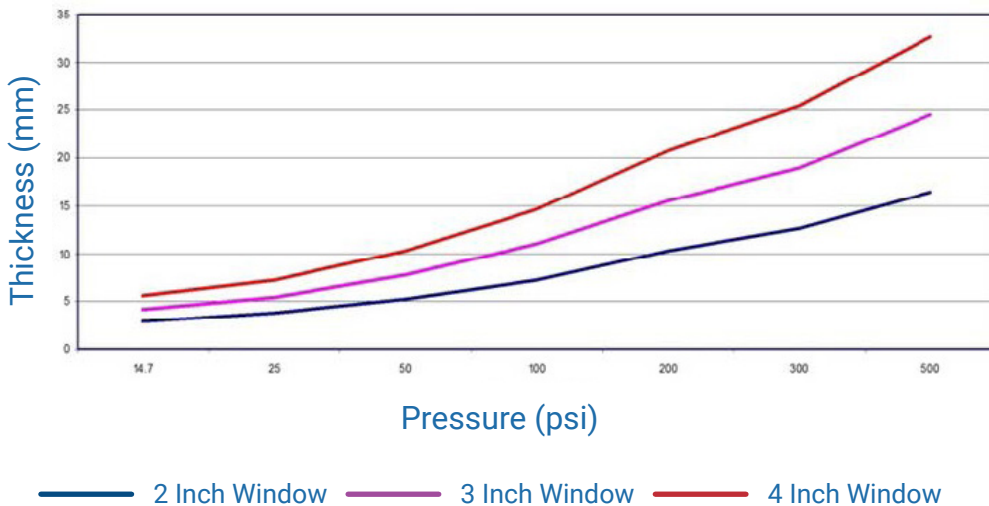




How to Calculate The Safe Minimum Thickness of a Viewing Pane Crystal?

Fragility increases proportionally to the ratio of the diameter to thickness. If thickness stays the same as the diameter increases, so does the fragility factor. Minimum thickness of a window required to withstand a pressure difference may be calculated by the following:

CaF2 Minimum Safe Thickness “V” Pressure



Modulus of Rupture

$$Th = 1.04880884817 \sqrt{\frac{P \times DIA^2}{MR}}$$

Whereas:

Th = Thickness, inches

DIA = unsupported diameter, inches

P = pressure difference, psi

MR = modulus of rupture, psi

Pressure at 1 atm = 14.7 psi
= 101.324 kPa

(psi) for Crystals Commonly

Used in IR Windows

BaF2	3,900
CaF2	5,300
ZnSe	8,000
Ge	10,500
Sapphire	65,000

2 Inch CaF2 IR Window Minimum Thickness Requirement

Pressure Differential (psi)	Minimum Required	
	(inch)	(mm)
14.7	0.110	2.8
25.0	0.144	3.7
50.0	0.204	5.2
100.0	0.288	7.3
200.0	0.407	10.3
300.0	0.499	12.7
500.0	0.644	16.4

3 Inch CaF2 IR Window Minimum Thickness Requirement

Pressure Differential (psi)	Minimum Required	
	(inch)	(mm)
14.7	0.166	4.2
25.0	0.216	5.5
50.0	0.306	7.8
100.0	0.432	11.0
200.0	0.611	15.5
300.0	0.749	19.0
500.0	0.966	24.5

4 Inch CaF2 IR Window Minimum Thickness Requirement		
Pressure Differential (psi)	Minimum Required	
	(inch)	(mm)
14.7	0.221	5.6
25.0	0.288	7.3
50.0	0.407	10.3
100.0	0.576	14.6
200.0	0.815	20.7
300.0	0.998	25.4
500.0	1.289	32.7

Note:

The minimum thickness of a CaF2 crystal to resist 1 atmosphere (14.7 psi) needs to be:

- 2 inch window = 2.8 mm
- 3 inch window = 4.2 mm
- 4 inch window = 5.6 mm

25 psi is the safety point where arc protected switchgear pressure relief devices are designed to work. The minimum thickness of a CaF2 crystal at this point needs to be:

- 2 inch window = 3.7 mm
- 3 inch window = 5.5 mm
- 4 inch window = 7.3 mm