.181	1.181	V-0	
	118	SQUARE	35.0	35.0	1.378	1.378	V-0	
27-	630	RECTANGLE	2.0	1.0	0.079	0.039	V-0	
	631	RECTANGLE	3.0	0.5	0.118	0.020	V-0	
	709	RECTANGLE	3.0	1.0	0.120	0.040	V-0	V-1 w/Ripstop
	632	RECTANGLE	3.0	1.5	0.118	0.059	V-0	
	737	RECTANGLE	3.0	2.0	0.118	0.079	V-0	
	738	RECTANGLE	3.0	2.5	0.118	0.098	V-0	
	739	RECTANGLE	3.5	2.5	0.138	0.098	V-0	
	740	RECTANGLE	3.5	4.5	0.138	0.177	V-0	
	720	RECTANGLE	3.9	2.5	0.155	0.100	V-0	
	710	RECTANGLE	4.0	1.0	0.157	0.040	V-0	V-1 w/Ripstop
	741	RECTANGLE	4.0	3.0	0.157	0.118	V-0	
	715	RECTANGLE	4.1	2.0	0.160	0.080	V-0	
	634	RECTANGLE	4.5	1.0	0.177	0.039	V-0	
	633	RECTANGLE	4.5	1.5	0.177	0.059	V-0	
	723	RECTANGLE	4.8	3.3	0.190	0.130	V-0	
	635	RECTANGLE	5.0	0.5	0.197	0.020	V-0	
	742	RECTANGLE	5.0	2.0	0.197	0.079	V-0	
	743	RECTANGLE	5.0	3.0	0.197	0.118	V-0	
	744	RECTANGLE	5.0	3.5	0.197	0.138	V-0	
	745	RECTANGLE	5.0	5.5	0.197	0.217	V-0	
	701	RECTANGLE	5.1	1.0	0.200	0.040	V-0	
	708	RECTANGLE	5.1	1.6	0.200	0.062	V-0	V-1 w/Ripstop
	728	RECTANGLE	5.1	4.1	0.200	0.160	V-0	
	636	RECTANGLE	6.0	1.0	0.236	0.039	V-0	
	746	RECTANGLE	6.0	2.0	0.236	0.079	V-0	
	747	RECTANGLE	6.0	3.0	0.236	0.118	V-0	
	749	RECTANGLE	6.0	4.0	0.236	0.157	V-0	
	750	RECTANGLE	6.0	5.0	0.236	0.197	V-0	
	751	RECTANGLE	6.0	6.5	0.236	0.256	V-0	
	721	RECTANGLE	6.4	3.2	0.250	0.125	V-0	
	748	RECTANGLE	6.4	3.2	0.252	0.126	V-0	
	718	RECTANGLE	6.7	2.5	0.265	0.100	V-0	
	637	RECTANGLE	7.0	0.5	0.276	0.020	V-0	
	711	RECTANGLE	7.0	1.0	0.275	0.040	V-0	V-1 w/Ripstop

TECKSOF 2000, continued

TECKSOF 2000 Profile Descriptions

TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	638	RECTANGLE	7.0	1.5	0.276	0.059	V-0	
	716	RECTANGLE	7.0	2.0	0.275	0.080	V-0	
	752	RECTANGLE	7.0	4.0	0.276	0.157	V-0	
	753	RECTANGLE	7.0	5.0	0.276	0.197	V-0	
	754	RECTANGLE	7.0	6.0	0.276	0.236	V-0	
	639	RECTANGLE	7.5	1.5	0.295	0.059	V-0	
	640	RECTANGLE	7.6	0.5	0.299	0.020	V-0	
	714	RECTANGLE	7.6	1.6	0.300	0.062	V-0	
	661	RECTANGLE	8.0	0.8	0.315	0.031	V-0	
	662	RECTANGLE	8.0	1.0	0.315	0.039	V-0	
	663	RECTANGLE	8.0	1.2	0.315	0.047	V-0	
	641	RECTANGLE	8.0	1.5	0.315	0.059	V-0	
	755	RECTANGLE	8.0	2.0	0.315	0.079	V-0	
	756	RECTANGLE	8.0	3.0	0.315	0.118	V-0	
	726	RECTANGLE	8.0	4.0	0.315	0.157	V-0	
	707	RECTANGLE	8.0	5.0	0.315	0.196	V-0	
	757	RECTANGLE	8.0	6.0	0.315	0.236	V-0	
	758	RECTANGLE	8.0	7.0	0.315	0.276	V-0	
	642	RECTANGLE	9.0	0.5	0.354	0.020	V-0	
	643	RECTANGLE	9.0	1.0	0.354	0.039	V-0	
	644	RECTANGLE	9.0	1.3	0.354	0.051	V-0	
	759	RECTANGLE	9.0	2.0	0.354	0.079	V-0	
	760	RECTANGLE	9.0	3.0	0.354	0.118	V-0	
	761	RECTANGLE	9.0	4.0	0.354	0.157	V-0	
	762	RECTANGLE	9.0	5.0	0.354	0.197	V-0	
	763	RECTANGLE	9.0	8.0	0.354	0.315	V-0	
	764	RECTANGLE	9.4	6.4	0.370	0.252	V-0	
	719	RECTANGLE	9.5	2.5	0.375	0.100	V-0	
	664	RECTANGLE	9.5	3.2	0.375	0.125	V0	
	722	RECTANGLE	9.5	4.0	0.375	0.156	V-0	
	706	RECTANGLE	9.5	6.4	0.375	0.250	V-0	
	724	RECTANGLE	9.7	3.3	0.380	0.130	V-0	
	645	RECTANGLE	10.0	0.8	0.394	0.031	V-0	
	712	RECTANGLE	10.0	1.0	0.395	0.040	V-0	V-1 w/Ripstop
	646	RECTANGLE	10.0	1.5	0.394	0.059	V-0	
	765	RECTANGLE	10.0	3.0	0.394	0.118	V-0	
	767	RECTANGLE	10.0	4.0	0.394	0.157	V-0	
	729	RECTANGLE	10.0	5.0	0.395	0.195	V-0	
	768	RECTANGLE	10.0	6.0	0.394	0.236	V-0	
	769	RECTANGLE	10.0	7.0	0.394	0.276	V-0	
	770	RECTANGLE	10.0	8.0	0.394	0.315	V-0	
	771	RECTANGLE	10.0	9.0	0.394	0.354	V-0	
	772	RECTANGLE	10.0	11.0	0.394	0.433	V-0	
	717	RECTANGLE	10.2	2.0	0.400	0.080	V-0	
	731	RECTANGLE	11.0	7.0	0.433	0.276	V-0	
	647	RECTANGLE	12.0	1.0	0.472	0.039	V-0	
	773	RECTANGLE	12.0	2.5	0.472	0.098	V-0	
	774	RECTANGLE	12.0	3.5	0.472	0.138	V-0	
	775	RECTANGLE	12.0	5.0	0.472	0.197	V-0	
	776	RECTANGLE	12.0	6.0	0.472	0.236	V-0	
	777	RECTANGLE	12.0	7.0	0.472	0.276	V-0	
	778	RECTANGLE	12.0	8.0	0.472	0.315	V-0	
	779	RECTANGLE	12.0	9.0	0.472	0.354	V-0	

TECKSOF 2000 Profile Descriptions

TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	780	RECTANGLE	12.0	10.0	0.472	0.394	V-0	
	656	RECTANGLE	12.7	0.8	0.500	0.031	V-0	V-1 w/Ripstop
	700	RECTANGLE	12.7	1.6	0.500	0.062	V-0	V-1 w/Ripstop
	705	RECTANGLE	12.7	3.2	0.500	0.125	V-0	
	725	RECTANGLE	12.7	3.8	0.500	0.150	V-0	
	730	RECTANGLE	12.7	6.4	0.500	0.250	V-0	
	733	RECTANGLE	12.7	9.5	0.500	0.374	V-0	
	713	RECTANGLE	13.0	1.0	0.510	0.040	V-0	V-1 w/Ripstop
	648	RECTANGLE	13.0	1.5	0.512	0.059	V-0	
	781	RECTANGLE	13.0	2.0	0.512	0.079	V-0	
	782	RECTANGLE	13.0	3.5	0.512	0.138	V-0	
	783	RECTANGLE	13.0	4.0	0.512	0.157	V-0	
	784	RECTANGLE	13.0	5.0	0.512	0.197	V-0	
	785	RECTANGLE	13.0	6.0	0.512	0.236	V-0	
	786	RECTANGLE	13.0	7.0	0.512	0.276	V-0	
	787	RECTANGLE	13.0	8.0	0.512	0.315	V-0	
	788	RECTANGLE	13.0	10.0	0.512	0.394	V-0	
	789	RECTANGLE	13.0	15.0	0.512	0.591	V-0	
	649	RECTANGLE	14.0	1.5	0.551	0.059	V-0	
	790	RECTANGLE	14.0	6.0	0.551	0.236	V-0	
	650	RECTANGLE	15.0	1.0	0.591	0.039	V-0	
	791	RECTANGLE	15.0	2.0	0.591	0.079	V-0	
	792	RECTANGLE	15.0	3.0	0.591	0.118	V-0	
	727	RECTANGLE	15.0	4.0	0.591	0.157	V-0	
	793	RECTANGLE	15.0	5.0	0.591	0.197	V-0	
	794	RECTANGLE	15.0	6.0	0.591	0.236	V-0	
	732	RECTANGLE	15.0	7.5	0.591	0.295	V-0	
	795	RECTANGLE	15.0	8.0	0.591	0.315	V-0	
	796	RECTANGLE	15.0	10.0	0.591	0.394	V-0	
	797	RECTANGLE	15.0	11.0	0.591	0.433	V-0	
	798	RECTANGLE	15.0	12.0	0.591	0.472	V-0	
	799	RECTANGLE	15.0	17.0	0.591	0.669	V-0	
	600	RECTANGLE	16.0	7.0	0.630	0.276	V-0	
	601	RECTANGLE	17.0	7.0	0.669	0.276	V-0	
	602	RECTANGLE	17.5	5.0	0.689	0.197	V-0	
	704	RECTANGLE	17.8	3.2	0.700	0.125	V-0	
	651	RECTANGLE	18.0	1.6	0.709	0.063	V-0	
	603	RECTANGLE	18.0	10.0	0.709	0.394	V-0	
	652	RECTANGLE	19.0	1.0	0.748	0.039	V-0	
	653	RECTANGLE	19.0	1.5	0.748	0.059	V-0	
	605	RECTANGLE	19.0	2.0	0.748	0.079	V-0	
	604	RECTANGLE	19.0	18.5	0.748	0.728	V-0	
	702	RECTANGLE	19.1	6.4	0.750	0.250	V-0	
	654	RECTANGLE	20.0	1.0	0.787	0.039	V-0	
	655	RECTANGLE	20.0	1.6	0.787	0.063	V-0	
	606	RECTANGLE	20.0	3.0	0.787	0.118	V-0	
	607	RECTANGLE	20.0	5.0	0.787	0.197	V-0	
	608	RECTANGLE	20.0	6.0	0.787	0.236	V-0	
	609	RECTANGLE	20.0	7.0	0.787	0.276	V-0	
	610	RECTANGLE	20.0	8.0	0.787	0.315	V-0	
	611	RECTANGLE	20.0	9.0	0.787	0.354	V-0	
	612	RECTANGLE	20.0	10.0	0.787	0.394	V-0	
	613	RECTANGLE	20.0	12.0	0.787	0.472	V-0	
	614	RECTANGLE	20.0	13.0	0.787	0.512	V-0	
	615	RECTANGLE	20.0	15.0	0.787	0.591	V-0	
	735	RECTANGLE	21.0	1.7	0.827	0.067	V-0	
	616	RECTANGLE	21.0	2.0	0.827	0.079	V-0	
	618	RECTANGLE	21.0	4.0	0.827	0.157	V-0	
	703	RECTANGLE	21.0	18.0	0.827	0.710	V-0	
	617	RECTANGLE	21.1	2.0	0.830	0.080	V-0	

TECKSOF 2000, continued

TECKSOF 2000 Profile Descriptions

TECKSOF 2000 Product Code:	PART No.	PROFILE	WIDTH mm	HEIGHT mm	WIDTH in	HEIGHT in	UL Rating	Notes:
27-	619	RECTANGLE	24.0	3.5	0.945	0.138	V-0	
	620	RECTANGLE	25.0	5.0	0.984	0.197	V-0	
	657	RECTANGLE	25.4	1.6	1.000	0.063	V-0	
	621	RECTANGLE	25.4	3.2	1.000	0.125	V-0	
	622	RECTANGLE	25.4	6.5	1.000	0.256	V-0	
	623	RECTANGLE	29.0	3.0	1.142	0.118	V-0	
	624	RECTANGLE	30.0	10.0	1.181	0.394	V-0	
	625	RECTANGLE	30.0	12.0	1.181	0.472	V-0	
	736	RECTANGLE	34.0	4.0	1.340	0.157	V-0	
	626	RECTANGLE	43.0	20.0	1.693	0.787	V-0	
	627	RECTANGLE	45.0	20.0	1.772	0.787	V-0	
	628	RECTANGLE	50.0	25.0	1.969	0.984	V-0	
	629	RECTANGLE	60.0	10.0	2.362	0.394	V-0	

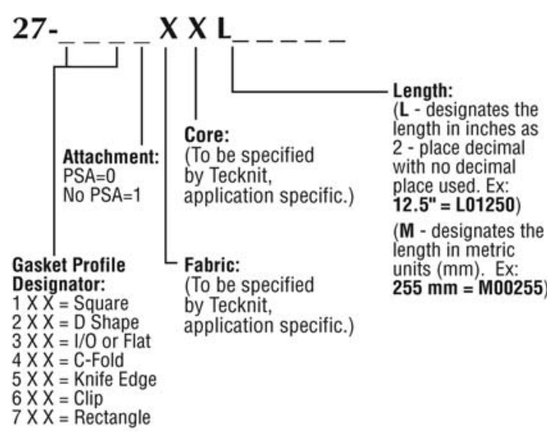
ENGINEERING TOLERANCES (TYPICAL VALUES)

CUT TO LENGTH

ENGLISH UNITS (Inches)		METRIC UNITS (mm)	
DIMENSIONS	TOLERANCE	DIMENSIONS	TOLERANCE
1 - 6	±.030	25 - 152	±0.8
6 - 11	±.050	152 - 280	±1.3
11 - 48	±.100	280 - 1,220	±2.6
48 - 70	±.187	1,220 - 1,780	±4.8
70 - 84	±.250	1,780 - 2,134	±6.4

CROSS SECTION

ENGLISH UNITS (Inches)		METRIC UNITS (mm)	
DIMENSIONS	TOLERANCE	DIMENSIONS	TOLERANCE
<0.100	±.020	<2.5	±0.5
<0.100	±.030	<2.5	±0.8



ORDERING INFORMATION

Pressure sensitive adhesive mounting strips are standard. Consult the factory for custom profiles.

Section K:
Glossary and Appendix A

U.S. Customary
[SI Metric]

PAGE

A

ABSORPTION Dissipation or loss of electromagnetic energy in the medium through which the energy passes. Measured is decibels (dB).

ADHESION The attraction of two dissimilar substances. Compare COHESION.

ADHESIVE-SEALANT A material which can perform as both an adhesive and environmental sealant.

AG/BR Silver plated brass.

ARRESTANCE The capacity of an air filter to capture and hold particulate material or dust.

ATTENUATION A loss of energy. Generally expressed in decibels.

B

BLEED To exude a liquid or gaseous material.

BOND, mechanical Joining of objects by means of adhesion.

BUNA-N A synthetic rubber compound useful in applications involving exposure to jet fuels, e.g.. JP- 1 through JP-6.

BUS A metallic electrical conductor used to make a common electrical connection.

BUTYL A synthetic rubber made by polymerization of butylene and isoprene or butadiene. Useful in applications involving exposure to phosphate type hydraulic fluids.

C

CHOKE FLANGE A waveguide flange having a mating surface designed with a slot to restrict leakage of electromagnetic energy.

CHROMATE CONVERSION COATING A surface protection treatment frequently used in shielding applications. Although non-conductive itself, the chromate conversion coating is easily penetrated by EMI gasket materials when pressure is applied. This low cost finish is usually applied in accordance with MIL-C-5541.

cm Centimeter.

COHESION The mutual attraction by which the elements of a material cling to each other. Compare

ADHESION in which the elements of a material cling to the elements of a different material.

COLD FLOW See CREEP.

COMPATIBILITY The ability of two materials to form a chemically stable system. Two or more metals which display no appreciable corrosion when in contact with each other are said to display compatibility.

COMPRESSION The application of pressure to a material as opposed to the application of tension. In the case of cellular or sponge elastomers, compression will result in a decrease in cross-section area. Compression of solid elastomers produces a change in the shape of a cross-section with no change in its area (compare DEFLECTION).

COMPRESSION SET The percent of permanent height reduction in a material caused by compression under specific conditions of load, temperature, and time.

COMPRESSION STOP A material which acts to limit further compression of a gasket material. Used when a specified gap is required to avoid damage to gasket materials due to overcompression.

CONDUCTANCE A measure of the ability of a material to conduct electric current. The reciprocal of the resistance of the material expressed in ohms.

CONDUCTIVITY Conductance of a unit cube of any material. Reciprocal of the volume resistivity, expressed in ohms per centimeter.

CONTACT RESISTANCE The resistance in ohms between two metal objects in contact with each other.

CREEP The diameter change in time of a material under load.

CURE To change the physical properties of a material by chemical reaction through the action of heat or catalysts or a combination of the two.

Glossary, Continued

U.S. Customary
[SI Metric]

D

dB See DECIBEL.

DECIBEL (dB) A dimensionless unit for expressing the ratio of two values of power (10 log P1 /P2) voltage (20 log E1 /E2).

DEFLECTION The amount of movement of a material as a result of stress. Deflection of elastomers occurs with the application of compression force.

DIELECTRIC STRENGTH The maximum potential gradient an insulating (dielectric) material can withstand before it breaks down, (volts per mil).

DRY BACK Solvent activated dry adhesive for permanent mounting of EMI gaskets which use solid or sponge neoprene rubber.

DYNAMIC RANGE The ratio of the specified maximum signal level capability of a system to its noise level. Usually expressed in decibels.

E

E-FIELD See ELECTRIC FIELD.

ELASTOMER Any of various polymers having elastic properties similar to natural rubber.

ELECTRIC OR E-FIELD The high impedance, or electric, component of an electromagnetic wave. An E-Field induces a charge of a shield. Compare MAGNETIC or H-FIELD.

ELECTROLYTIC CORROSION Corrosion which occurs when a DC current flows between two metals in the presence of a conducting fluid, electrolyte. The rate of corrosion does not depend on the metals (they may be the same) but upon the amount of current and the nature of the corrosive fluid. Compare GALVANIC CORROSION.

ELECTROMAGNETIC COMPATIBILITY (EMC) The ability of electronic equipment or systems to operate in their intended operational environments without causing or suffering unacceptable degradation because of unintentional electromagnetic radiation or response.

ELECTROMAGNETIC INTERFERENCE (EMI) Any electromagnetic interference, periodic or random, which may have a disturbing influence on devices exposed to it.

ELECTROMAGNETIC PULSE (EMP) Broadband, high-intensity, transient electromagnetic fields such as those produced by lightning and nuclear explosions.

ELECTROSTATIC CHARGE An electric charge accumulated on an object, usually by friction.

ELONGATION The fractional increase in length of a material stressed in tension.

EMULSION A suspension of one fluid in another.

EXPANDED METAL A technique whereby metal foil or sheet material is pierced with a pattern of small slits and stretched, or expanded, to yield a screen consisting of one unbroken piece of metal.

F

FILLER Generally, material added to another material in order to improve its existing properties or add new ones. In the case of conductive elastomers (e.g.,

TECKNIT Consil materials) silver or carbon is introduced to add electrical conductivity.

FLASH The excess material on a rubber part resulting from rubber being forced out of the mold cavity during the molding operation.

FLUOROSILICONE A synthetic rubber useful in applications involving petroleum oils and fuels and silicone oils.

FULL INTEGRITY Said of an enclosure when all seams, joints, and apertures are completely sealed or covered so as to provide no degradation in electromagnetic shielding performance.

FUNGUS Mold, yeast, mildew, and other microorganisms.

FUNGUS INERT Neither destroying nor supporting fungi.

FUNGUS RESISTANT Unaffected by fungi when tested in accordance with MIL-STD-810, Method 508.

G

G Giga (a multiplier, 109). g Gram (metric unit of mass). g/cm3 Gram per cubic centimeter. Metric expression for density (mass per unit volume).

GALVANIC CORROSION Corrosion which occurs between two dissimilar metals in the presence of moisture or some other electrolyte. Under these conditions an electrochemical cell is formed and current will flow from one metal to the other carrying ions of the metal with it. Compare ELECTROLYTIC CORROSION. GASKET, EMI A material, or combination of materials, which conducts electricity and which is used to ensure a continuous low-impedance contact between two surfaces which conduct electromagnetic energy.

GO/NO-GO A test technique in which the object tested is required to perform in a specified manner. If it performs, it passes (GO); if it does not perform, it fails (NO-GO). (e.g., a tapped hole which will (GO) or will not (NO-GO) accept a particular screwthread gauge).

GROUND A reference potential to which all signal and power voltages are established.

GROUNDING The establishment of an electrically conductive path between two points, with one point generally being a reference point.

GROUNDPLANE A conductive surface or plate used as a common reference point for circuit returns and electrical or signal potentials.

H

HARDNESS Resistance of material to plastic deformation usually by indentation.

HERTZ (Hz) A unit of frequency which is equivalent to one cycle per second (1/s).

H-FIELD See MAGNETIC FIELD.

HONEYCOMB A low air resistance core material used in EMI shielding air vent panels. Generally made of aluminum, brass, or steel, the material consists of multiple hexagonal cells operating as wave guides below cut-off. The material offers extremely low resistance to air flow and high shielding effectiveness.

HYDROSCOPIC Tending to absorb moisture.

Hz See HERTZ (Hz).

I

IMPEDANCE (Z) The total opposition offered by a compound or circuit to the flow of an alternating or varying current. Impedance Z is expressed in ohms and is a combination of resistance R and reactance X, computed as Z =ÖR2 + X2. Impedance is also computed as Z = E/I, where E is applied a-c voltage and I is the resulting current. In computations, impedance is handled as a complex ratio of voltage to current. IMPINGEMENT FILTER An air filter coated with a viscous fluid to improve its dust attestance and holding capacity.

INSERTION LOSS The loss in power due to the insertion of a gasket, window, or vent panel in a seam, joint, or aperture. Generally expressed as the ratio in decibels of the power received before insertion to the power received after insertion.

IRIDITE See CHROMATE CONVERSION COATING.

K

k Kilo (multiplier, 103).

K kelvin (a unit of temperature).

M

m Milli (a multiplier, 10-3).

M Mega (a multiplier, 106).

MAGNETIC or H-FIELD The low impedance, or magnetic component of an electromagnetic wave. A magnetic field induces current in a shield. Compare ELECTRIC or E-FIELD.

MIL 0.001 inch.

MONEL An alloy of nickel and copper.

Glossary, Continued

U.S. Customary
[SI Metric]

N

NECKING The localized reduction in cross-section that may occur in a material under tensile stress.

NEOPRENE Polychloroprene Rubber. A general purpose polymer with many desirable characteristics, including high resilience with low compression set and flame resistance. Attacked by ozone and various hydrocarbon fluids including jet fuels.

NOMINAL A stated value as opposed to an actual one. Values expressed as nominals may actually express a mid point between two limits, or an average, normal, or typical value.

NONSETTING Nonhardening.

O

OHM (W) A unit of electrical resistance.

OHM-cm A unit of material volume resistivity.

OVERCOMPRESSION Compression which causes irreparable damage to a material or component.

P

PARAMETER A quantity to which arbitrary values may be assigned.

PASCAL (Pa) The metric unit of pressure or stress equal to one n/m2, or 0.000145 psi.

PERMEABILITY (μ) A relative measure of the ability of a material to serve as a path for magnetic lines of force based on air = 1. Permeability is the magnetic induction B in gauss divided by the magnetizing force H in oersteds.

PLANE WAVE A simple wave in which all points normal to the direction of propagation are in phase.

PRESSURE-SENSITIVE ADHESIVE An adhesive which, under normal conditions of temperature and humidity, remains tacky. Used on gasket materials as a positioning aid during equipment assembly. It is not intended to be used for permanent mounting. See DRY BACK.

POT LIFE The period of time during which a reacting plastic or rubber compound remains suitable for application after a reaction with an initiating agent or hardener.

R

RADIATION Electromagnetic energy, such as light waves, sound waves, radio waves, x-rays, infrared and thermal waves traveling through a medium or through space.

RADIO WAVES (or Hertzian Waves) Electromagnetic waves in the frequency range of 3 kHz to 300 GHz propagated in space without artificial guide.

REF. Reference information. Not a requirement.

REFLECTION The loss of electromagnetic energy due to reflection at the air-metal boundary of a shield. The efficiency of the reflecting shield is a complex function of the wave and shield impedance. Compare ABSORPTION.

RELATIVE CONDUCTIVITY A comparative measure of electrical conductivity based on copper = 1.

RESILIENCY The ratio of energy input is a rapid instantaneous full recovery of a deformed specimen.

RFI Radio Frequency Interference. Electromagnetic interference (EMI) within the frequency range 3 kHz to 300 GHz.

RH Relative humidity.

RTV (Room Temperature Vulcanizing) An elastomeric adhesive which cures at room temperature, about 23°C.

S

SHELF LIFE Length of time under specified conditions that a material retains its usability and specified properties.

SHIELD Electrically conductive materials placed around a circuit, component, or cable to suppress the effect of an electromagnetic field within or beyond definite regions.

SHIELDING EFFECTIVENESS The effectiveness of a given material as a shield under a specific set of conditions, measured in decibels (dB).

SHIELD-SEAL A material which provides both EMI and environmental sealing.

SHORE A A scale used for the measurement of hardness with a durometer.

SILICONES Polymeric materials in which the recurring chemical group contains silicon and oxygen atoms as links in the main chain.

SINTERED Metal particles fused together under pressure at a temperature below their melting points.

Sn/Cu/Fe Tecknit designation for a tin coated, copper- clad steel wire used to make EMI gasket materials.

STRESS RELAXATION The decrease in stress after a given time at constant strain.

STRIPLINE A type of transmission line which consists of a single narrow conductor parallel and equidistant to one or two wide ground planes.

SURFACE RESISTIVITY The resistance of a material between two opposite sides of a unit square of its surface.

T

TEAR STRENGTH The maximum force required to tear a specified specimen the force acting substantially parallel to the major axis of the test specimen.

TENSILE STRENGTH The maximum tensile stress applied during stretching a specimen to rupture.

THERMOPLASTIC A term used to describe those materials which can be repeatedly made to flow under the application of heat.

THERMOSETTING A term used to describe plastic materials that are capable of being changed into substantially infusible or insoluble products when cured by application of heat or by chemical means. Once cured, the plastic cannot be made to flow.

THIXOTROPIC Describes materials that are gellike at rest but fluid when agitated.

V

VISCOSITY The resistance of a material to flow under stress.

VOLUME RESISTIVITY The electrical resistance between opposite faces of a centimeter cube of material, commonly expressed in ohm-centimeters (ohm-cm).

W

W.G. Water gauge.

WICKING Capillary absorption of liquid (including water) along fibers or holes in a base material.

W/m-K Watt per meter-kelvin (metric unit of thermal conductivity).

Appendix A

U.S. Customary [SI Metric]

Materials normally encountered in enclosure and shielding design are presented in Table A-1. The materials are listed in two groups. The first grouping ranks the relative conductivity of nonmagnetic materials from silver (most conductive) through titanium (least conductive). The second group ranks the materials by relative permeability for steel (lowest permeability) through supermalloy (highest permeability). Relative permeability for the first group is effectively independent of frequency, whereas the materials in the second group are highly dependent upon frequency and magnetic induction or flux density (gauss).

The relative permeability values for the magnetic materials (relative permeability greater than 1, $\mu_r > 1$) are provided for frequencies of 1 kHz, 10 kHz and 100 kHz. Above 1 megahertz, the relative permeability approaches 1 and approximates the permeability of the nonmagnetic material of the first group.

The effect of frequency dependent permeability on the absorption loss term (A_{dB}) is shown for the magnetic materials at the discrete frequencies from 1kHz to 1 MHz. For example, the absorption loss for Mu- Metal peaks at about 9 kHz whereas supermalloy peaks at about 20 kHz with a constant magnetic induction (B) of 20 gauss.

The last columns, relative reflection loss, depict the effects of loss in the reflection term (R_{dB}) due to the high values of permeability at low frequencies.

Table A-1

SHIELDING MATERIAL CHARACTERISTICS

	Relative Conductivity	Relative Permeability μ_r B (Magnetic Ind) = 20 Gauss			Absorption Loss (dB) Per MIL Barrier Thickness $A_{dB} = 3.334\,(t_{in})\,(\mu_r\sigma_r f)^{1/2}=$				Relative Reflection Loss (dB) $\Delta R_{dB} = 10\log_{10}(\sigma_r/\mu_r)$		
Material	σ_r (Cu=1)	f= 1 kHz	f= 10 kHz	*f= 100 kHz	f= 1 kHz	f= 10 kHz	f= 100 kHz	f= 1 MHz	f= 10 kHz	f= 100 kHz	f= 1 MHz
Group 1											
Silver (Pure)	1.08	1	1	1	0.11	0.35	1.10	3.46	+ 0.3	+ 0.3	+ 0.3
Copper (Annealed)	1.00	1	1	1	0.11	0.33	1.05	3.33	0.0	0.0	0.0
Gold	0.70	1	1	1	0.09	0.28	0.88	2.79	- 1.6	- 1.6	- 1.6
Chromium	0.66	1	1	1	0.09	0.27	0.86	2.71	- 1.8	- 1.8	- 1.8
Aluminum	0.61	1	1	1	0.08	0.26	0.82	2.60	- 2.2	- 2.2	- 2.2
Brass (91% Cu 9% Zn)	0.47	1	1	1	0.07	0.23	0.72	2.29	- 3.3	- 3.3	- 3.3
Magnesium	0.37	1	1	1	0.06	0.20	0.64	2.03	- 4.3	- 4.3	- 4.3
Tungsten	0.31	1	1	1	0.06	0.19	0.59	1.86	- 5.1	- 5.1	- 5.1
Zinc	0.30	1	1	1	0.06	0.18	0.58	1.83	- 5.2	- 5.2	- 5.2
Cadmium	0.23	1	1	1	0.05	0.16	0.51	1.60	- 6.4	- 6.4	- 6.4
Nickel	0.22	1	1	1	0.05	0.16	0.49	1.56	- 6.6	- 6.6	- 6.6
Phosphor-Bronze	0.22	1	1	1	0.05	0.16	0.49	1.56	- 6.6	- 6.6	- 6.6
Tin	0.15	1	1	1	0.04	0.13	0.41	1.29	- 8.2	- 8.2	- 8.2
Beryllium	0.10	1	1	1	0.03	0.11	0.33	1.05	- 10.0	- 10.0	- 10.0
Lead	0.08	1	1	1	0.03	0.09	0.30	0.94	- 11.0	- 11.0	- 11.0
Monel	0.041	1	1	1	0.02	0.07	0.21	0.68	- 13.9	- 13.9	- 13.9
Manganese	0.040	1	1	1	0.02	0.07	0.21	0.67	- 14.0	- 14.0	- 14.0
Titanium	0.039	1	1	1	0.02	0.07	0.21	0.66	- 14.1	- 14.1	- 14.1
Group II											
Steel	0.10	180	60	5	0.45	0.82	0.75	1.05	-27.8	- 17.0	- 10.0
Iron	0.17	200	100	10	0.61	1.37	1.37	1.37	-27.7	-17.7	- 7.7
4% Silicon Iron	0.23	500	150	10	1.13	1.96	1.60	1.60	-28.1	-16.4	- 6.4
Permalloy	0.21	2,500	800	50	2.42	4.32	3.42	1.53	-35.8	-23.8	- 6.8
Hypernik	0.21	4,500	1,400	95	3.24	5.72	4.71	1.53	-38.2	-26.6	- 6.8
Iron (Purified)	0.17	5,000	1,500	100	3.07	5.32	4.35	1.37	-39.5	-27.7	- 7.7
Mu-Metal	0.20	20,000	6,000	400	6.67	11.55	9.43	1.49	-44.8	-33.0	- 7.0
Supermalloy	0.20	100,000	30,000	2,000	14.91	25.83	21.09	1.49	-51.8	-40.0	- 7.0

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