Innovative EMI shielding solutions

101 Tips & tricks
101 SHIELDING TIPS AND TRICKS

Shielding radiated emission and susceptibility of electronics components can be done in many ways. Sometimes it is possible to achieve the same goal in 10 different ways. But what is the most economical manner and which has the longest lifespan?

On this page and the following pages we have 101 shielding tips and tricks that can help you make the right choice.

If you have any questions, do not hesitate and contact one of our enthusiastic EMI problem solvers today.

Please note, red squares with numbers in the drawing refer to the corresponding tip or trick

GASKET SELECTION & STIFFNESS OF ENCLOSURE

Shielding gaskets can be broken down into four classifications of environmental resistance. The following table explains the required installation environment for Holland Shielding Systems BV EMI-IP gaskets

<table>
<thead>
<tr>
<th>Classification</th>
<th>Rating</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor</td>
<td>&lt; 44</td>
<td>Indoor</td>
<td>Not intended for submersion in water. Installation in an indoor location required</td>
</tr>
<tr>
<td>Weather resistant</td>
<td>44-65</td>
<td>Indoor / Outdoor</td>
<td>Under shelter</td>
</tr>
<tr>
<td>Weatherproof</td>
<td>66-67</td>
<td>Indoor / Outdoor</td>
<td>Not intended for submersion in water. Installation in a sheltered location required</td>
</tr>
<tr>
<td>Submersible</td>
<td>68</td>
<td>Underwater</td>
<td>Full immersion.</td>
</tr>
</tbody>
</table>

GASKET SELECTION & GALVANIC CORROSION

<table>
<thead>
<tr>
<th>Encausted material</th>
<th>Volts</th>
<th>Anodic shield</th>
<th>Cathodic shield</th>
<th>Galvanic Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc plating on steel</td>
<td>-0.60</td>
<td>+0.05</td>
<td>-0.60</td>
<td>+0.05</td>
</tr>
<tr>
<td>Aluminium plating on steel</td>
<td>-0.70</td>
<td>+0.05</td>
<td>-0.70</td>
<td>+0.05</td>
</tr>
<tr>
<td>Iron and steel plating on steel</td>
<td>-0.70</td>
<td>+0.05</td>
<td>-0.70</td>
<td>+0.05</td>
</tr>
<tr>
<td>Nickel plating on steel</td>
<td>-0.80</td>
<td>+0.05</td>
<td>-0.80</td>
<td>+0.05</td>
</tr>
<tr>
<td>Copper and its alloys</td>
<td>-0.80</td>
<td>+0.05</td>
<td>-0.80</td>
<td>+0.05</td>
</tr>
<tr>
<td>Silver</td>
<td>0</td>
<td>-0.60</td>
<td>0</td>
<td>+0.05</td>
</tr>
<tr>
<td>Conductive graphite in isotropic</td>
<td>+0.05</td>
<td>-0.60</td>
<td>+0.05</td>
<td>+0.05</td>
</tr>
<tr>
<td>Platinum</td>
<td>+0.15</td>
<td>-0.60</td>
<td>+0.15</td>
<td>+0.05</td>
</tr>
</tbody>
</table>
**PRINCIPLE OF SHIELDING**

The principle of shielding is creating a conductive layer completely surrounding the object you want to shield. This was invented by Michael Faraday and this system is known as a Faraday cage.

Ideally, the shielding layer will be made up of conductive sheets or layers of metal that are connected by means of welding or soldering, without any interruptions. The shielding is perfect when there is no difference in conductivity between the used materials. When dealing with frequencies below 30 MHz, the metal thickness affects shielding effectiveness. We also offer a range of shielding methods for plastic enclosures. A complete absence of interruptions is not a realistic goal, since the Faraday cage will have to be opened from time to time so electronics, equipment or people can be moved in or out. Openings are also needed for displays, ventilation, cooling, power supply, signals etc.

**Shielding works in both directions**: items inside the shielded room are shielded from outside influences. (Fig. 3)

- **The quality of the cage** is expressed as the ratio of the field strength in Volts/meter (V/m) inside the cage and outside the cage.
- **It is common practice to present field strength Figures in a logarithmic scale (in dB)**.
- **The reduction depends on the frequency** in Hz. Each frequency has a wavelength in meters. For example 100 MHz = 100.000 kHz = 3 meter. For a better explanation, see the table on the right. (Fig. 6)

**TABLE: Reduction of Field Strength**

<table>
<thead>
<tr>
<th>dB</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>100 times reduction of the field strength</td>
</tr>
<tr>
<td>60</td>
<td>1.000 times</td>
</tr>
<tr>
<td>80</td>
<td>10.000 times</td>
</tr>
<tr>
<td>100</td>
<td>100.000 times</td>
</tr>
<tr>
<td>120</td>
<td>1 million times</td>
</tr>
<tr>
<td>140 dB and up</td>
<td>Very difficult to measure, and only used in scientific applications</td>
</tr>
</tbody>
</table>

**WAVES**

A wave is a combination of electric field and magnetic fields. An electromagnetic wave is composed of a magnetic part depending on the electric current (ampere), and an electrical section, depending on the electrical voltage (volts). Near the source (near-field) the magnetic part is dominant. At a greater distance, the electrical part and the magnetic part are present in a fixed ratio (far field). (Fig. 7)

**The material thickness determines which frequencies** are blocked from penetrating into or out of the cage. For low frequencies like 10 kHz (generally the near-field/magnetic fields), a mild steel layer of 6mm is needed to achieve a reduction of 80 dB, but a frequency of 30 MHz can be shielded by copper foil that is only 0.03mm thick. For higher frequencies in the GHz area the mechanical strength of the used shielding material will generally specify the thickness of the shield.

**For very low frequencies and DC** where the magnetic field is dominant, besides thick layers also special materials like Mu-metal and Mu-ferro alloys are needed. In addition, combinations of multiple layers are required to get sufficient shielding performance. Please consult our engineers.

**When a wire penetrates a shield** that is not completely connected to the shield, it will work as an antenna and this reduce the shielding performance of the cage. This is especially the case at higher frequencies. (Fig. 10)
» 101 SHIELDING TIPS AND TRICKS

WHY THE FARADAY CAGE PRINCIPLE FOR EMI SHIELDING?

- Circumstances in which EMI shielding has to be implemented
  - When a product has to meet government standards like CE or FCC which regulate immunity and compatibility of products.
  - The regulations do not cover the requirements of daily practice (e.g., medical instruments are tested at 3 meters distance while they are used within 15 cm).
  - Extra safety is desired for military use, e.g., for EMP (electromagnetic pulses).
  - If someone wants to create increased levels of shielding for TEMPEST requirements, so that there is no risk of spying.
  - Sensitive instruments or equipment are to be protected from interfering or harmful frequencies.
  - Rules for sensitive measuring and weight equipment like balances and petrol-delivery materials have to be met.

- Other aspects related to shielding
  - Regulations regarding ESD (electrostatic discharge).
  - Regulations regarding ATEX (explosion safety).
  - Lightning protection / EMP / HEMP / NEMP
  - Short circuit protection / prevention of sparks.

- Identification systems like RFID (Radio Frequency Identification) prevent RFID from making contact with the stations. Several frequency ranges, lower the frequency are for longer distances.
  - 125 kHz (Low Frequency)
  - 13.56 MHz (High Frequency)
  - 860 to 950 MHz (Ultra High Frequency)
  - 2.45 GHz (Microwave)

- Medical / personal protection: shielding certain frequencies can prevent illness caused by radiation levels. Protective clothing can reduce the field strength. Depending on the density. To this end, there is personal protection in the form of clothing, hats, gloves, stockings, sleeping bags, tents and so on.

HOW TO CREATE OPTIMAL EMI SHIELDING

- In general, a shield consisting of more layers or zones is cheaper to produce than a shield made out of 1 high performance layer. It is easy to create 3 zones.
  - Level 1: The component on the PCB is shielded by a can. Shielding at the source. (Fig. 15.1)
  - Level 2: The entire PCB is shielded by foil, wraps or a box or the PCB and all the cables are connected inside the shielded box. (Fig. 15.2)
  - Level 3: Or the outer housing is shielded as well. (Fig. 15.3)

- Shielding at the source
  - The component on the PCB is shielded by a can. Shielding at the source. (Fig. 15.1)

- Shielding the entire PCB
  - The entire PCB is shielded by foil, wraps or a box or the PCB and all the cables are connected inside the shielded box. (Fig. 15.2)

- Shielding the entire enclosure
  - Or the outer housing is shielded as well. (Fig. 15.3)

CABLE SHIELDING

- Cables inside the housing
  - Once the PCB is covered, the attached cables can also be shielded. The longer a cable, the higher its potential for emitting lower frequencies. Shielding a wire inside the enclosure will also prevent cross-talk and will make the main enclosure act as a cavity, and thus amplify the radiation. To prevent this, the enclosure can be (partly) laminated with EM absorption material.

- For round and flat cables
  - We produce shields in the shape of sleeves, wraps, tubes and textiles so that all type of cables can be shielded. Some cable shields need to be grounded at both ends, but it is usually best to ground at only one end to prevent common-mode currents.

- Covering the entire PCB
  - Another option is covering the entire PCB in shielding material. This can be achieved either by means of a small housing, custom-made to exactly the right shape, or by simply wrapping or sticking material around the PCB.
  - Foils, textiles, stretch material, and wrapshields, cut to the appropriate shape, are easy to apply.
  - Since it is always important to prevent short circuits, all materials can be provided with insulation layers.

- Shielding at the source
  - Shielding at the source is usually the most cost-effective solution. Generally speaking, the source of unwanted radiation can be produced by voltage and current through one or more components or interconnections on the PCB. Application of a shielding can will reduce it directly at the source.

- Clip mounting
  - Shielding cans are mounted onto the PCB with SMD clips, which come in several sizes. After the re-flow, the can (a cover with walls attached) is placed into the clips and can subsequently be removed for adjustments.

- Pin mounting
  - There are also systems with pins for though holes or covers with integrated pins that can be soldered directly onto the PCB. (Fig. 18)

- Shield layout
  - Cooling holes can be made in the cover or steps to prevent short circuits with the tracks on the PCB. (Fig. 19.1)
  - Covers can also consist of a fixed part on the PCB (fence) and a separate cover which is clipped on to this fence. (Fig. 19.2)
CABLE SHIELDING

The housings themselves, i.e. the rack, the box, the enclosure, the metallized box, and the Faraday cage they constitute the main cover of the entire system and also the connection to the outside world. Housings are equipped with displays, entries for power and signal lines, and cooling air-vents. For more information see the case on the beginning of this article.

Elements that can reduce the effectiveness of a Faraday cage

<table>
<thead>
<tr>
<th>Level III A</th>
<th>Level III B</th>
<th>Level III C</th>
<th>Level III D</th>
<th>Level III E</th>
<th>Level III F</th>
<th>Level III G</th>
<th>Level III H</th>
<th>Level III I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seams (Fig. 24.1)</td>
<td>Doors</td>
<td>Entries</td>
<td>Transparent displays</td>
<td>Ventilation panels</td>
<td>Cables for power supply</td>
<td>Cables for signals</td>
<td>Pipes for fluids, air, heating (Fig. 24.2)</td>
<td>Cables for optical connection</td>
</tr>
</tbody>
</table>

SEAMS

It is important for the conductivity of the seam to be more or less identical to that of the basic material that the cage is constructed out of. Welding or soldering tends to works best, but for places that have to be opened easily several mechanical connection methods are available: clamping, screwing, adhesive, sealing, sticking.

Characteristics of an optimal seam

- It is flat and smooth
- It has the right dimensions (Fig. 26.1)
- The construction is stiff enough (Fig. 26.1)
- It is and will remain free of corrosion (Fig. 26.2)
- If possible, it is in a single plane

PREVENTION OF CORROSION

In the design stage it is important to specify the environment. It makes a difference whether the construction has to be able to withstand only humidity, or exposure to water (possibly even salt water), fog, or condensation, e.g. during transport.

If the metal of the housing is sensitive to corrosion, a finishing of e.g. nickel and chrome can help the contact surface maintain the required conductivity. Materials like aluminium and zinc-plated steel develop an oxidation layer, which reduces the corrosion process but is less conductive.

Gasket selection & galvanic corrosion

Even when the materials of the housing withstand corrosion well, it is important that they work together not only with one another but also with the gasket (Fig. 35).

![Figure 24.1: The pressing force on the panels of the housing is minimized.](image-url)

![Figure 24.2: Pipes of conductive material need insulating couplings.](image-url)

![Figure 26.1: Examples of a stiff construction to prevent openings.](image-url)

![Figure 26.2: A EMI gasket combined with a environmental seal.](image-url)

![Figure 35: Galvanic corrosion table](image-url)
**101 SHIELDING TIPS AND TRICKS**

10. **Sea/water environment:** In a situation where the galvanic values of the gasket and the housing material differ more than 0.3 volts. In a salty environment, or 0.5 volts in an environment with just water, galvanic corrosion will occur. Even at a distance of 10 km from the sea, the atmosphere may be as salty as right on the coast. So the appropriate gasket material has to be chosen, see gasket selection graph.

11. **Around the bolt holes should be sufficient space for a water seal.** Water should never reach the EMI gasket or the construction via the bolt holes. Alternatively extra water sealing can be applied around the bolts in the form of rings. (Fig. 37)

12. **For small parts,** where there is less space a gasket out of e.g. electrically conductive rubber can be used. These are available in profiles and plates, which can be cut accurately to the required dimensions.

13. **For bigger parts** it can be more efficient to use a combined gasket. An EMI gasket with a water seal made of neoprene, silicone or EPDM rubber. (Fig. 39)

14. **Neoprene has quite good flame retardant properties and can handle temperatures of -40 to +100 °C.** EPDM rubber can withstand temperatures up to 120 degrees, making it suitable for the engine compartment of cars. Silicone rubber is used for temperatures up to 220 °C; it can be sterilized for medical applications and is soft. Neoprene has quite good flame retardant properties and can handle temperatures of -40 to +100 °C. Silicone or EPDM rubber. (Fig. 39)

15. **it can be more efficient to use a combined gasket.** An EMI gasket with a water seal made of neoprene, silicone rubber with a thickness of 2-3mm are suitable. (Fig. 42)

16. **For bigger parts** where there is less space a gasket out of e.g. electrically conductive rubber can be used. These are available in profiles and plates, which can be cut accurately to the required dimensions.

17. **For small parts,** where there is less space a gasket out of e.g. electrically conductive rubber can be used. These are available in profiles and plates, which can be cut accurately to the required dimensions.

18. **RULES OF THUMB FOR GASKET CHOICE, DEPENDING ON THE TYPE OF ENCLOSURE**

19. **Very small construction:** (smaller than 150 x 150) grooves, casted, molded or machined: conductive profiles, O-ring gasket or cut gasket out of highly conductive rubber are suitable. (Fig. 41)

20. **Small construction:** (about 200 x 200mm) multi-shield gasket, consisting of metal wire from top to bottom through an o-ring or cut gasket out of highly conductive rubber are suitable. (Fig. 41)

21. **Medium size construction:** zinc-plated steel/metal: standard shield, neoprene foam with water seal, minimum width about 4mm and thickness 2-3mm. (Fig. 42)

22. **Large size construction:** zinc-plated steel/metal: standard shield, neoprene foam with water seal, minimum width about 4mm and thickness 2-3mm. (Fig. 42)

23. **Full size rack with door:** Ultra-soft twin shield with separate water seal or knitted mesh over silicone tube with water seal, V-shape with additional water sealing, thickness 6-10mm are suitable. Other products like finger strips, textile-covered parts, clip-on gaskets or custom build hybrid gaskets are suitable. (Fig. 44)

24. **Compression stops** or O-ring gasket can be used in constructions where EMI with water sealing is required and when there is just one flange. Maximum compression is 30%. (Fig. 44)

25. **Gasket thickness:** Ultra-soft gaskets will help limit the closing force as well as bending of the door.

26. **Med size construction:** Medium size constructions. (Fig. 43)

27. **Medium size construction:** Medium size constructions. (Fig. 43)

28. **Gaskets must be made in the shape of a frame,** complete with mounting holes and self-adhesive strip for mounting, if desired.

29. **In order to keep a gasket from becoming overly compressed,** it is possible to add compression stops next to the bolt holes. If there is enough space, plastic or metal rings (compression stops) with the final thickness can be integrated in the gasket.

30. **For easy mounting** there are gaskets in a P-shape or U-shape available. These gaskets can be easily mounted on a rim due to their shape. (Fig. 53)

31. **L-shaped gasket** can be used in constructions where EMI with water sealing is required and when there is just one flange. Maximum compression is 30%. (Fig. 54)

32. **For instruments and introducing high currents** into a construction we make over 2400 different Be-Cu finger strips. These are not allowed in every country and are susceptible to being damaged when they are used in a construction that is not protected properly (knife-edge).

33. **Gaskets must be made in the shape of a frame,** complete with mounting holes and self-adhesive strip for mounting, if desired.

34. **In order to keep a gasket from becoming overly compressed,** it is possible to add compression stops next to the bolt holes. If there is enough space, plastic or metal rings (compression stops) with the final thickness can be integrated in the gasket.

35. **For easy mounting** there are gaskets in a P-shape or U-shape available. These gaskets can be easily mounted on a rim due to their shape. (Fig. 53)

36. **L-shaped gasket** can be used in constructions where EMI with water sealing is required and when there is just one flange. Maximum compression is 30%. (Fig. 54)
CABLE SHIELDING

To prevent high closure force, V-shaped gaskets can be used which clamp the door not in the direction of the opening but in the direction of the door, so only the friction force is the closing force. (Fig. 55)

For special constructions, our custom-built profiles can help to create an optimal seal.

Watertight EMI gaskets in any shape can be cut out of sheets of material like conductive rubber, or multi-shield with small conductive wires in the material. They have a compression of 10-15%. (Fig. 57)

Conductive foam is an open structure so it is not watertight, but it can be combined with a watertight neoprene gasket.

Knitted mesh for military and low-frequency use is available made out of full metal (10-15% compression) neoprene foam covered with knitted metal wires which has 30-40% compression. Silicone tube covered with knitting has up to 50% compression and low compression force.

The knitted mesh gasket can be mounted into a groove or can be produced with a fin so that it can be screwed or clamped.

When there is no groove in your construction, the knitted wire mesh gasket can be glued to self-adhesive rubber, to keep it in place.

For high-performance gaskets to seal gaps in for example Faraday cages for sensitive measurement, the gaskets can be produced in a double implementation and bolted in the center.

CABLE SHIELDING

Cables entering a Faraday cage can carry undesirable signals into and out of the housing. When these cables are shielded, the cable shield should be 360 degrees around the cable, and be connected to the housing using a gland or cable entry plate. Entry shielding is also available in watertight and flame retardant versions. Power lines and signal lines should be filtered when it is not certain what frequencies are on the line. (Fig. 63)

Filters for power, signals and data. A power line coming from the grid function as an antenna of immense length and brings many unwanted frequencies with it. It has to be “cleaned” by a filter before entering the shielded room. The same goes for signal lines and pipes going into the housing. They will work as an antenna and interfere with the shielding. (Fig. 64)

In order to ensure good shielding performance a transparent conductive shield can be provided with a silver contact busbar. Mounting a transparent window.

DISPLAYS

Products for transparent shielding

- Woven mesh
- Woven mesh between sheets of acrylic, polycarbonate or glass, connected at the edges (edge bonded)
- Woven mesh, fully laminated between plates of acrylic, polycarbonate or glass
- Woven mesh between foil with or without self-adhesive (mesh foil)
- Indium tin oxide (ITO) on foil or glass, 4 or 6mm (transparent foil)
- Copper grid on foil, high light transmission versus shielding performance
- High performance combinations of above materials, framed in metal with gaskets for easy mounting
- Transparent foil with anti-static layer (ESD foil)

Mounting a transparent window.

In order to ensure good shielding performance a transparent conductive shield can be provided with a silver contact busbar. Some shields can be made with flying mesh so that the flying mesh can be connected to the shielded housing. The shielded window should make full contact with the housing on all its sides by means of conductive adhesives, conductive seals, tape with conductive adhesive, or clamping with a gasket if desired. (Fig. 71)

Conductive foils can be stuck to a standard screen or window with cleanly removable self-adhesive. More rigid transparent shields can be made with a frame or mounted with a bezel.

Warning

It is currently not possible to make transparent shields 100% optically correct because of the so called moiré effect, so minor disturbances have to be accepted.
101 SHIELDING TIPS AND TRICKS

**CHOICE OF TRANSPARENT MATERIAL**

- **Metallic Foils**
  - For shielding at low frequencies, mesh shielding types show the best performance. They have lower light transmission than for example ITO coated windows and foils but that is considered normal for a display rather than a problem. (Fig. 73)

When the foil is applied to a monitor and the lines of the mesh in the film do not correspond with the dots of the monitor a Newton’s ring effect or a moiré pattern will arise. Orienting the mesh at a certain angle between 17 and 45 degrees will minimize this effect.

- **ITO Coating**
  - Indium tin oxide coating does not produce a moiré effect and offers good shielding at higher frequencies. The product is however sensitive to acid substances, such as for instance found in finger prints. Optionally a plastic film layer may be applied in order to protect the ITO layer. (Fig. 74)

- **Framed windows**
  - We produce turnkey shielded windows with up to and even over 100 dB attenuation that can be installed directly into an MRI room. These windows are framed and have several layers of shielding, all of which are connected to one another. (Fig. 75)

- **Mesh foil**
  - Since a jig is needed for this process, it is not recommended for small production amounts. (Fig. 78)

Metallization under vacuum (sputtering) is another option; this can also be done partially.

- **Parts can be subjected to galvanic treatment** when dealing with larger quantities.

**SHIELDING METHODS FOR PLASTIC HOUSING**

- It is possible to apply a shielding foil inside the housing, either completely or partially glued to the housing. With the use of stiffer foils a shielded box can be created inside the plastic housing in cases where there is no need to have the housing fit a specific shape. Lids on the precut foil can be used for grounding and/or mounting.

- **For housings with complex shapes**, a shielding paint or spray (in cans) can be used. The paint is filled with conductive metal particles like nickel, copper, silver or combinations.

- **Metalization** under vacuum (sputtering) is another option; this can also be done partially.
  - Since a jig is needed for this process, it is not recommended for small production amounts. (Fig. 78)

- **Parts can be subjected to galvanic treatment** when dealing with larger quantities.

**VENTILATION PANELS**

- **A honeycomb ventilation panel can be framed and pre-drilled on request for easy mounting or can be produced frameless with optional a pressed flange for smaller constructions or when the honeycomb ventilation panel is mounted in a clamped construction.**

- **For outdoor use** the honeycomb can be treated with a nickel or other finish. This is to protect the honeycomb ventilation panel from environmental influences such as corrosion.

- **To keep raindrops from falling into the enclosure** we can make the honeycomb also at a slant (45 degrees is standard) since the structure of the honeycomb material ensures that air waves. (Fig. 80)

- **Two layers of slanted honeycomb** placed opposite to one another also make it impossible for metal rods to be entered into the cage, and thus prevent from electrocution.

- **Mounting framed honeycombs** can be done via through holes or threaded holes which are flow drilled into the frame in order to achieve a good screw length. Flow drilling is better than using rivets which may become loosened.

- **Honeycombs can also be used as flow straighteners** since the structure of the honeycomb material ensures that air is blown in a fixed direction.

- **The honeycomb can optionally be provided with a flange** so that the honeycomb after mounting forms one whole shape with the shielded enclosure. (Fig 89.1 & 89.2)

- **Within a few days we can produce Honeycomb ventilation panels according to the customer’s drawing. The honeycomb structure is like waveguides and lets air through while blocking electromagnetic waves from entering.**

- **The cell size of the honeycombs is 3.2mm and combinations of sever layers is possible, even under cross constructions for higher performance. A cross cell honeycomb consists of minimal two layers of honeycomb material stepped and rotated 90 degrees relative to each other. This results in a good shielding performance independent of the polarization of the waves. (Fig. 80)**

- **To prevent from dust, a dust filter can be integrated in the ventilation panel. The dust filter can also be mounted to the outside of the enclosure. (Fig. 81)**

- **The standard cost-effective honeycomb is made of aluminium but for special applications like EMP it can also be made out of mild steel, which is more expensive. (Fig. 82)**
CABLES

Cables from and to a shielded enclosure should also be shielded when no sufficient entry like power line filters are used.

Optimal cable shielding can be achieved with several materials like conductive flexible shielding tubes, wraps made of knitted metal, highly conductivity textiles or foils. All these materials can be supplied with- or without self-adhesive.

The cable shield should be low impedance connected at the entrance of the screen, wall or body of the shielded enclosure. That way there is not only a galvanic connection but this also creates a high frequency coupling. A full 360-degrees connection around the cable works best. For this purpose we produce cable entries. (Fig. 92)

Inside the enclosure cables can emit radiation which can then be amplified by the cavity of the enclosure, so it may be important to also shield the cables inside the enclosure. Tie-wraps and compressible cable-clamping strips can be helpful to make good connections with the conductive metal connector of the cable.

FINGERSTRIPS

To pass on higher currents for entry plates and so on, a very good product are beryllium copper fingerstrips. Please note that not all countries accept these due to the percentage of beryllium which is toxic, therefore we have developed many other types of conductive gaskets. Which are more friendly for the environment and also less sensitive for damaging.

Also a good solution is to place knit mesh between the entry panel and the cage wall.

For screwed connections the 2400 series twisted fingerstrips are very popular. They can be compressed to the fingerstrips material thickness like 0.25mm. Most versions can be stickered with a self-adhesive strip to keep the strip in place.

For shielded doors and Faraday cage doors you need a bigger range of compression. You find these in the 2800 series fingers can be clamped, soldered or screwed.

The 2100 series clip-on mounting fingerstrips can be clamped on regular metal plate thicknesses like 0.5, 0.8, 1 and 1.5mm. Some even have lances so that the strip will not slip loose quickly.

When there is a wide range of compression required, our 2200 series Snap-on Fingerstrips or our 2300 series Stick-on fingerstrips may be suitable. These fingerstrips can be integrated in the construction, Snap-on Fingerstrips can be firmly mounted in slots in your construction so that also a compression to nearly 0.25 can be realized. (Fig. 98)

For special constructions the 2500 series show fingers mounted under an 90 degree angle. (Fig. 99)

For circular mounting the fingers in the 2600 series have on top of the finger spherical tips so that there is under any angle a good point contact.

For sliding, rotating and moving applications, please contact our specialists.

To prevent wear down there is a conductive lubricant available.

ADDRESS

Holland Shielding Systems BV
Jacobus Lipsweg 124
NL-3316 BP Dordrecht
The Netherlands

Ph +31(0)78- 204 90 00
Fax +31(0)78- 204 90 08
info@hollandshielding.com
hollandshielding.com

We help think solve invest listen advise
Create improve develop you succeed

24-HOURS SAMPLE SERVICE
Send us an email with part numbers or drawings of the desired product. Be sure to mention the amount. You may also send part numbers of competitors.

Figure 92 : Example of a full 360 degrees connection around the cable

Figure 93 : Example of Finger under 90 degrees

Figure 94 : Example of a full 360 degrees connection around the cable

Figure 95 : Example of Finger under 90 degrees

101 SHIELDING TIPS AND TRICKS

Figure 96 : Snap-on Fingerstrips for slot mounting and large compression

Figure 97 : Example of a full 360 degrees connection around the cable