



General Description

Shielded windows consist of one or more window layers with a conductive intermediate layer. They are applicable for all visual display systems, e.g. in meters and monitors.

Due to the variety of possibilities, our standard is custom-made production. The window should be selected according to following criteria:

- 1 window material
- 2 color of material
- 3 dimensions
- 4 anti-reflectivity
- 5 intermediate layers
- 6 construction
- 7 gasket type
- 8 frame finish

Shielded windows are generally used for all kinds of electric displays, e.g. LCD, LED, plasma and EL displays, etc.



Orientation of the mesh

90° - 45° - 30° - 15°

Tolerances

1. Outer dimensions

up to 23.622 inch (600 mm)
> 23.622 inch (600 mm)

Glass	Acrylic
inch (mm)	inch (mm)
± 0.020 (± 0.5)	± 0.008 (± 0.2)
± 0.079 (± 2.0)	- -

2. Material thickness (per material sheet)

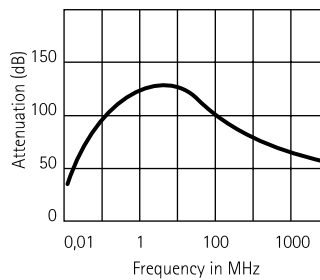
up to 0.158 inch (4 mm)
> 0.158 inch (4 mm)

Glass	Acrylic
inch (mm)	inch (mm)
± 0.008 (± 0.2)	± 0.012 (± 0.3)
± 0.016 (± 0.4)	± 0.020 (± 0.5)

Shielding Test Data

Measured on shielded window
11.811 x 11.811 inch (300 x 300 mm).

Mesh: Blackened silver plated stainless steel 100 opi.





1 Window Material

- Glass, plexiglass (acryl), makrolon (polycarbonate) and PVC can be selected.
- For further details see also construction table on page 6.

2 Color

- Base color of all materials is transparent/clear. However, for some applications it may be more advantageous to color the material yellow, green, red or amber.
- The base material for acrylic windows is colored whereas for glass windows the adhesive foil between the panes is colored.
- Please consider that with colored materials the light transmission will be affected.

3 Dimensions

- **Outer dimensions:**
There is no standard outer dimension, all windows are custom-made.
- **Material thickness:**
The material thickness for glass starts from 0,031 - 0,047 inch (0,8 - 1,2 mm), for acrylic from 0,031 inch (0,8 mm) and for polycarbonate from 0,059 inch (1,5 mm). The variety of available material thicknesses helps to meet almost all customer requirements. For a final glass-glass window, the shielding mesh and the adhesive add 0,031 inch (0,8 mm) to the thickness when laminated together.
- For further details see also construction table on page 6.

4 Anti-Reflectivity

- All materials can be supplied with anti reflective surface to avoid glaring and to enhance contrast. Different procedures can be used.

Anti-reflectivity for glass:

- Multi-layer coating per MIL SPEC 675 B (less than 0,6% remaining reflection)
- Single-layer coating per DIN 58197 (less than 1,5% remaining reflection)
- Chemical etching:
 - 5% reflection (R11G or GW 80)
 - 9% reflection (R19G or GW 100)
 - 13% reflection (R27G or GW 120)

Anti-reflectivity for plastics

- Chemical etching is the standard procedure for a good anti reflectivity with plastics which comes out very strong.
- A special coating, giving a scratch resistance in addition to anti reflectivity, can influence the intensity of reflectivity.

5 Intermediate Layers

- The intermediate layer for EMI/RFI shielding is a woven microstructure mesh. Mesh materials are copper, stainless steel or silver plated stainless steel.
- The mesh can be blackened so as to enhance contrast on the display. This does not affect the shielding performance. To avoid interferences between mesh grid pattern and monitor or display ("Moiré fringes"), simply change the orientation of the mesh by turning it a little. The number of openings per inch (opi) determine the shielding effectiveness, but also the light transmission.
- In applications with a very high resolution display which does not allow the use of a mesh, a highly conductive, transparent foil can be laminated onto the glass, or it can be equipped with a conductive ITO coating.
- **Note:**
The mesh is also available as an individual part for other applications.



Selection of mesh and its shielding performance

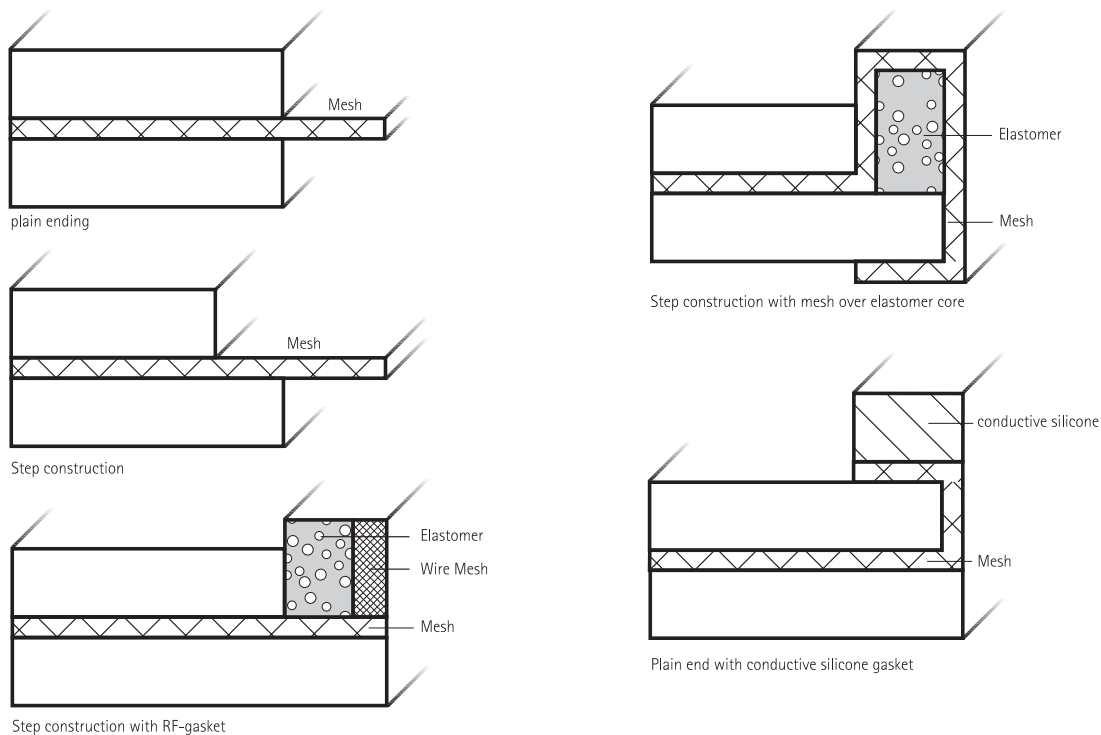
Mesh	Surface	Open. per inch	Wire ø	1 MHz	E-field 10 MHz	100 MHz	400 MHz	P-field 1 GHz	10 GHz	Max. size available	Open area %
Copper	blackened	70	0,07	110	111	98	68	64	38	47,24 x 39,37 inch (1200 x 1000 mm)	65
Copper	blackened	100	0,05	107	111	85	70	58	-	47,24 x 39,37 inch (1200 x 1000 mm)	64
Stainless steel	bright	100	0,025	110	105	88	76	62	-	47,24 x 39,37 inch (1200 x 1000 mm)	81
Silver plated stainless steel	blackened	100	0,025	128	112	92	86	80	74	27,56 x 27,56 inch (700 x 700 mm)	81
Silver plated stainless steel	blackened	165	0,05	130	124	106	100	81	61	27,56 x 27,56 inch (700 x 700 mm)	46
Silver plated stainless steel	blackened	200	0,025	128	108	98	88	86	68	27,56 x 27,56 inch (700 x 700 mm)	64

6 Construction

- The window consists of a carrier with a laminated mesh on the rear or laminated between two carriers, depending on the application.
- The mesh overlaps the carrier to serve as contact area for the gasket or installation.
- Plastic will be laminated either with adhesives or with high temperatures.
- Glass will be laminated in vacuum with double sided adhesive foils. Please note that a fully laminated glass window using a PVB interlayer (PVB = Polyvinyl Butyral) as an adhesive cannot be cleaned with solvents, because the solvent will damage the PVB interlayer.



Schematic illustration



All dimensions shown are in inches (millimeters) unless otherwise specified.



Construction Table

Laminate	Total material thickness		Temp. range °C	Construction	Form	Conductive medium Mesh	Filter	Anti-reflectivity	
	min.	max.						Refraction of light	Anti-reflection
Glass / glass	2.4	on request	-55 +75	plain end. step constr.	flat, curved	see mesh selection	grey, green, red, orange	chem. etching	Multi layer
Polycarbonate / polycarbonate	3.8	on request	-55 +60	plain end. step constr.	flat, curved in 1 direction	see mesh selection	grey	chem. etching	-
Acrylic / acrylic	1.3	on request	-50 +60	plain end. step constr.	flat, curved	see mesh selection	different colours of acrylic glass	chem. etching	-

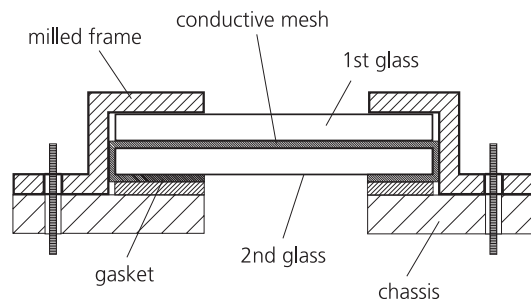
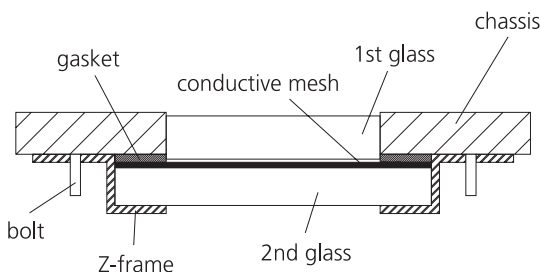
7 Gasket Type

- To achieve shielding effectiveness, a good contact between mesh and enclosure is required. The contact can either be established in a direct way or by means of a conductive gasket. When selecting the gasket, you should consider the environmental seal (IP-protection etc.) characteristics that have to be met by the finished product.
- For a choice of gasket and contact methods please contact our sales department.

8 Frame Finish

- Windows can be supplied from the factory as complete units. The finish is made according to customer specification and facilitates the assembly. The appropriate gasket is integrated in the frame to provide a good contact between mesh and enclosure.

Assembly Examples



Ordering Information

The ordering code consists of the material code, followed by a new assigned P/N (including all necessary dimensions, tolerances and process steps):

- For glass laminated windows

LT/FG/xxxx

└─ P/N will be assigned after order is placed
└─ Material code

- For polycarbonate laminated windows

LT/PG/xxxx

└─ P/N will be assigned after order is placed
└─ Material code

All dimensions shown are in inches (millimeters) unless otherwise specified.