

It is important that the right material is used to ensure that operation in an emergency is carried out properly and safely. At Safeglass, we believe that there can be no compromise over safety. That is why we have developed a broad spectrum of materials suitable for a range of applications.

Grade of Material

Deciding what grade of material is required depends on the desired breaking strength - in other words, how easy or hard it is to break. The exact amount of force which will break a panel is known as the stress limit of the material. A mathematical equation is available which considers the amount of stress on a material and takes into account size, shape, mounting and force.

With Safeglass® panels, all of these variables are known and the stress limit can be calculated. In turn, this is used to determine the grade of material required.

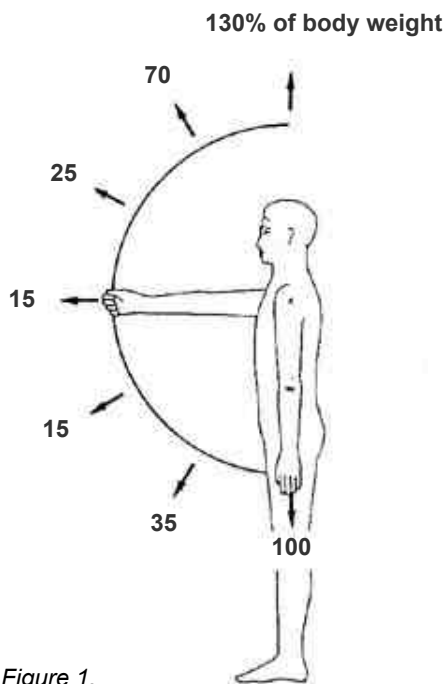


Figure 1.

The Human Factor

The designers of an application will have already set the size, shape and mounting of the panel. All that is required is to decide what pressure or force must be applied to the panel to make it break.

This can be quite difficult unless there are specific guidelines laid down by the government or industry. In the Fire Industry, the standard for break glass fire alarm call points is clearly defined by BS5839 part 2. No such standard exists in the transport or many other industries where the application is more varied.

Ergonomic data, however, is available and indicates the amount of pushing force a person is capable of applying. This is a good starting point when considering what force CAN be applied to a panel. Ergonomic tests done on people give accurate force values summarised in Fig 1.

Force can be applied by pushing up, pushing forward or pushing down. The output force from any one individual can be expressed as a percentage of body weight, depending on the type of pushing action:

PUSHING UP	130% of body weight
PUSHING FORWARD	15% of body weight
PUSHING DOWN	100% of body weight

Example

Assume a design for a rectangular panel which may be used by a small adult or child weighing 46kg. The panel will be wall mounted. Exerting a forward push at 15% body weight would result in applied force of 67N.

Safeglass (Europe) Limited
Whitworth Building
Scottish Enterprise Technology Park
East Kilbride
G75 0QD
UK

Tel: +44 (0) 1355 272438
 Fax: +44 (0) 1355 272788

info@safeglass.co.uk



Worked Example

A rectangular panel of dimension 250 x 104 x 2 mm is to break under a load of 67 Newtons. The load is to be applied at the centre of the panel over a 30mm diameter area. The panel is held all round in a frame.

Legend

W 67N t 0.002m (2mm) a 0.104m (104mm)
 e 0.0015m (15mm) k 0.041

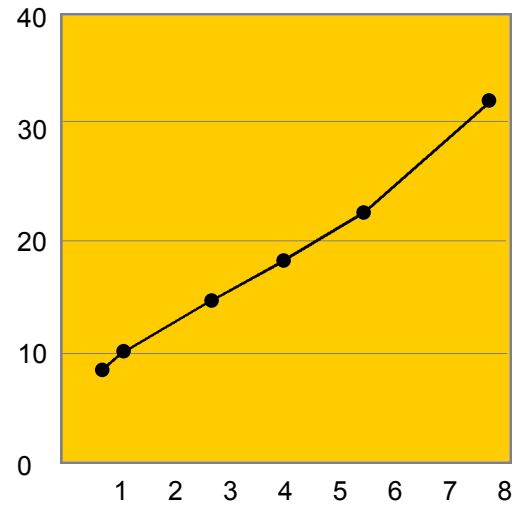
$$S = \frac{1.5W}{\pi t^2} \left[1.3 \ln \frac{a}{\pi e} + 1 - K \right]$$

$$S = \frac{1.5 \times W}{\pi 0.002^2} \left[1.3 \ln \frac{0.104}{\pi 0.0015} + 1 - 0.041 \right]$$

$$S = 15.9 \text{ N/mm}^2$$

Table 1

This table charts the grade of the material against the stress limit.



BS5839 Part 2

This is an important standard to achieve since it is used in the fire alarm industry - a heavily regulated sector. In break-glass call points, the glass must break when a force of 25N is applied. Using calculation 4 (below), it is possible to determine the grade of material if the dimensions of the glass are known.

Formulae

Circular Flat Panel

For a panel with an edge fixed around the circumference and a concentrated load at the centre.

The formula is:

$$S = \frac{0.62 W}{t^2} \left[\frac{R}{\ln 0.325 t} + 0.0625 \frac{t^2}{R^2} \right]$$

Rectangular Flat Panel

A panel with the edge supported all round, load at the centre.

The formula is:

$$S = \frac{1.5 W}{\pi t^2} \left[1.3 \ln \frac{a}{\pi e} + 1 - K \right]$$

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Square Flat Panel

Edge supported all round, load over the area at the centre.

The formula is:

$$S = \frac{0.62 W}{t^2} \left[\ln \frac{L}{2r} + 0.577 \right]$$

Rectangular Panel

Supported at both ends, load at centre

The formula is:

$$S = \frac{3 W L}{2 a t^2}$$

Legend

- Ⓢ stress N/mm² Ⓜ applied force N Ⓡ radius of panel supporting edge m Ⓛ length of panel m
Ⓣ thickness m ⓐ width m ⓔ radius of local area m ⓘ distance between supports
Ⓚ constant derived from empirical length and width tests:

Length / Width	1.0	1.1	1.2	1.4	1.6	1.8	2.0	3.0	∞
K	0.564	0.455	0.349	0.211	0.124	0.072	0.041	0.003	0.000

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